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Parks Canada Agency

791 PUK NP Road Reconstruction Project

Pukaskwa National Park

Contract Documents and Specifications

August 2017

Prepared For;

Northern Ontario Field Unit
Pukaskwa National Park

Prepared by;

PARSONS



791 Road Reconstruction Project

Pukaskwa National Park

Northern Ontario Field Unit

Parks Canada Agency

Technical Specification (Contract Document)

‘Issued for Tender’

Prepared by: Parsons Inc.

Contract # 5P301-15-0001-004

CONSULTANTS

PROJECT MANAGER, CIVIL,
 MUNICIPAL AND ELECTRICAL
 ENGINEERS



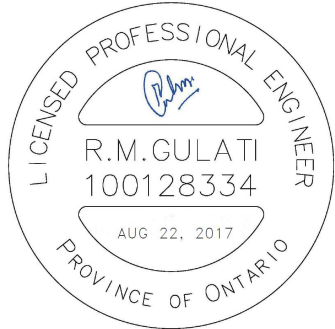
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END OF SECTION

PART 1 GENERAL

1.1 WORK DESCRIPTION

- .1 Work of this project comprises of the reconstruction for Pukaskwa Entrance Road, North and South Campground Loops, and entrances and parking lots for administration building and visitors centre within Pukaskwa National Park, near Heron Bay, Ontario. The work for this project includes, but not limited to the following:
- .1 Excavation in earth and rock for pavement widenings, grading, paving and minor drainage.
 - .2 In-place full depth reclamation of bituminous pavement and underlying granular to a depth of 150mm.
 - .3 Pavement of road and parking lot surfaces.
 - .4 Trenching in earth and rock for sanitary sewers, manholes and force mains.
 - .5 Sanitary sewer and manholes installation.
 - .6 Force main replacement.
 - .7 Pump replacement.
 - .8 Electrical, internet conduit and site partial illumination.
 - .9 Landscaping (Optional), and
 - .10 Other Related Work.

END OF SECTION

PART 1 GENERAL

1.1 SUBCONTRACTORS

- .1 Evaluation of Sub-contractors qualifications shall be part of the Contract bid evaluation process. Sub-contractor(s) will be accountable to the principle Contractor and only the principle Contractor shall be accountable to Parks Canada Agency.
- .2 Parks Canada Agency as further described in the General Conditions reserves the right to reject a proposed subcontractor for reasonable cause.
- .3 Refer to CCDC 5A, CCDC 17, CCDC 5B, CCDC 2, CCDC 18, and CCDC 3 as to PCA rights to accept or dismiss subcontractors.

END OF SECTION

PART 1 GENERAL

1.1 SUBSURFACE INVESTIGATION REPORT

- .1 Two investigation reports with respect to the applicable road reconstruction and sanitary sewers and force mains project site and important immediate affected surroundings, are titled as follows:
 - .1 Titles:
 - .1 Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation Pukaskwa National Park Report.
 - .2 Geotechnical Investigation and Design for Proposed Replacement and Rehabilitation of the Sewer Infrastructure at Pukaskwa National Park Report.
 - .2 Dated: December 7, 2016 & December 7, 2016
 - .3 Prepared by: Golder Associates.
- .2 Copies of the above detailed investigation reports are part of the bid document. Also, available for viewing at the office of Parks Canada Agency.
- .3 The subsurface investigation reports record properties of the soils, subgrade conditions, and offers recommendations for the design of pavement.
- .4 The reports as prepared primarily for the use of the design Consultants.
- .5 The recommendations given shall not be construed as a requirement of this Contract unless also contained in the Contract Documents.
- .6 The reports, by their nature, cannot reveal all conditions that exist or can or might occur on the subject site. Should subsurface conditions be found or be a concern thereto, or to vary substantially from the investigation reports, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to the PCA.

END OF SECTION

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GENERAL REQUIREMENTS

DIVISION 01

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Documents and terminology.
- .2 Associated requirements.
- .3 Work expectations.
- .4 Work by other parties.
- .5 Contractor Use of Premises.

1.2 RELATED SECTIONS

- .1 Section 01 21 00 - Allowances.
- .2 Section 01 56 00 – Temporary Barriers and Enclosures.
- .3 Section 01 78 10 - Closeout Submittals.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 RELATED DOCUMENTS

- .1 Division 01 sections describe requirements applicable to all Sections within Divisions 02 to 49 inclusive.

1.4 WORDS AND TERMS

- .1 Refer to and acknowledge other words, terms, and definitions in Canadian National Master Specifications (NMS) and CCDC 3, CCDC 4, CCDC 18, and CCDC 2 Definitions. Additional words and terms are cited in Section 00 52 13 described in Supplementary Conditions.

1.5 COMPLEMENTARY DOCUMENTS

- .1 Refer to General Condition of Contract Section GC1.4 and Section 00 52 13 for words and terms.
- .2 Drawings, specifications, and schedules are complementary to each other and what is called for by one to be binding as if called for by all. Should any discrepancy appear between documents which leave doubt as to the intent or meaning, abide by Precedence of Documents article below or obtain direction from the Departmental Representative or Delegate (DR/D).
- .3 In the event of any inconsistency or conflict in the contents of the following documents, such documents shall take precedence and govern in the following descending order:
 - .1 Agreement
 - .2 Addenda during the Tender
 - .3 Special Provisions
 - .4 Contract Drawings
 - .5 NMS Standard Specifications

- .6 OPSD Standard Drawings
- .7 Instructions to Tenderers
- .8 Tender
- .9 General Conditions
- .10 Working Drawings

Later dates shall govern within each of the above categories of documents

- .4 In the event of any conflict among or inconsistency in the information shown on Drawings, the following rules shall apply:
 - .1 Dimensions shown in figures on a Drawing shall govern where they differ from dimensions scaled from the same drawing;
 - .2 Drawings of larger scale shall govern over those of smaller scale;
 - .3 Detailed Drawings shall govern over general Drawings; and
 - .4 Drawings of a later date shall govern over those of an earlier date in the same series.

Later dates shall govern within each of the above categories of documents.

- .5 In the event of any inconsistency or conflict in the contents of Standard Specifications the following descending order of precedence shall govern:
 - .1 Owner's Standard Specifications
 - .2 National Master Specification
 - .3 Other Standard Specifications, such as those produced by CSA, CGSB, ASTM, and ANSI and referenced in the National Master Specification
- .6 The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all.
- .7 Drawings indicate general location and route of conduit and wire/conductors. Install conduit or wiring/conductors and plumbing piping not shown or indicated diagrammatically in schematic or riser diagrams to provide an operational assembly or system.
- .8 Install components to physically conserve headroom, to minimize furring spaces, or obstructions.
- .9 Locate devices with primary regard for convenience of operation and usage.
- .10 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional work beyond work described to be brought to attention of the Departmental Representative or Delegate (DR/D).

1.6 WORK DESCRIPTION

- .1 Work of this project comprises of the reconstruction for Pukaskwa Entrance Road, North and South Campground Loops, entrances and parking lots for administration building and visitors centre within Pukaskwa National Park, near Heron Bay, Ontario. The work for this project includes, but not limited to the following:
 - .1 Excavation in earth and rock for pavement widenings, grading, paving and minor drainage.

- .2 In-place full depth reclamation of bituminous pavement and underlying granular to a depth of 150mm.
 - .3 New Pavement of road and parking lot surfaces.
 - .4 Trenching in earth and rock for sanitary sewers, manholes and force mains.
 - .5 Sanitary sewer and manholes installation.
 - .6 Force main replacement.
 - .7 Pump replacement.
 - .8 Electrical, internet conduit and site partial illumination.
 - .9 Landscaping, and
 - .10 Other Related Work.
- .2 Division of the Work among suppliers and/or Subcontractors is solely the Contractor's responsibility. Neither the PCA nor the Departmental Representative or Delegate (DR/D) assumes any responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.

1.7 WORK SEQUENCE

- .1 Construct Work to accommodate owner's usage requirements in stages during the construction periods listed below and shown on the contract drawings, the locations and sequence of work to be implemented is laid out below and described as follows:
- .1 **Stage 1:** Comprises of the reconstruction of Admin Road, RV Dumping Loop, Admin Parking and Lagoon Access. Work for this stage shall be undertaken in the spring of 2018 and finishes by Canada Day long weekend. The Contractor is permitted to close affected roadways to public traffic up to Friday before Victoria Day long weekend. The Contractor shall provide undisturbed site access for Parks Canada and emergency services vehicles at all times. Public traffic shall be maintained at the intersection of the Admin Road and Pukaskwa Entrance Road. The Contractor shall complete the work at the RV Dumping station by the Friday prior to Victoria Day long weekend or alternatively provide approved temporary measures for visitor use.
- Work involves, but not limited to the following:
- 1. Mobilisation and Site clearing.
 - 2. Installation/replacement of force main and sanitary sewers.
 - 3. Plugging and abandonment operations of unused/replaced sanitary systems.
 - 4. In-place full depth reclamation of bituminous pavement and underlying granular to a depth of 150mm, regrade to match proposed elevations and complete finished grading.
 - 5. Installation of internet conduits, secondary lighting line and associated items.
 - 6. Lagoon Access - Place granular 'A', regrade to match proposed grade and complete finished grading.
 - 7. Place asphalt surface course, where applicable.
 - 8. Install pavement markings, and signage.
 - 9. Demobilize, clean-up site and open to traffic.

- .2 **Stage 2:** Comprises of the reconstruction of Pukaskwa entrance Road from North limit of project at ± Sta. 20+000 southerly. Work for this stage shall commence on Tuesday following 2018 Labour Day weekend and shall be finalized by May 15, 2019. The Contractor is permitted to close affected roadways to public traffic. The Contractor shall provide undisturbed site access for Parks Canada and emergency services vehicles at all times. The Contractor shall prepare and present for review and approval to the Departmental Representative or Delegate (DR/D) a traffic plan to allow public access to camping areas and trails for the two weeks of September following Labour Day during in each year Fall construction seasons. The plan shall include potential impacts on expected project completion schedule and additional costs, if any.

Work involves, but not limited to the following:

1. Mobilisation and site cleaning.
2. Installation/replacement of force main and sanitary sewers. Installation of temporary connection between 'new' and existing force mains at south limit of construction.
3. Plugging and abandonment operations of unused/replaced sanitary systems.
4. Installation of internet conduits, and associated items.
5. In-place full depth reclamation of bituminous pavement and underlying granular to a depth of 150mm, regrade to match proposed elevations and complete finished grading.
6. Place asphalt surface course.
7. Install pavement markings, and signage.
8. Demobilize, clean-up site and open to traffic.

- .3 **Stage 3:** Comprises of the reconstruction of North Campground Loop. Work for this stage shall be undertaken in the spring of 2019 and finishes by June 15th, 2019. The Contractor is permitted to close affected roadways to public traffic. The Contractor shall provide undisturbed site access for Parks Canada and emergency services vehicles at all times.

Work involves, but not limited to the following:

1. Site clearing.
2. Installation/replacement of force main and sanitary sewers.
3. Plugging and abandonment operations of unused/ replaced sanitary systems
4. Installation of RV outlets and associated items.
5. Place granular 'A'. Regrade to match proposed grade and complete finish grading.
6. Demobilize, clean-up site and open to visitors.

- .4 **Stage 4:** Comprises of the reconstruction of Pulaskwa entrance Road from south limit of Stage 2 southerly to limit of paving at Sta. 17+664, Visitor's Centre Road, Parking Lot, and South Campground Loop (Centre, east & west).

Work for this stage shall commence on Tuesday following 2019 Labour Day weekend and shall be finalized by November 30, 2019. The Contractor is permitted to close affected roadways to public traffic. The Contractor shall provide undisturbed site access for Parks Canada and emergency services vehicles at all times.

Work involves, but not limited to the following:

1. Mobilisation and Site clearing.
 2. Installation/replacement of force main and sanitary sewers.
 3. Removal and replacement of PS#1.
 4. Plugging and abandonment operations of unused/replaced sanitary systems.
 5. Installation of internet conduits, secondary lighting line, RV outlets and associated items.
 6. In-place full depth reclamation of bituminous pavement and underlying granular to a depth of 150mm, and construct localized widenings. Regrade to match proposed elevations and complete finished grading.
 7. Place asphalt surface course, where applicable.
 8. Place granular 'A' on camp roads. Regrade to match proposed grade and complete finished grading.
 9. Install Landscaping and associated items throughout project limits (OPTIONAL).
 10. Install pavement markings and signage.
 11. Cleanout and demobilization.
- .2 Coordinate construction schedule and operations with the owner and Departmental Representative or Delegate (DR/D).
- .3 Maintain fire access and control of fire protection equipment at all times.
- .4 The above staging sequence layout includes most of the activities, in general format, required to construct the project within the specified timing. However, the Contractor is responsible to determine all activities required over and above the ones listed above and may employ alternate staging methods subject to approval by the Departmental Representative or Delegate (DR/D).

1.8 OPERATIONAL CONSTRAINTS

- .1 **Granular Driving Surface Restriction:** Operations shall be scheduled such that there are no granular driving surfaces on Pukaskwa Entrance Road and all other paved access roads between Victoria Day long weekend and Labour Day long weekend of any year. Between Victoria Day long weekend and Canada Day long weekend, an exception may be applied to the Admin Road, Admin Parking, Admin Extension and RV Dumping Loop in which granular driving surfaces are permitted. No additional payment will be made for any labour, equipment, or materials required to comply with the granular driving surface restrictions.
- .2 **Rock Blasting:** Rock blasting operations is prohibited between May 15 and October 15 of any year.
- .3 **Sewage Discharge:** Sewage discharge from the Administrative building must be accounted for at all time during the construction period. Contractor to install appropriate temporary measure to pump and/or to divert sewage during periods where force main is disconnected. Sewage discharge from RV dumping station to be accounted for between Victoria Day long

weekend and Labour Day long weekend. Main force main must be reconnected to existing force main to keep system operational at the end of all construction periods. No additional payment will be made for any labour, equipment, or materials required to comply with the temporary sewage discharge requirements.

1.9 WORK BY OTHERS

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative or Designate.
- .2 Coordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor report promptly to Departmental Representative or Delegate, in writing, any defects which may interfere with proper execution of work.

1.10 CONTRACTOR USE OF PREMISES

- .1 Contractor has unrestricted use of site until Substantial Performance of the Work has been completed including deficiency corrections.
- .2 Limit use of site and premises to allow:
 - .1 PCA and public occupancy.
 - .2 Work by PCA and/or Other Contractors.
 - .3 Use of site and premises by the public.
- .3 Emergency Building Exits During Construction: Limited to 3 at main building and 2 at visitor centre.
- .4 Construction Operations: Limited to areas noted on Drawings.
- .5 Utility Outages and Shutdown: Not permitted from Victoria Day weekend to Labor Day weekend of every year.
- .6 Use of premises by Contractor(s) shall not interfere with or disturb Parks Canada operations.
- .7 Co-ordinate use of premises under direction of Departmental Representative or Delegate.
- .8 Obtain and pay for use of additional storage or work areas needed for operations under this contract.
- .9 Remove or alter existing work to prevent injury or damage to portions of existing work which remain in place.
- .10 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative or Delegate.
- .11 At completion of work, existing work area condition shall be equal to or better than what existed before new work started.

1.11 PARKS CANADA AGENCY OCCUPANCY

- .1 PCA will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with PCA in scheduling operations to minimize conflict and to facilitate PCA usage.
- .3 Maintain fire and life safety systems and public access to exits during all stages of the Work.

1.12 PARTIAL PCA OCCUPANCY

- .1 PCA will occupy designated areas for purpose of installation of equipment and/or storage of furnishings and equipment.
- .2 Maintain fire and life safety systems and public access to exits during all stages of the Work.
- .3 Maintain sanitary sewer network during all stages of the work.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Connecting to existing services.
- .2 Special scheduling requirements.
- .3 Verification of existing utilities.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 51 00 – Temporary Utilities.
- .3 Section 01 56 00 – Temporary Barriers and Enclosures.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 EXISTING UTILITY SERVICES

- .1 Contractor to be responsible for location of all existing underground and overhead utilities. Various utilities require advance notice prior to digging, for stake out. PCA assumes no responsibility for the accuracy of the location of exiting utilities shown on the contract drawings.
- .2 Notify the Departmental Representative or Delegate (DR/D) of intended interruption of services and obtain required permission.
- .3 Where Work involves breaking into or connecting to existing services, give the Departmental Representative or Delegate (DR/D), forty-eight (48) hours of notice for necessary interruption of mechanical or electrical service throughout course of work.
 - .1 Keep duration of interruptions minimum.
 - .2 Perform interruptions after normal working hours of occupants, preferably on weekends.
- .4 Provide for vehicular, pedestrian, and personnel traffic.
- .5 Construct barriers in accordance with Section 01 56 00.

1.4 SPECIAL REQUIREMENTS

- .1 Perform noise generating work:
 - .1 From Monday to Friday from 07:00 a.m. to 6:00 p.m.
 - .2 On Saturdays, Sundays, and statutory holidays to the Departmental Representative or Delegate (DR/D) approval.
- .2 Submit schedule of special requirements or disruptions in accordance with Section 01 33 00.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Cash allowances.
- .2 Inspection and testing allowances.

1.2 RELATED SECTIONS

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 CASH ALLOWANCES

- .1 Costs Included in Cash Allowances: Cost of Product to Contractor less applicable trade discounts; delivery to site, and applicable taxes.
- .2 Departmental Representative or Delegate Responsibilities:
 - .1 Consult with both Consultant and Contractor for consideration and selection of Products, suppliers, and installers.
 - .2 Departmental Representative or Delegate and Consultant to select Products.
 - .3 Prepare Change Order.
- .3 Contractor Responsibilities:
 - .1 Assist Consultant in selection of Products, suppliers and installers.
 - .2 Obtain proposals from suppliers and installers and offer recommendations.
 - .3 On notification of selection by Departmental Representative or Delegate with Consultant recommendations, execute purchase agreement with designated supplier and installer.
 - .4 Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - .5 Promptly inspect Products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- .4 Differences in costs will be adjusted by Change Order.

1.4 INSPECTING AND TESTING ALLOWANCES

- .1 Costs Included in Inspecting and Testing Allowances: Cost of engaging an inspecting or testing agency; execution of inspecting and tests; and reporting results.
- .2 Costs Not Included in the Inspecting and Testing Allowance But Included in the Contract Price:
 - .1 Costs of incidental labour and facilities required to assist inspecting or testing agency.
 - .2 Costs of testing services used by Contractor separate from Contract Document requirements.
 - .3 Costs of retesting upon failure of previous tests as determined by Consultant.
- .3 Payment Procedures:
 - .1 Submit one (1) copy of the inspecting or testing firm's invoice with next application for payment.
 - .2 Pay invoice on approval by PCA.

- .4 Differences in cost will be adjusted by Change Order.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Substantial performance procedures.

1.2 RELATED SECTIONS

- .1 Refer to CCDC 18-2001, CCDC 2-2008 and CCDC 4-1982 for specific requirements.

1.3 SUBSTANTIAL PERFORMANCE OF THE WORK

- .1 Submit a schedule of request for payments on CCDC 24 printed copy with an authorized signature.
- .2 Accompany schedule with a CCDC 9A-2001 Statutory Declaration form.
- .3 Prepare and submit to Departmental Representative or Delegate a comprehensive list of items to be completed or corrected. Failure to include an item on the list does not alter responsibility to complete the Contract.
- .4 Request Departmental Representative or Delegate (DR/D) review to establish Substantial Performance of the Work.
- .5 Where permitted by local lien legislation, Contractor may apply for substantial performance of a designated portion of the Work, subject to PCA acceptance of that portion of the Work being substantially performed.
- .6 No later than ten (10) days after receipt of list/schedule, Departmental Representative or Delegate (DR/D) will form a review team and will review work to verify validity of list/schedule, and no later than seven (7) days after completing review, will notify Contractor if the Work, or the designated portion of the Work, is substantially performed. The review team shall include Departmental Representative or Delegate, Consultant and Contractor's representative in minimum.
- .7 Departmental Representative or Delegate (DR/D) will state in their certificate the date of Substantial Performance of the Work, or the date of the designated portion of the Work, as applicable.
- .8 Immediately following issuance of certificate of Substantial Performance of the Work, in consultation with Departmental Representative or Delegate (DR/D) establish reasonable date for finishing Work.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Coordination of work with Contractor, other contractors and work by PCA under administration of the Departmental Representative or Delegate (DR/D).
- .2 Scheduled progress meetings.

1.2 RELATED SECTIONS

- .1 Section 01 32 00 - Construction Progress Documentation.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 COORDINATION

- .1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities and construction Work, with progress of Work of Contractor, other contractors and Work by PCA, under instructions of the Departmental Representative or Delegate (DR/D).

1.4 PROJECT MEETINGS

- .1 Schedule and administer weekly project meetings throughout progress of Work as determined by Departmental Representative or Delegate (DR/D).
- .2 Schedule and administer pre-start meetings when specified in sections and when required to coordinate related or affected Work.
- .3 Prepare agenda for meetings.
- .4 Distribute written notice of each meeting four (4) days in advance of meeting date to Departmental Representative or Delegate (DR/D).
- .5 Provide physical space and make arrangements for meetings.
- .6 Preside at meetings.
- .7 Record minutes. Include significant proceedings and decisions. Identify action by parties.
- .8 Reproduce and distribute copies of minutes within three (3) days after each meeting and transmit to meeting participants, affected parties not in attendance, and the Departmental Representative or Delegate (DR/D).

1.5 CONSTRUCTION ORGANIZATION AND START-UP

- .1 Within fifteen (15) days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 The Departmental Representative or Delegate (DR/D), Contractor, major Subcontractors, field inspectors, Consultant(s) and construction supervisors are to be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.

- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include following:
 - .1 Departmental Representative or Delegate (DR/D) to provide outline of pre-start up meeting as part of the applicable forms.
- .6 Comply with Departmental Representative or Delegate (DR/D)'s allocation of mobilization areas of site; field office(s), sheds, accesses, traffic, and parking facilities.
- .7 During construction, coordinate use of site and facilities through the PCA's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .8 Comply with instructions of Departmental Representative or Delegate (DR/D) for use of temporary utilities and construction facilities.
- .9 Coordinate field engineering and layout work with Departmental Representative or Delegate (DR/D).

1.6 ON-SITE DOCUMENTS

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings.
 - .5 List of outstanding shop drawings.
 - .6 Change orders.
 - .7 Other modifications to Contract.
 - .8 Field test reports.
 - .9 Copy of approved Work schedule.
 - .10 Manufacturers' installation and application instructions.
 - .11 Labour conditions and wage schedules.
 - .12 Applicable current editions of municipal regulations and by-laws. Current building codes, complete with addenda bulletins applicable to the Place of the Work.
 - .13 Health and Safety Plan and other safety related documents.
 - .14 Contractors site specific environment procedure.
 - .15 Other documents as specified.

1.7 SCHEDULES

- .1 Submit preliminary construction progress schedule as specified in Section 01 32 00 to Departmental Representative or Delegate (DR/D) coordinated with Consultant's project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by Departmental Representative or Delegate (DR/D).

1.8 CONSTRUCTION PROGRESS MEETINGS

- .1 During course of Work and four (4) weeks prior to project completion, schedule progress meetings weekly.

- .2 Contractor, major subcontractors involved in Work, Consultant, Departmental Representative or Delegate (DR/D) and PCA representative as identified by Departmental Representative are to be in attendance.
- .3 Notify parties minimum five (5) days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three (3) days after meeting.
- .5 Agenda to include following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for effect on construction schedule and on completion date.
 - .12 Review site safety and security issues.
 - .13 Other business.

1.9 SUBMITTALS

- .1 Prepare and issue submittals to Departmental Representative or Delegate (DR/D) for review.
- .2 Submit preliminary Shop Drawings, product data and samples as specified in Section 01 33 00 for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Departmental Representative or Delegate (DR/D).
- .3 Submit requests for payment for review, and for transmittal to Departmental Representative or Delegate (DR/D).
- .4 Submit requests for interpretation of Contract Documents, and obtain instructions from PCA.
- .5 Process change orders through Departmental Representative or Delegate (DR/D).
- .6 Deliver closeout submittals for review and preliminary inspections, for transmittal to Departmental Representative or Delegate (DR/D).

1.10 COORDINATION DRAWINGS

- .1 Provide information required by Consultant for preparation of coordination Drawings.
- .2 Review and approve revised Drawings for submittal to Consultant.

1.11 CLOSEOUT PROCEDURES

- .1 Notify Departmental Representative or Delegate (DR/D) when work is considered ready for Substantial Performance.

- .2 Accompany Departmental Representative or Delegate (DR/D) and Consultant representative on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Departmental Representative or Delegate (DR/D)'s instructions for correction of items of work listed in executed certificate of Substantial Performance and for access to PCA-occupied areas.
- .4 Notify Departmental Representative or Delegate (DR/D) of instructions for completion of items of Work determined in final inspection team's report.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Schedules, form, content, submission.
- .2 Critical path scheduling.
- .3 Progress video and photographs.
- .4 Submittals schedule.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SCHEDULES

- .1 Submit schedules as follows:
 - .1 Submittal Schedule for Shop Drawings and Product Data.
 - .2 Submittal Schedule for Samples.
 - .3 Submittal Schedule for timeliness of PCA-furnished Products.
 - .4 Product Delivery Schedule.
 - .5 Cash Allowance Schedule for acquiring Products only or Products and Installation, or Installation only.
 - .6 Shutdown or closure activity.
- .2 Schedule Format.
 - .1 Prepare schedule in form of a horizontal Gantt bar chart.
 - .2 Provide a separate bar for each major operation, item of work and subcontract.
 - .3 Split horizontally for projected and actual performance.
 - .4 Provide horizontal time scale identifying last Working Day of each week.
 - .5 Format for listings: Table of Contents of the Project Manual, Chronological order of start of each item of work.
 - .6 Identification of listings: By specification Section numbers or specification subjects.
- .3 Schedule Submission.
 - .1 Submit initial format of schedules within fifteen (15) working days after award of Contract.
 - .2 Submit schedules in electronic format, forward through e-mail and on a memory stick/DVD in *.tif or *.pdf files.
 - .3 Submit one (1) opaque reproduction, plus two (2) copies to be retained by Departmental Representative or Delegate (DR/D).
 - .4 Departmental Representative or Delegate (DR/D) will review schedule and return review copy within ten (10) days after receipt.
 - .5 Resubmit finalized schedule within seven (7) days after return of review copy.
 - .6 Submit revised progress schedule with each application for payment. In addition, distribute copies of revised schedule to:
 - .1 Job site office.
 - .2 Subcontractors.

- .3 Other concerned parties.
- .7 Instruct recipients to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.

1.4 CONSTRUCTION PROGRESS SCHEDULING

- .1 Submit initial schedule in duplicate within fifteen (15) days after date of PCA-Contractor Agreement established in Notice to Proceed.
- .2 Revise and resubmit as required.
- .3 Submit revised schedules with each Application for Payment, identifying changes since previous version.
- .4 Submit a horizontal bar computer generated chart with separate line for each major portion of Work or operation, section of Work, identifying first work day of each week.
- .5 Submit computer generated network analysis diagram using the critical path method.
- .6 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
- .7 Indicate estimated percentage of completion for each item of Work at each submission.
- .8 Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.
- .9 Include dates for commencement and completion of each major element of construction as, but not limited to the followings:
 - .1 Site clearing.
 - .2 Site utilities.
 - .3 Special Subcontractor Work.
 - .4 Equipment Installations.
 - .5 Finishes.
- .10 Indicate projected percentage of completion of each item as of first day of month.
- .11 Indicate progress of each activity to date of submission schedule.
- .12 Indicate changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .13 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
 - .3 Effect of changes on schedules of other prime contractors.

1.5 CRITICAL PATH SCHEDULING

- .1 Include complete sequence of construction activities.
- .2 Include dates for commencement and completion of each major element of construction as, but not limited to the followings:
 - .1 Site clearing.
 - .2 Site utilities.

- .3 Special Subcontractor Work.
- .4 Equipment Installations.
- .5 Finishes.
- .3 Show projected percentage of completion of each item as of first day of month.
- .4 Indicate progress of each activity to date of submission schedule.
- .5 Show changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .6 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
 - .3 Effect of changes on schedules of other prime contractors.

1.6 PROGRESS PHOTOGRAPHS

- .1 Digital Photography in a flash drive format:
 - .1 Submit electronic copy of colour digital photography in *.jpg format, minimum 6 megapixel resolution.
 - .2 Identification: Name and number of project and date of exposure indicated.
- .2 Number of Viewpoints: Four (4). Locations of viewpoints determined by Departmental Representative or Delegate (DR/D).
- .3 Frequency: Monthly with progress statement.
- .4 Frequency: At completion of excavation, framing and services before concealment, foundation, as directed by Departmental Representative or Delegate (DR/D).
- .5 Photographic Prints:
 - .1 Sizes: Prints 100 x 150 mm or 4 x 6 inch.
 - .2 Type: Glossy and in Colour with binding margin at one end.
 - .3 Paper: Single weight, unmounted.
 - .4 Number of Prints Required: Two (2) sets.
 - .5 Identification: Typewritten name and number of project and date of exposure on reverse side 25 x 50 mm or 1 x 2 inch white patch in upper right hand corner.

1.7 PROGRESS VIDEO

- .1 Submit colour video in digital format.
- .2 Frequency: Monthly with progress statement.
- .3 Frequency: At completion of excavation, and foundation as directed by Departmental Representative or Delegate (DR/D), framing and services before concealment.
- .4 At end of completion of major work that is buried.

1.8 SUBMITTALS SCHEDULE

- .1 Include schedule for submitting shop drawings, product data, and samples.

- .2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.
- .3 Include dates when delivery submittals will be required for PCA-furnished products.
- .4 Include dates when reviewed submittals will be required from Departmental Representative or Delegate (DR/D).

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Shop Drawings and product data.
- .2 Samples.
- .3 Certificates and transcripts.

1.2 RELATED SECTIONS

- .1 Section 01 32 00 - Construction Progress Documentation.
- .2 Section 01 77 00 - Closeout Procedure.
- .3 Section 01 78 10 - Closeout Submittals.
- .4 Other sections requesting submittals.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 ADMINISTRATIVE

- .1 Submit to Departmental Representative or Delegate (DR/D) submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Present Shop Drawings, product data, samples and mock-ups in SI metric units.
- .4 Where items or information is not manufactured or produced in SI metric units, converted values within the metric measurement tolerances are acceptable.
- .5 Review submittals prior to submission to Departmental Representative or Delegate (DR/D). 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.
- .6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
- .7 Notify Departmental Representative or Delegate (DR/D), in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work are coordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative or Delegate (DR/D)'s review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative or Delegate (DR/D) review.
- .11 Keep one (1) reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow five (5) days for Departmental Representative or Delegate (DR/D) review of each submission.
- .4 Adjustments made on Shop Drawings by Contract Administration are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative or Delegate (DR/D) prior to proceeding with Work.
- .5 Make changes in Shop Drawings as Departmental Representative or Delegate (DR/D) may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative or Delegate (DR/D) in writing of any revisions other than those requested.
- .6 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.
- .7 Submissions shall 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 other parts of the Work.
- .8 After Departmental Representative or Delegate (DR/D)'s review, distribute copies.
- .9 Submit one (1) electronic copy of Shop Drawings for each requirement requested in specification Sections and as Departmental Representative or Delegate (DR/D) may reasonably request.

- .10 Submit one (1) electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Departmental Representative or Delegate (DR/D) where Shop Drawings will not be prepared due to standardized manufacture of product.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 If upon review by Departmental Representative or Delegate (DR/D), 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 re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.5 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 or Delegate (DR/D) site office.
- .3 Notify Departmental Representative or Delegate (DR/D) 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 or Delegate (DR/D) are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative or Delegate (DR/D) prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative or Delegate (DR/D) 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.

1.6 MOCK-UP

- .1 Erect mock-ups as per Section 01 45 00 – Quality Control.

1.7 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Safety requirements and adherence.

1.2 RELATED SECTIONS

- .1 Section 01 31 00 - Project Managing and Coordination.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 Province of Ontario: Occupational Health and Safety Act, Regulation and Code R.S.A - Amended 1995, including requirements for a "Prime Contractor" as defined by the Act.

1.4 SAFETY PLAN

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative or Delegate (DR/D) may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.5 RESPONSIBILITY

- .1 The "Prime Contractor" according to applicable local jurisdiction, is 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 and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .3 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Ontario having jurisdiction. Advise Departmental Representative or Delegate (DR/D) verbally and in writing.

1.6 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Submit site-specific Health and Safety Plan: Within seven (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 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative or Delegate (DR/D), weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit Material Safety Data Sheets (MSDS) to Departmental Representative or Delegate (DR/D).
- .7 Departmental Representative or Delegate (DR/D) will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five (5) days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative or Delegate (DR/D) within five (5) days after receipt of comments.
- .8 Departmental Representative or Delegate (DR/D)'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 or Delegate (DR/D).
- .10 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.
- .11 File Notice of Project with Provincial authorities prior to commencement of Work.

1.7 SAFETY ACTIVITIES

- .1 Perform site specific safety hazard assessment related to project.
- .2 Schedule and administer Health and Safety meeting with Departmental Representative or Delegate (DR/D) prior to commencement of Work.
- .3 Perform Work in accordance with Section 01 41 00 - Regulatory Requirements and this section.

1.8 HEALTH AND SAFETY COORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have minimum two (2) years' site-related working experience specific to activities associated with this project.
 - .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.

1.9 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 or Delegate (DR/D).

1.10 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative or Delegate (DR/D).
- .2 Provide Departmental Representative or Delegate (DR/D) with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative or Delegate (DR/D) may stop Work if non-compliance of health and safety regulations is not corrected.

1.11 HAZARDOUS WORK

- .1 Blasting or other use of explosives is permitted with prior receipt of written instruction by Departmental Representative or Delegate (DR/D) and shall only be allowed from October 1st to May 15 of any year.
- .2 Use powder actuated devices only after receipt of written permission from Departmental Representative or Delegate (DR/D).

1.12 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.

1.13 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.
- .3 Maintain placed or installed fire resistive construction fire stopping/fireproofing to protect the portions of the Work during construction.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Site fires.
- .2 Site Drainage.
- .3 Site clearing and plant protection.
- .4 Wildlife Habitat Protection.
- .5 Work adjacent to waterways.
- .6 Pollution control.

1.2 RELATED SECTIONS

- .1 Section 01 74 00 - Cleaning and Waste Processing.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 FIRES

- .1 Fires and burning of rubbish on site permitted only when approved by Departmental Representative or Delegate (DR/D).
- .2 Where fires or burning are permitted, prevent staining or smoke damage to structures, materials or vegetation which is to be preserved. Restore, clean and return to new condition stained or damaged work.
- .3 Provide supervision, attendance and fire protection measures as directed.

1.4 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.5 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, 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 or 6 ft.
- .3 Protect roots of designated trees to drip-line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.

- .5 Restrict tree removal to areas indicated on plans. If additional trees are to be removed it must be approved by Departmental Representative or Delegate (DR/D).

1.6 VEGETATION/TREES REMOVAL AND MITIGATION

The road reconstruction project within the park may impact the nesting of birds. To avoid impacts to nesting birds, do not clear trees/vegetation in June or July. If an active nest is found, stop work immediately, move away as quickly and quietly as possible and contact the Surveillance Officer for further direction.

1.7 WILDLIFE HABITAT PROTECTION

The road reconstruction project within the park may impact the movement and resting of caribous. The measures that should be taken in the event a caribou is spotted or seen during the course of this project, are as follows:

1. Halt all operations.
2. Notify the Surveillance Officer (SO) for further direction.
3. If work can resume, obtain written approval from the Park Ecologist and the Departmental Representative or Delegate (DR/D), prior to proceeding with planned work.

1.8 ARCHAEOLOGICAL RESOURCES

The Pukaskwa National Park area has a rich history including a strong First Nations presence. The possibility of uncovering archaeological objects during project implementation, while minor due to the work focused on existing developed areas, does exist. Archaeological resources are valued for their potential contribution to the understanding and presentation of local First Nation history.

The measures that should be taken in the event archeological resources are discovered during construction, are as follows:

1. Halt all operations.
- .2 Notify the Surveillance Officer (SO) for further direction.
2. Work with the Surveillance Officer (SO) to develop a plan to address the object, before proceeding with the work.
3. Obtain written approval from the Departmental Representative or Delegate (DR/D), prior to proceeding with planned work.

1.9 POLLUTION CONTROL

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

END OF SECTION

Part 1 General**1.1 REFERENCES AND CODES**

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative or Delegate and refer to Section 02 82 00.01 - Asbestos Abatement - Minimum Precautions, Section 02 82 00.02 - Asbestos Abatement - Intermediate Precautions, and Section 02 82 00.03 - Asbestos Abatement - Maximum Precautions.
- .1 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative or Delegate and refer to Section 02 84 00 - Polychlorinate Biphenyl Remediation.
- .2 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative or Delegate and refer to Section 02 85 00.01 - Mould Remediation - Minimum Precautions, Section 02 85 00.02 Mould Remediation - Intermediate Precautions, and Section 02 85 00.03 - Mould Remediation - Maximum Precautions.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions and municipal by-laws.

1.4 NATIONAL PARKS ACT

- .1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.

END OF SECTION

Part 1 General**1.1 OVERVIEW**

- .1 The Contractor acknowledges that certain standard detail drawings and standard specifications, which are provisions of this Contract, have not been reproduced for inclusion in the Contract Documents.
- .2 Only the municipal and provincial common standards on OPS Volumes 1 to 4 and the municipal-oriented specifications in OPS volumes 7 and 8 apply to this Contract, unless specified otherwise in the Contract Documents.
- .3 The Contractor shall obtain its own copy of the standard detail drawings and standard specifications from the most recent version of these documents found at the web links indicated in ‘References’ below.

1.2 REFERENCES

- .1 The Ontario Provincial Standard Drawings (OPSD) and the Ontario Provincial Standard Specifications (OPSS) which are provisions of this Contract can be found at: <http://www.raqsb.mto.gov.on.ca/techpubs/OPS.nsf/OPSHomepage>
- .2 The Canadian Master Specifications (CMS), the National Master Specifications (NMS) and other which are provisions of this Contract can be found at: <https://secure.spex.ca/>
- .3 The Canadian Construction Documents Committee (CCDC) which is a provision of this Contract can be found at: <http://docs.ccdc.org/downloads/index.html>

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups.
- .4 Mill tests.
- .5 Written and electronic reports.

1.2 RELATED SECTIONS

- .1 Section 01 21 00 - Allowances.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 ISO/IEC 17025-2005 - General Requirements for the Competence of Testing and Calibration Laboratories.
- .2 SCC (Standards Council of Canada).

1.4 INSPECTION BY AUTHORITY

- .1 Allow Authorities having Jurisdiction 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 whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the 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.

1.5 REVIEW BY DEPARTMENTAL REPRESENTATIVE

- .1 Departmental Representative or Delegate (DR/D) may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.
- .2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.
- .3 If such Work is found in accordance with Contract Documents, Departmental Representative or Delegate (DR/D) will pay cost of review and replacement.

1.6 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection and Testing Agencies will be engaged as required by Departmental Representative or Delegate (DR/D) for purpose of inspecting and testing

- portions of Work. Cost of such services will be borne by Departmental Representative or Delegate (DR/D) as a separate project cost
- .2 Testing Organizations: Listed by SCC within info.palcan@scc.ca listings.
 - .3 Allocate Costs: To Section 01 21 00.
 - .4 Provide equipment required for executing inspection and testing by appointed agencies.
 - .5 Employment of inspection and testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
 - .6 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative or Delegate (DR/D) at no cost to PCA. Pay costs for retesting and re-inspection.

1.7 ACCESS TO WORK

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

1.8 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative or Delegate (DR/D) in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

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

1.10 REPORTS

- .1 Submit one (1) electronic copy and four (4) paper copies of signed inspection and test reports to Departmental Representative or Delegate (DR/D).

- .2 Provide signed paper copies to manufacturer or fabricator of material being inspected or tested.

1.11 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as may be requested.
- .2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative or Delegate (DR/D) and may be authorized as recoverable.

1.12 MOCK-UP

- .1 Prepare mock-up for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in all locations as specified in specific Section acceptable to Departmental Representative or Delegate (DR/D).
- .3 Prepare mock-ups for Departmental Representative or Delegate (DR/D) review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative or Delegate (DR/D) will assist in preparing a schedule fixing dates for preparation.
- .6 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative or Delegate (DR/D). Repair any damage and clean-up at place of mock-up.
- .7 Approved mock-up may remain as part of Work.
- .8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed.

1.13 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Existing Services.
- .2 Salvaging products for reuse.
- .3 Temporary utilities.

1.2 RELATED SECTIONS

- .1 Section 01 52 00 - Construction Facilities.

1.3 EXISTING SERVICES

- .1 Contractor will be required to provide any electrical, water, and sanitary services required to complete the work.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative or Delegate 48 hours' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to vehicular traffic.
- .3 Provide alternative routes for personnel and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative or Delegate of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative or Delegate for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services when directed by Departmental Representative or Delegate to maintain critical building systems.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative or Delegate and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.4 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Salvage and assist in recycling products for potential reuse.
- .3 Remove from site all such work after use.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.5 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
- .2 Record the dewatering log that includes time, date, duration and rate of discharge.

1.6 WATER SUPPLY

- .1 Provide continuous supply of potable water for construction use.
- .2 Arrange for connection with PCA and pay all costs for installation, maintenance and removal.
- .3 Pay for PCA charges at prevailing rates.

1.7 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .3 Maintain temperatures of minimum 10 degrees C or 50 degrees F in areas where construction is in progress.
- .4 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .5 Permanent heating system of building, may be used when available. Be responsible for damage to heating system if use is permitted.
- .6 On completion of Work for which permanent heating system is used, replace filters and/or bearing in furnace and clean ducts.
- .7 Ensure date of Substantial Performance of the Work and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative or Delegate (DR/D).

- .8 Pay costs for maintaining temporary heat, when using permanent heating system. PCA will pay charges when temporary heat source is existing building equipment.
- .9 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform to applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .10 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.8 TEMPORARY POWER AND LIGHT

- .1 Contractor will provide a source for, and pay the costs of temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volt, 30 amps.
- .2 Provide a temporary meter and reimburse PCA for costs of temporary power used.
- .3 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.
- .4 Provide and pay for temporary power for electric cranes and other equipment requiring temporary power in excess of above noted requirements.
- .5 Provide and maintain temporary lighting throughout project. Ensure level of illumination is not less than 162 lx or 16 lumen per sq ft.
- .6 Maximum power supply of 1.5 kVA, at 120 V, 1 phase to neutral at 50 Hz is available and will be provided for construction use at no cost. Connect to existing power supply in accordance with Canadian Electrical Code and provide meters and switching.
- .7 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative or Delegate (DR/D) provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than three (3) months.

1.9 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary fax, high speed internet, telephone, data and hook up, line/lines and equipment necessary for own use and use of Departmental Representative or Delegate (DR/D).

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Construction aids.
- .2 Office and sheds.
- .3 Construction Parking.
- .4 Staging Area.

1.2 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

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

1.4 HOISTING

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

1.5 USE OF THE WORK SITE

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

1.6 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt park operation and continuing operation of the facility.
- .2 Provide and maintain adequate access to project site.
- .3 Build and maintain temporary roads where directed by Departmental Representative or Delegate (DR/D) and provide snow removal during period of Work.
- .4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and prevent damage resulting from Contractors' use of roads.

1.7 SECURITY

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

1.8 OFFICES

- .1 Provide office heated to 22 degrees C or 71 degrees F, lighted 750 lx or 75 lumen per sq ft and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.
- .4 PCA's site office.
 - .1 Provide temporary office for Contract Administrator.
 - .2 Inside dimensions minimum 3.6 m or 12 ft long x 3 m or 10 ft wide x 2.4 m or 8 ft high, with floor 300 mm or 12 inches above grade, complete with four (4) 50% opening windows and one (1) lockable door.
 - .3 Insulate building and provide heating system to maintain 22 degrees C or 71 degrees F inside temperature at -20 degrees C or -4 degrees F outside temperature.
 - .4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm or 3/4 inch thick plywood.
 - .5 Install electrical lighting system to provide min 750 lx or 75 lumens per sq ft using surface mounted, shielded commercial fixtures with 10% upward light component.
 - .6 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
 - .7 Equip office with 900 x 1800 mm or 36 x 72 inch table, four (4) chairs, 6 m or 20 ft of shelving, 300 mm or 12 inch wide, one (1) three (3) drawer filing cabinet, one (1) plan rack and one (1) coat rack and shelf.
 - .8 Maintain in clean condition.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

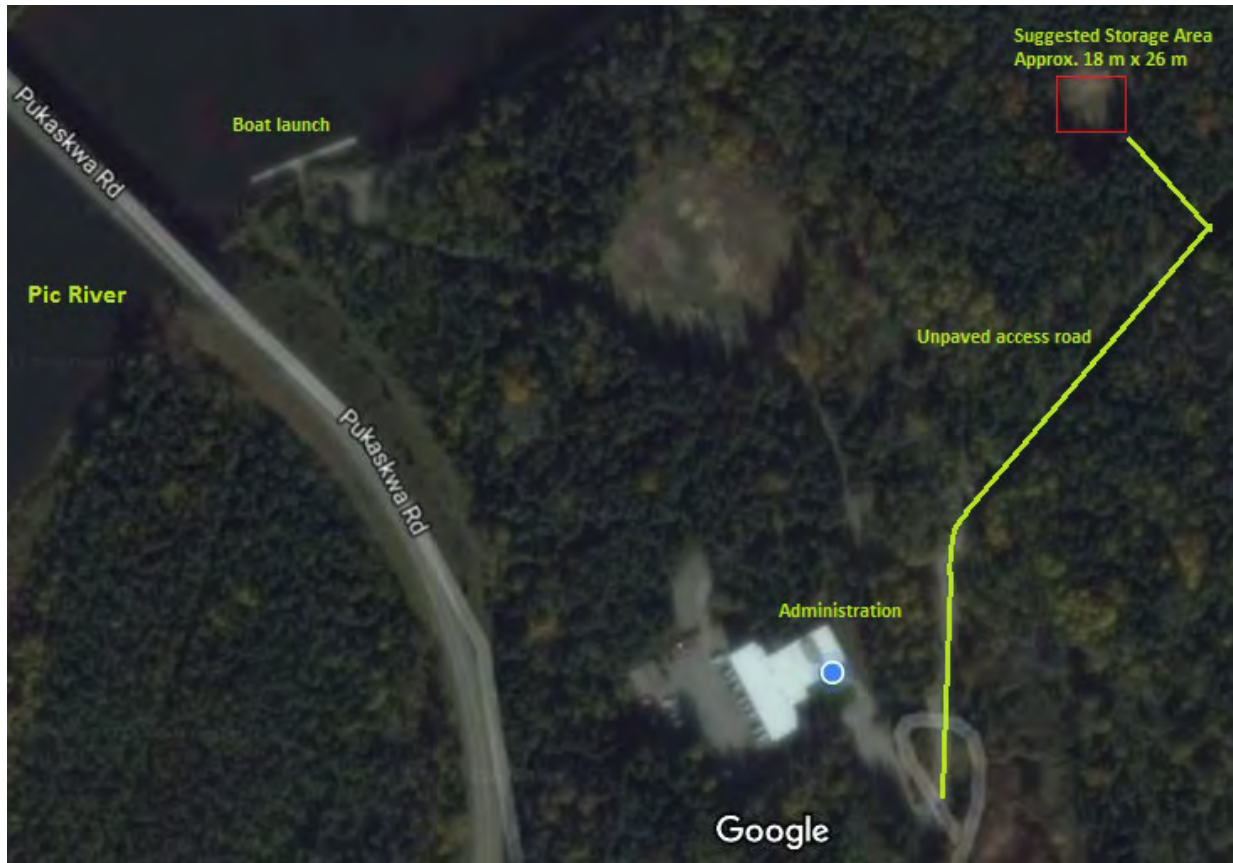
- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.10 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities.
- .3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building.
- .4 Except where connected to owner sewer system, periodically remove wastes from Site.
- .5 New or Existing permanent facilities may not be used unless approved by Departmental Representative or Delegate (DR/D).
- .6 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times

1.11 STAGING AREA

- .1 Parks Canada Agency will only allow the Contractor's staging area and site office to be located as shown and titled "Suggested Storage Area" in the sketch below within the park limits. No other area(s) shall be used for staging within park limits.



END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Informational and warning devices.
- .2 Protection and control of public traffic.
- .3 Operational requirements.

1.2 RELATED SECTIONS

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 Ontario Traffic Manual, Book 7: Temporary Conditions.
- .2 Municipal guidelines and regulations enforceable in the Place of the Work.

1.4 ACCESS TO SITE

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

1.5 PUBLIC TRAFFIC FLOW

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

1.6 PROTECTION OF PUBLIC TRAFFIC

- .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 When working on travelled way:
 - .1 Place equipment in position to present minimum of interference and hazard to traveling 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 Do not close any lanes of road without approval of Departmental Representative or Delegate (DR/D). Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in OTM (Book 7).
- .4 Keep travelled way graded, free of pot holes and of sufficient width for required number of lanes of traffic.
 - .1 Provide minimum seven (7) m wide temporary roadway for traffic in two-way sections through Work and on detours.
 - .2 Provide minimum five (5) m wide 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, unless other means of road access exist that meet approval of Departmental Representative or Delegate (DR/D).

1.7 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in the Ontario Traffic Manual, Book 7: Temporary Conditions.
- .3 Place signs and other devices in locations recommended in in Ontario Traffic Manual, Book 7: Temporary Conditions.
- .4 Meet with Departmental Representative or Delegate (DR/D) prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative or Delegate (DR/D).
- .5 Continually maintain traffic control devices in use by:
 - .1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Removing or covering signs which do not apply to conditions existing from day to day.

1.8 CONTROL OF PUBLIC TRAFFIC

- .1 Provide competent flag persons, trained in accordance with, and properly equipped as specified in the Ontario Traffic Manual, Book 7: Temporary Conditions for the following situations:
 - .1 When public traffic is required to pass working vehicles or equipment which block all or part of travelled roadway.
 - .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
 - .3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
 - .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
 - .5 For emergency protection when other traffic control devices are not readily available.
 - .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
 - .7 At each end of restricted sections where pilot cars are required.
 - .8 Delays to public traffic due to contractor's operators: maximum fifteen (15) minutes.
- .2 Provide and Equip pilot cars with orange flashing lights and signs clearly designating vehicles as pilot cars.
- .3 Where roadway carrying two-way traffic is to be restricted to one lane for twenty-four (24) hours each day, provide portable traffic signal system.

- .1 Adjust as necessary, and regularly maintain system during period of restriction.
- .2 Signal system to requirements of the Ontario Traffic Manual, Book 7: Temporary Conditions.

1.9 OPERATIONAL REQUIREMENTS

- .1 Maintain existing conditions for traffic throughout period of Contract except that, when required for construction under this Contract and when measures have been taken as specified and approved by Departmental Representative or Delegate (DR/D) to protect and control public traffic, existing conditions for public traffic to be restricted as indicated in Section 01 10 00 – Summary of Work (paragraph 1.10 – Work Sequence).

1.10 FIRE ROUTES

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

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 01 10 00 Summary of Work
- .2 Section 01 55 26 Traffic Control & Procedure
- .3 Section 02 41 13.15 Site Work Demolition and Removals
- .4 Section 10 14 53 Traffic Control Signs
- .5 Section 31 23 18 Trenching

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

1.3 INSTALLATION AND REMOVAL

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

1.4 HOARDING

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

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

1.5 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, and open edges of floors and roofs.

1.6 PUBLIC TRAFFIC FLOW

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

1.7 FIRE ROUTES

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

1.8 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.

1.9 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Create an erosion and sediment control plan.
- .2 Prevent loss of soil during construction by storm water runoff and wind erosion.
- .3 Protect stockpiled subsoil/topsoil.
- .4 Prevent sedimentation of storm water and receiving streams.
- .5 Prevent pollution of the air with dust and particulate matter.

1.2 RELATED SECTIONS

- .1 Section 02 41 13.14 Site Work Demolition and Removals
- .2 Section 31 11 00 Clearing and Grubbing
- .3 Section 31 14 13 Soil Stripping and Stockpiling
- .4 Section 31 23 16 Excavating

1.3 REFERENCES

- .1 Ontario Provincial Standard Specifications OPSS 805 (November 2015)
- .2 EPA 832/R-92-005 - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices, September 1992.
- .3 Local erosion and sediment control guidelines.

1.4 DEFINITIONS

- .1 Erosion: Deterioration, displacement, or transportation of land surface by wind or water, intensified by land-clearing practices related to construction activities.
- .2 Rain or Rain Storm: An event defined causing the pooling of water on road or other impervious surfaces.
- .3 Sediment: Particulate matter transported and deposited as a layer of solid particles within a body of water.
- .4 Snow Melt: An event in snow conditions when the temperature is above 0 degrees C or 32 degrees F or when environmental conditions causing snow on the ground to melt.

1.5 SUBMITTALS

- .1 Provide requested information specified in Section 01 33 00.
- .2 Provide within fourteen (14) days of date established for commencement of the Work.
- .3 Application for Payment: Concurrent with each application, provide the following Inspection Log information:
 - .1 Weekly inspection record.
 - .2 Report damages or deficiencies and maintenance of erosion and sediment control measures.
 - .3 Identify and address standing rainwater or snowmelt conditions.

PART 2 PRODUCTS

2.1 LIGHT-DUTY SILT FENCING

- .1 Posts: Wooden stake, lengths as required.
- .2 Geotextile: Shall be free of holes, tears, and punctures. Woven polypropylene filter fabric, resistant to ultra-violet degradation.

PART 3 EXECUTION

3.1 LIGHT-DUTY SILT FENCING

- .1 Install silt fencing as per Ontario Provincial Standard Specifications OPSS 805 (November 2015)

3.2 SITE PROTECTION

- .1 Limit operation of vehicles on site to paved surfaces or temporary gravel surfaces in order to avoid the disturbing of soil.
- .2 Prevent cleared topsoil and excavated earth stockpiled on site from being eroded by rain storm, snow melt or wind.

3.3 OWNER STORM WATER

- .1 Protect catch basins, drains, culverts and other points of entry into owner storm water collection systems.
- .2 Each Week: Inspect for erosion and sediment control measures, to ensure proper functions are not damaged.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Sections containing products, materials and or equipment in Division 02, 10, 26, 31, 32 and 33

1.2 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 or Delegate 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 or Delegate in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.3 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 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.
- .3 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative or Delegate based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 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 or Delegate 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 or Delegate at commencement of Work and should it subsequently appear that Work may be delayed for such reason,

Departmental Representative or Delegate reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Touch-up damaged factory finished surfaces to Departmental Representative or Delegate satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.6 TRANSPORTATION

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

1.7 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 or Delegate in writing, of conflicts between specifications and manufacturer's instructions, so Departmental Representative or Delegate will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative or Delegate to require removal and re-installation at no increase in Contract Price or Contract Time.

1.8 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative or Delegate 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 or Delegate 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 or Delegate, whose decision is final.

1.9 CO-ORDINATION

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

- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.10 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.11 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.12 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative or Delegate.
- .2 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.
- .3 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.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Sections require survey layout in Division 02, 10, 26, 31, 32 and 33.

1.2 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-94, Stipulated Price Contract.
- .2 Owner's identification of existing survey control points and property limits.

1.3 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to the Departmental Representative or Delegate (DR/D).

1.4 SURVEY REFERENCE POINTS

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

1.5 SURVEY REQUIREMENTS

- .1 Establish at least two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations where applicable.
- .7 Establish foundation column locations and floor elevations where applicable.
- .8 Establish lines and levels for electrical work.

1.6 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative or Delegate (DR/D) of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative or Delegate (DR/D).

1.7 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative or Delegate (DR/D) of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative or Delegate (DR/D).

1.8 RECORDS

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

1.9 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative or Delegate (DR/D).
- .2 On request of Departmental Representative or Delegate (DR/D), submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying that those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.10 SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Organization and mobilization of the Contractor's forces.
- .2 Transporting construction plant and equipment to the jobsite and setting up of same.
- .3 Transporting various tools, materials, equipment and personnel to the jobsite.
- .4 Erection of temporary buildings and facilities as required for field offices, staging area, storage, and construction operations.

1.2 RELATED SECTIONS

- .1 Section 01 31 00 - Project Managing and Coordination for specific requirements, as applicable.
- .2 Section 01 51 00 - Temporary Utilities.
- .3 Section 01 52 00 - Construction Facilities.

1.3 MEASUREMENT AND PAYMENT

- .1 Measurement: The work of this Section will not be measured separately for payment.
- .2 Payment: Mobilization will be paid for at the Contract lump sum price, under “Mobilization and Demobilization” item and will include accumulating tools, apparatus, equipment, materials, and personnel, and performing final removal and demobilization. The Contract lump sum price will be paid as follows:
 - 1. 45 percent of the Contract lump sum price within 30 days of the effective date of the Notice to Proceed.
 - 2. 45 percent of the Contract lump sum price within 60 days of the effective date of the Notice to Proceed.
 - 3. 10 percent of the Contract lump sum price after the Departmental Representative or Delegate (DR/D), has determined that the Contractor has left the work site in a clean condition after the completion of all phases of work.

1.1 DESCRIPTION

- .1 Mobilization shall include mobilization of all construction equipment, materials, supplies, appurtenances, facilities, and the like, staffed and ready for commencing and prosecuting the Work; and the subsequent demobilization and removal from the jobsite of said equipment, appurtenances, facilities, and the like upon completion of the work.
- .2 Mobilization shall also include assembly and delivery to the jobsite of plant, equipment, tools, materials, and supplies necessary for the prosecution of work which are not intended to be incorporated in the Work; the clearing of and preparation of the Contractor's work area; the complete assembly, in working order, of equipment necessary to perform the

required work; personnel services preparatory to commencing actual work; and all other preparatory work required to permit commencement of the actual work on construction items for which payment is provided under the Contract.

1.2 SUBMITTALS

- .1 Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.
- .2 Submit a plan of the proposed layout of the construction site, including fences, roads, parking, buildings, staging, and storage areas, within seven days after the effective date of the Notice to Proceed.

1.3 DELIVERY

- .1 Delivery to the jobsite of construction tools, equipment, plant, temporary buildings, materials, and supplies shall be accomplished in conformance with local governing ordinances and regulations.

1.4 TOOLS AND SUPPLIES

- .1 Provide construction tools, equipment, materials, and supplies of the types and quantities necessary to facilitate the timely execution of the Work.
- .2 Provide personnel, products, construction materials, equipment, tools, and supplies at the jobsite at the time they are scheduled to be installed or utilized.

1.5 PLANT LOCATION

- .1 Locate plant, or plants, appropriately close to the portion of the Work for which it will be used.

1.6 DEMOBILIZATION

- .1 Upon completion of the Work, remove construction tools, apparatus, equipment mobile units and buildings, unused materials and supplies, plant, and personnel from the Jobsite.
- .2 Restore all areas utilized for mobilization to their original, natural state or when called for in the Contract Documents, complete such areas indicated.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Common Product Requirements

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of PCA or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.3 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.4 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.5 TOLERANCES

- .1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.
- .2 Do not permit tolerances to accumulate beyond effective or practical limits.
- .3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Consultant before proceeding.
- .4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability, before permanently securing Products in place.

1.6 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Remove samples of installed Work for testing.
- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .10 Restore work with new products in accordance with requirements of Contract Documents.
- .11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Cleaning prior to acceptance.

1.2 RELATED SECTIONS

- .1 Section 01 74 20 – Waste Managing and Disposal.
- .2 Section 01 74 21 – Construction Demolition Waste Management and Disposal.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

- .1 Cleaning Agents and Materials: Low VOC content.

PART 3 EXECUTION

3.1 PROGRESSIVE CLEANING

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than caused by Owner or other Contractors.
- .2 Remove waste materials from site at regularly scheduled times and dispose of as directed by Contract Administration. Do not burn waste materials on site, unless approved by Departmental Representative or Delegate (DR/D).
- .3 Clear snow and ice from area of construction, remove from site or pile in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Containers:
 - .1 Provide on-site steel framed, hinged lid containers for collection of waste materials and debris.
 - .2 Provide and use clearly marked, separate bins for recycling.
 - .3 Refer to 01 74 21 – Construction, Demolition, Waste Managing and Disposal.
- .6 Remove waste material and debris from site and deposit in waste container at end of each working day.
- .7 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of enclosure ventilation systems is not permitted for this purpose.

- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

3.2 CLEANING PRIOR TO ACCEPTANCE

- .1 Prior to applying for Substantial Performance of the Work, 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 PCA or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times and dispose of as directed by Departmental Representative or Delegate (DR/D). Do not burn waste materials on site, unless approved by Departmental Representative or Delegate (DR/D).
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove dirt and other disfiguration from exterior surfaces.
- .8 Sweep and wash clean paved areas.
- .9 Remove snow and ice from access to facilities.

3.3 FINAL PRODUCT CLEANING

- .1 Clean site following stage 1 and 3 (before tourists season)
- .2 Sweep paved areas, rake clean landscaped surfaces.
- .3 Remove waste and surplus materials, rubbish, and construction facilities from the site.
- .4 Execute final cleaning prior to final project assessment.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Waste goals.
- .2 Waste management plan.
- .3 Third party responsibilities.
- .4 Waste management plan implementation.
- .5 Disposal of waste.
- .6 Forms for documenting program.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 00 – Cleaning and Waste Processing.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DEFINITIONS

- .1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.
- .2 Construction and Demolition Waste: Solid wastes typically including but not limited to, building materials, packaging, trash, debris, and rubble resulting from construction, re-modelling, repair and demolition operations.
- .3 Hazardous: Exhibiting the characteristics of hazardous substances including, but not limited to, ignitability, corrosiveness, toxicity or reactivity.
- .4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including, but not limited to, ignitability, corrosiveness, toxicity, or reactivity.
- .5 Non-toxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- .6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and re-manufactured into a new product for reuse by others.
- .7 Recycle: To remove a waste material from the Project site to another site for re-manufacture into a new product for reuse by others.
- .8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .9 Return: To give back reusable items or unused products to vendors for credit.
- .10 Reuse: To reuse a construction waste material in some manner on the Project site.
- .11 Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.
- .12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- .13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

- .14 Toxic: Poisonous to humans either immediately or after a long period of exposure.
- .15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- .16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:
 - .1 Solvents in paints and other coatings.
 - .2 Wood preservatives; strippers and household cleaners.
 - .3 Adhesives in particle board, fibreboard, and some plywood; and foam insulation.
 - .4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.
- .17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- .18 Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.4 SUBMITTAL

- .1 Section 01 33 00: Submission procedures.
- .2 Prepare and submit the following submittals prior to project start-up:
 - .1 Submit two (2) copies of completed Waste Audit.
 - .2 Submit two (2) copies of completed Waste Reduction Work Plan.

1.5 OWNER WASTE MANAGEMENT GOALS

- .1 PCA has established this Project is to generate the least amount of waste possible. This requires that construction processes ensure as little waste as possible, either due to error, poor planning, breakage, mishandling, contamination, or other factors.
- .2 PCA recognizes that waste in any project is inevitable, but indicates that as much of the waste materials as economically feasible. Reused, salvage, or recycle as required.
- .3 Minimize waste disposal to landfills.

1.6 WASTE MANAGEMENT PLAN

- .1 Draft Waste Management Plan: Within ten (10) days after receipt of Notice of Award of Bid, or prior to any waste removal, whichever occurs sooner.
- .2 Submit a Draft Waste Management Plan to Departmental Representative or Delegate (DR/D) for review, refer to sample at the end of this Section.
- .3 Draft Plan to contain the following:
 - .1 Analysis: Proposed site waste generated, including types and quantities.
 - .2 Landfill Options: Name of landfill where trash will be disposed, applicable landfill fees, and projected cost of disposing of Project waste in landfill.
 - .3 Alternatives to Landfill: List of each material proposed to be salvaged, reused, or recycled during course of the Project, proposed local market for each material, and estimated net cost savings or additional costs resulting from separating and recycling, versus landfill each material; "net" means that the following have been subtracted from the cost of separating and recycling:

- .1 Revenue from sale of recycled or salvaged materials.
- .2 Landfill tipping fees saved due to diversion of materials from landfill. List of materials to include the following materials:
 - .1 Cardboard.
 - .2 Clean dimensional wood.
 - .3 Beverage containers.
 - .4 Land clearing debris.
 - .5 Concrete.
 - .6 Brick.
 - .7 Concrete Masonry Units (CMU).
 - .8 Asphalt.
 - .9 Metals from banding, steel stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - .10 Gypsum board.
 - .11 Plastic buckets - waste reduced by using plastic lined cardboard dry packed materials instead of premixed moist packed materials where this option is available.
 - .12 Carpet and carpet pad trim.
 - .13 Paint.
 - .14 Plastic sheeting and packaging, where recycling programs are available.
 - .15 Rigid plastic foam insulation, where recycling programs are available.
- .4 Resources for Development of Waste Management Plan:
 - .1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, then incorporate into Waste Management Plan.
 - .2 Recycling Economics Information: Information available to bidders with regard to estimating the value of recyclable costs is included in Section 00 21 13 of the original National Master Specification (NMS) to be obtained by contractor.
- .5 Final Waste Management Plan: Once the PCA has determined which of the recycling options addressed in the draft Waste Management Plan are acceptable, submit, within ten (10) calendar days, a Final Waste Management Plan, containing the following:
 - .1 Analysis of proposed jobsite waste to be generated, including types and quantities.
 - .2 Landfill options: The name of landfill site where trash will be disposed of, the applicable landfill tipping fees, and the projected cost of disposing of all Project waste at the landfill.
 - .3 Alternatives to Landfill: A list of waste materials from Project that will be separated for reuse, salvage, or recycling.
 - .4 Meetings: A description of regular meetings held to address waste management, refer to Section 01 31 00.
 - .5 Materials Handling Procedures: A description of the means any waste materials identified above will be protected from contamination, and a description of the means to be employed in recycling materials consistent with requirements for acceptance by designated facilities.
 - .6 Transportation: A description of the means of transportation of recyclable materials, whether materials will be site-separated and self-hauled to designated centres, or

whether mixed materials will be collected by waste hauler and removed from site, and destination of materials.

1.7 THIRD PARTY RESPONSIBILITY

- .1 Cooperate with all parties on site to implement a Waste Reduction Plan.
- .2 Failure to cooperate may result in PCA not achieving their environment goal requirements for CaGBC LEED Certification.
- .3 Such result may involve penalties being assessed to Contractor.

1.8 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative or Delegate (DR/D).
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative or Delegate (DR/D).
- .7 Protect surface drainage, storm sewers, sanitary sewers, and utility services from damage and blockage.

1.9 SCHEDULING

- .1 Coordinate work with other activities at site to ensure timely and orderly progress of the work.

PART 2 EXECUTION

2.1 PREPARATION

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

2.2 SITE VISIT

- .1 Pre-bid site visit: Walk-through of project site prior to completion of bid submittal is not mandatory. Date, time and location will be arranged by Departmental Representative or Delegate (DR/D) for those interested in one pre-bid site visit.
- .2 Maintain at job site, one (1) copy of following documents:
 - .1 Waste Audit (WA).
 - .2 Waste Reduction Workplan (WRW).
 - .3 Material Source Separation Plan (MMSP).
 - .4 Schedules 'A' completed for project.

2.3 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by existing facility.
- .3 Provide temporary security measures as approved by Departmental Representative or Delegate (DR/D).

2.4 WASTE MANAGEMENT PLAN IMPLEMENTATION

- .1 **Manager:** Designate an on-site party responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for Project.
- .2 **Distribution:** Distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the PCA, and the Departmental Representative or Delegate (DR/D).
- .3 **Instruction:** Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by parties at appropriate stages of Project.
- .4 **Separation facilities:** Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
- .5 **Hazardous wastes:** Hazardous wastes shall be separated, stored, and disposed of according to local regulations.
- .6 **Application for Progress Payments:** Submit with each Application for Progress Payment a Summary of Waste Generated by the Project:
 - .1 Failure to submit information shall render Application for Payment incomplete and delay Progress Payment.
 - .2 Submit summary on a form acceptable to PCA containing the following information:
 - .1 Amount in tonnes or cubic metres (tons or cubic yards) of material land filled from the Project,
 - .2 Identity of the landfill, and total amount of tipping fees paid at the landfill, and.
 - .3 Total disposal cost. Include manifests, weight tickets, receipt, and invoices.
 - .4 Each material recycled, reused, or salvaged from the Project.
 - .5 Amount tonnes or cubic metres (tons or cubic yards).
 - .6 Date removed from the job site, the receiving party, and the transportation cost.
 - .7 Amount of any money paid or received for the recycled or salvaged material.
 - .8 Net total cost or savings of salvage or recycling each material.
 - .3 Attach manifests, weight tickets, receipts, and invoices.

2.5 DISPOSAL OF WASTE

- .1 Burying of rubbish and waste materials is prohibited unless approved by authority having jurisdiction.
- .2 Disposal of waste, volatile materials, mineral spirits, oil and paint thinner into waterways, storm, or sanitary sewers is prohibited.

2.6 CLEANING

- .1 Remove tools and waste materials on completion of work, leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

2.7 SPECIAL PROGRAMS

- .1 Be responsible for final implementation of programs involving tax credits or rebates or similar incentives related to recycling, if applicable to the Project.
- .2 Revenues or other savings obtained for recycling or returns to accrue to Contractor.
- .3 Recycling facility accessible from the Project site.
- .4 Obtain information packets relevant to all of the above listed programs prior to starting work on the Project, and confirm facility's ability to accept waste from Project.
- .5 Document work methods, recycled materials, alternate disposal methods that qualify for tax credits, rebates, and other savings under programs listed by authority having jurisdiction.

END OF SECTION

Part 1 General**1.1 WASTE MANAGEMENT GOALS**

- .1 Prior to start of Work conduct meeting with the Departmental Representative or Delegate (DR/D) to review and discuss PWGSC's waste management goal and Contractor's proposed Waste Reduction Workplan for construction demolition waste that will be project generated.
- .2 PWGSC's waste management goal: to divert a minimum 75 percent of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative or Delegate (DR/D) documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced. The overall waste diversion goal for this project is 90%.
- .3 Target percentage goals are achievable for waste diversion. Contractor to review and confirm with Departmental Representative or Delegate (DR/D) Waste Audit acceptable values.
- .4 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.
- .5 Protect environment and prevent environmental pollution damage.

1.2 RELATED REQUIREMENTS

- .1 Sections containing Masonry, pavement materials, Mechanical piping and fixtures, Electrical lighting/wiring/conduits/boxes and fixtures, Wood, in Division 02, 10, 26, 31, 32 and 33.
- .2 Section 01 74 00 – Cleaning and Waste Processing.

1.3 REFERENCES

- .1 Definitions:
 - .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by Departmental Representative or Delegate (DR/D).
 - .2 Class III: non-hazardous waste - construction renovation and demolition waste.
 - .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
 - .4 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices (Schedule E).
 - .5 Inert Fill: inert waste - exclusively asphalt and concrete.

- .6 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .7 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .8 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .9 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .10 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .11 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .12 Separate Condition: refers to waste sorted into individual types.
- .13 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .14 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.
- .15 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.
- .16 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
- .17 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.
- .2 Reference Standards:
 - .1 Ontario Ministry of Environment
 - .1 Ontario 3 R's Regulations (regulation 102/94) for waste management programs applicable to construction and demolition projects greater than 2,000 m².
 - .2 Ontario Environmental Protection Act (EPA)

- .1 Regulation 102/94, Waste Audits and Waste Reduction Workplans.
- .2 Regulation 103/94, Source Separation Programs.
- .3 Canadian Construction Association (CCA)
 - .1 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.
- .4 Public Works and Government Services Canada (PWGSC)
 - .1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.
 - .2 CRD Waste Management Market Research Report (available from PWGSC's Environmental Services).
 - .3 Sustainable Development Strategy 2007-2009: Target 2.1 Environmentally Sustainable Use of Natural Resources.
 - .1 Real Property projects over \$1 million and in communities where industrial recycling is supported, implementation of CRD waste management practices will be completed, with waste materials being reused or recycled.
 - .2 Contractually ensure resources used in construction or maintenance are consumed and recovered in a sustainable manner.

1.4 DOCUMENTS

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
 - .1 Waste Audit (Schedule A).
 - .2 Waste Reduction Work plan (Schedule B).
 - .3 Waste Source Separation Program.
 - .4 Schedules A, B completed for project.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 1 copy (hard copy and digital) of completed Waste Audit (WA): Schedule A.
 - .2 1 copy (hard copy and digital) of completed Waste Reduction Work plan (WRW): Schedule B.
 - .3 1 copy (hard copy and digital) of Cost/Revenue Analysis Work plan (CRAW): Schedule E.
 - .4 1 copy (hard copy and digital) of Waste Source Separation Program (WSSP).
- .3 Prepare and submit on bi-weekly basis, throughout project or at intervals agreed to by the Departmental Representative or Delegate (DR/D) the following:

- .1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.
- .2 Updated Waste Materials Tracking form (Schedule D).
- .3 Written bi-weekly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.
- .4 Submit prior to final payment the following:
 - .1 Waste Diversion Report, indicating final quantities in tones by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials (See Schedule C).
 - .2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.6 WASTE AUDIT (WA)

- .1 Departmental Representative or Delegate (DR/D) will prepare WA prior to project start-up. WA will be provided with bid documentation (see Schedule A).
- .2 WA provides detailed inventory, estimated quantities and types of waste materials that will be generated as well as their potential to be reused and/or recycled and project's waste diversion goals and objectives.
- .3 After award of contract, contractor to review WA and confirm that anticipated quantities of waste generated are accurate and goals achievable.
- .4 If after review, contractor determines that indicated quantities or opportunities in WA are not accurate or achievable, contractor to provide written details of discrepancies and revised quantities for areas of concern. Contractor to meet with Departmental Representative or Delegate (DR/D) to review and justify revisions.
- .5 Post on-site WA where contractor and sub-contractors are able to review content.

1.7 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare and submit WRW (Schedule B) at least 10 days prior to project start-up.
- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.
- .3 WRW should include but not limited to:
 - .1 Applicable regulations.
 - .2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
 - .3 Destination of materials identified.
 - .4 Deconstruction/disassembly techniques and schedules.
 - .5 Methods to collect, separate, and reduce generated wastes.
 - .6 Location of waste bins on-site.

- .7 Security of on-site stock piles and waste bins.
- .8 Protection of personnel, sub-contractors.
- .9 Clear labelling of storage areas.
- .10 Training plan for contractor and sub-contractors.
- .11 Methods to track and report results reliably (Schedule D).
- .12 Details on materials handling and removal procedures.
- .13 Recycler and reclaimer requirements.
- .14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
- .15 Requirements for monitoring on-site wastes management activities.
- .4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .5 Post WRW or summary where workers at site are able to review content.
- .6 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project (Schedule D).

1.8 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

- .1 Prepare CRAW (see Schedule E) and include the following:
 - .1 Cost of current waste management practices.
 - .2 Implementation cost of waste diversion program.
 - .3 Savings and benefits resulting from waste diversion program.

1.9 WASTE SOURCE SEPARATION PROGRAM (WSSP)

- .1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.
- .2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.
- .3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .5 Locate containers to facilitate deposit of materials without hindering daily operations.
- .6 Provide training for contractor, sub-contractors and workers in handling and separation of materials for reuse and/or recycling.
- .7 Locate separated materials in areas which minimizes material damage.
- .8 Clearly and securely label containers to identify types/conditions of materials accepted and assist contractor, sub-contractors and workers in separating materials accordingly.

- .9 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.
- .10 On-site sale of salvaged materials is not permitted unless authorized in writing by the Departmental Representative or Delegate (DR/D) and provided that site safety regulations and security requirements are adhered to.

1.10 USE OF SITE AND FACILITIES

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative or Delegate (DR/D).

1.11 WASTE PROCESSING SITES

- .1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.

1.12 QUALITY ASSURANCE

- .1 After award of Contract, a mandatory site examination will be held for this Project for Contractor and/or sub-contractors responsible for construction demolition/deconstruction waste management.
 - .1 Date, time and location will be arranged by the Departmental Representative or Delegate (DR/D).
- .2 Waste Management Meeting: Waste Management Co-ordinator is to provide an update on status of waste diversion and management activities at each meeting. Written bi-weekly Waste Diversion Report summary to be provided by Waste Management Coordinator (refer to the Waste Diversion Report form in Schedule C and Waste Materials Tracking form in Schedule D).

1.13 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by the Departmental Representative or Delegate (DR/D).
- .2 Unless specified otherwise, materials for removal do not become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed and salvaged materials from movement or damage.
- .6 Protect surface drainage, mechanical and electrical from damage and blockage.
- .7 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.

- .8 Separate and store materials produced during project in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to offsite processing facility for separation.
 - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
 - .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.14 DISPOSAL OF WASTES

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

1.15 SCHEDULING

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

Part 2 Execution

2.1 APPLICATION

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

2.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00
 - .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 00.
- .3 Waste Management: separate waste materials for reuse/recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Source separate materials to be reused/recycled into specified sort areas.

2.3 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by the Departmental Representative or Delegate (DR/D) and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged, recovered, reusable, and recyclable materials is not permitted.

2.4 WASTE DIVERSION REPORT

- .1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:
 - .1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.
 - .2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.
 - .1 Supporting documentation.
 - .2 Waybills and tracking forms.
 - .3 Description of issues, resolutions and lessons learned.

2.5 WASTE AUDIT (WA)

- .1 Schedule A - Waste Audit (WA)

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood and Plastics Material Description						
Off-cuts						
Warped Pallet Forms						
Plastic Packaging						
Cardboard						

Packaging						
Other						
Doors and Windows Material Description						
Painted Frames						
Glass						
Wood						
Metal						
Other						

2.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destination
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packaging							
Card-board Packaging							
Other							
Doors and Windows Material Description							
Painted Frames							
Glass							
Wood							
Metal							
Other							

2.7 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Schedule E - Cost/Revenue Analysis Workplan (CRAW)

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cum)	(4) Weight (cum)	(5) Disposal Cost/Credit \$(+/-)	(6) Category Sub-Total \$(+/-)
Wood					
Wood Stud					
Plywood					
Baseboard - Wood					
Door Trim - Wood					
Cabinet					\$
Doors and Windows					
Panel Regular					
Slab Regular					
Wood Laminate					
Byfold - Closet					
Glazing					\$
		(7) Cost (-) / Revenue (+)			\$

2.8 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule G - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
Ontario	Ministry of Environment and Energy, 135 St. Clair Avenue West Toronto ON M4V 1P5	416-323-4321 800-565-4923	416-323-4682

2.9 SCHEDULES

.1 Following Schedules are attached to this Specification:

- .1 Waste Audit - Schedule A.
- .2 Waste Reduction Workplan Form - Schedule B.
- .3 Waste Diversion Report Form - Schedule C.
- .4 Waste Materials Tracking Form - Schedule D.
- .5 Cost/Revenue Analysis Workplan - Schedule E.
- .6 Market Research Report - Schedule F (When Available).

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 01 78 10 Closeout Submittals

1.2 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-2008, Stipulated Price Contract.
- .2 Canadian Environmental Protection Act (CEPA)
 - .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

1.3 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 or Delegate in writing of satisfactory completion of inspection and submit verification that corrections have been made.
 - .2 Request Departmental Representative or Delegate (DR/D) inspection.
 - .2 Departmental Representative or Delegate (DR/D) Inspection:
 - .1 Departmental Representative or Delegate (DR/D) and Contractor to inspect Work and identify defects and deficiencies that have not been corrected.
 - .2 Contractor to re-correct Work as directed.
 - .3 Declaration of Substantial Performance: when Departmental Representative or Delegate considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
 - .4 Commencement of Lien and Warranty Periods: date of PCA's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
 - .5 Final Payment:
 - .1 When Departmental Representative or Delegate considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
 - .2 Refer to CCDC 2: when Work deemed incomplete by Departmental Representative or Delegate, complete outstanding items and request re-inspection.

- .6 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.4 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse/recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Inspections and declarations.
- .2 Closeout submittals.
- .3 Operation and maintenance manual format.
- .4 Contents each volume.
- .5 Recording actual site conditions.
- .6 Record (as-built) documents and samples.
- .7 Record documents.
- .8 Final survey.
- .9 Warranties and bonds.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSPECTIONS AND DECLARATIONS

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative or Delegate (DR/D) in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative or Delegate (DR/D)'s Inspection.
- .2 Departmental Representative or Delegate (DR/D)'s Inspection: Departmental Representative or Delegate (DR/D) shall form an inspection team comprised of Departmental Representative or Delegate (DR/D), and Contractor or representative. This team shall estimate the dollar value of the deficiencies and/or work not completed. The Departmental Representative or Delegate (DR/D) will issue order to the contractor to inspect of work to identify defects and deficiencies with a date of completion. The estimated dollar amount for the deficient and/or the incomplete work will be in hold-back until the satisfactory completion of such work. The prime contractor will be allowed to bring the sub-contractors or their representative to become part of the inspection team.
- .3 Completion: Submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted, balanced and are fully operational.
 - .4 Certificates required by authorities having jurisdiction have been submitted.
 - .5 Operation of systems have been demonstrated to PCA's personnel.
 - .6 Work is complete and ready for Final Inspection.

- .2 Final Inspection: When items noted above are completed, request final inspection of Work by the Departmental Representative or Delegate (DR/D) that will reassemble the same team to reconvene for final inspection. If Work is still deemed incomplete by the inspection team, complete outstanding items and request re-inspection.
- .3 Declaration of Substantial Performance: When Departmental Representative or Delegate (DR/D) considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial completion certification.
- .4 Commencement of Warranty Periods: The date of Substantial completion certification of the Work shall be the date for commencement of the warranty period.
- .5 Commencement of Lien Periods: The date of publication of the certificate of Substantial completion certification of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.
- .6 Final Payment: When Departmental Representative or Delegate (DR/D) considers final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment and final completion certification.
- .7 Payment of Hold-back: After issuance of certificate of Substantial completion certification of the Work, submit an application for release of hold-back amount.

1.4 CLOSEOUT SUBMITTALS

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection with Departmental Representative or Delegate (DR/D) comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Departmental Representative or Delegate (DR/D) four (4) final copies of operating and maintenance manuals in Canadian English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.5 OPERATION AND MAINTENANCE MANUAL FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm or 8.5 x 11 inch with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

- .5 Arrange content by systems or process flow under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in *.dwg AutoCAD Release 13 format on DVD.

1.6 CONTENTS - EACH VOLUME

- .1 Table of Contents: Provide:
 - .1 Title of project.
 - .2 Date of submission.
 - .3 Names, addresses, and telephone numbers of Departmental Representative or Delegate (DR/D) and Contractor with name of responsible parties.
 - .4 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including pressure vessel acceptance, code compliance certificate and life safety systems performance certificate.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Departmental Representative or Delegate (DR/D).
- .2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.

- .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: Maintain manufacturer's certifications, field test records and inspection certifications required by individual specifications sections.

1.8 RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for the Departmental Representative or Delegate (DR/D), one (1) record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 List of outstanding shop drawings.
 - .7 Field test records.
 - .8 Copy of approved work schedule.
 - .9 Inspection certificates.
 - .10 Contractors Environmental Procedures.
 - .11 Manufacturer's certificates.
 - .12 Health and Safety plan and other safety related documents.
 - .13 Other documents as specified.
- .2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document AS-BUILT DOCUMENTS in neat, large, printed letters.
- .4 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.
- .5 Keep as-built documents and samples available for inspection by Departmental Representative or Delegate (DR/D).

1.9 RECORD DOCUMENTS

- .1 Prior to Substantial Performance of the Work, provide on DVD the marked up information from the as-built documents to a master set of drawing and specification files provided by the Departmental Representative or Delegate (DR/D), as follows:
 - .1 Drawings: AutoCAD Release 13.
 - .2 Specifications: Adobe Acrobat (pdf)
- .2 Mark revised documents as RECORD DOCUMENTS. Include all revisions, with special emphasis on electrical.
- .3 Employ a competent computer draftsman to indicate changes on the electronic set of record drawings. Provide updated record drawings in Adobe Acrobat and AutoCAD Release 13.

- .4 Employ a competent specification writer to indicate changes to the electronic set of record specifications. Provide updated record specifications in Adobe Acrobat on DVD or CD.
- .5 Submit completed record documents to Departmental Representative or Delegate (DR/D) on a CD or DVD, accompanied by three (3) hard copy sets.

1.10 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.
- .2 Inaccurate or neglectful information shall become a liability of the Contractor.

1.11 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.
- .4 Except for items put into use with PCA's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittals.

END OF SECTION

EXISTING CONDITIONS
DIVISION 02

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 In-place pavement processing to a depth of 150mm.

1.2 REFERENCES

- .1 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS.MUNI 330 - November 2014, Construction Specification for In-Place Full Depth Reclamation of Bituminous Pavement and Underlying Granular.
 - .2 OPSS.MUNI 510 - November 2014, Construction Specification for Removal.
- .2 Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation Report, Pukaskwa National Park, Heron Bay, Ontario, dated December 7, 2016 Report Number: 1545167, prepared by Golder Associates.

PART 2 PRODUCTS**2.1 EQUIPMENT**

- .1 Use Conventional pulverization equipment for this Work.
 - .1 Depending on the type of pulverization equipment used, some localized milling of the existing asphalt may be required. Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from stringline, and capable of removing part of pavement surface to depths or grades indicated.

PART 3 EXECUTION**3.1 PREPARATION**

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control Plan.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls, restore and stabilize areas disturbed during removal.
- .2 Prior to beginning of removal operation, inspect and verify with Departmental Representative or Delegate, depths and lines of asphalt pavement to be removed.
- .3 Protection: protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Departmental Representative or Delegate at no additional cost.

3.2 PULVERIZATION AND MIXING

- .1 Use pulverization equipment and break up existing asphalt pavement to lines and grades as indicated on contract drawings. The in-situ pulverization should be carried out in accordance with OPSS.MUNI 330.
- .2 Mix existing asphaltic concrete and granular base. Carried out to a depth of about 150mm. The blend material should contain a maximum of 50% by volume of bituminous material.
- .3 Prevent contamination with topsoil, underlying gravel or other materials.
- .4 Suppress dust generated by removal process.

3.3 FINISH TOLERANCES

- .1 Finished surfaces in areas where asphalt pavement has been removed/processed to be within +/-5 mm of grade specified but not uniformly high or low.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00
 - .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 00
- .3 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.
- .4 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Surplus mix materials can be used in lieu of granular A on Lagoon Access Road.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Removal of surface debris.
- .2 Removal of paving and wooden curbs.
- .3 Removal of Pipes and Culverts.
- .4 Removal of fence.
- .5 Removal of Shed and Accessories.

1.2 RELATED SECTIONS

- .1 Section 31 11 00 – Clearing and Grubbing.
- .2 Section 31 22 13 – Rough Grading.
- .3 Section 31 23 17 – Rock Removal.
- .4 Section 01 35 23 – Health and Safety.
- .5 Section 01 57 13 – Temporary Erosion and Sediment Control.
- .6 Section 01 74 00 – Cleaning and Waste Processing.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .2 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.
- .2 Ontario Provincial Standard Specifications (OPSS)
 - OPSS.PROV 510 (November 2014) Construction Specification for Removal

1.4 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated price: Section 01 29 00 - payment procedures affecting this section.
- .2 Site Clearing: measured by the square metre, linear metre and each as applicable. Includes clearing site, loading and removing waste materials from site.

1.5 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for environmental requirements, disposal of debris.
- .2 Coordinate clearing Work with utility companies, and Contract Administrator as applicable.

Part 2 Execution

2.1 PREPARATION

- .1 Verify that existing plant life designated to remain is tagged or identified.
- .2 Identify a salvage area or waste area for placing removed materials.

2.2 PROTECTION

- .1 Locate, identify and protect utilities that remain, from damage.
- .2 Protect trees, plant growth, and features designated to remain, as final landscaping.
- .3 Protect bench marks, survey control points, and existing structures from damage or displacement.

2.3 CLEARING

- .1 Clear areas required for access to site and execution of Work.
- .2 Clear undergrowth and deadwood, without disturbing subsoil.

2.4 REMOVAL

- .1 Remove debris, rock, and extracted plant life from site.
- .2 Remove paving and wooden curbs. Edges of partially removed pavement shall be neatly saw cut at right angle to surface.
- .3 Remove Corrugated Steel pipe Culvert.
- .4 Remove fencing.
- .5 Remove Shed(s) and Accessories.
- .6 Removals shall be according to OPSS PROV 510.

2.5 STOCKPILING

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

2.6 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work match condition of adjacent, undisturbed areas.

- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

2.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.
 - .1 Leave Work area clean at end of each day.
 - .2 Remove debris, trim surfaces and leave work site clean, upon completion of Work
 - .3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Processing.
- .3 Waste Management: separate waste materials for reuse/recycling in accordance with this section.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

CONCRETE
DIVISION 03

Part 1 General**1.1 RELATED SECTIONS**

- .1 Section 01 35 23 – Health and Safety.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Section 31 05 16 – Aggregate Materials.
- .4 Section 32 11 23 – Aggregate Base Course.
- .5 Section 32 12 16.04 – Flagstone Paving.
- .6 Section 32 13 13 – Concrete Paving.

1.2 MEASUREMENT FOR PAYMENT

- .1 No measurement for payment will be made under this section. Include costs in items where required.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260-01, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M-03, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM D412-98a (2002) e1, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .6 ASTM D624-00e1, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .7 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .8 ASTM D1752-04a, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34-M86 (R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA International)

- .1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.
- .3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting once week prior to beginning concrete work.
 - .1 Ensure key personnel, site supervisor, Departmental Representative, speciality contractor – finishing, forming attend.
 - .1 Verify project requirements.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit testing results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken.
- .4 Concrete hauling time: submit for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .5 Provide two (2) copies of WHMIS MSDS in accordance with Section 01 35 23– Health and Safety.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Submit to Departmental Representative, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Curing.
 - .2 Finishes.
 - .3 Joints.
- .4 Quality Control Plan: submit written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged 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.

Part 2 Products**2.1 DESIGN CRITERIA**

- .1 Performance: to CSA A23.1/A23.2.

2.2 PERFORMANCE CRITERIA

- .1 Quality Control Plan: Ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance.

2.3 MATERIALS

- .1 Cement: to CAN/CSA-A3001, Type GU.
- .2 Water: to CSA-A23.1.
- .3 Aggregates: to CAN/CSA-A23.1/A23.2.
- .4 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494 ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .5 Curing compound: to CSA-A23.1/A23.2 white.

2.4 MIXES

- .1 Performance Method for specifying concrete: to meet Departmental Representative performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
 - .1 Compressive strength at 28 days: 32 MPa minimum.
 - .2 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .3 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

Part 3 Execution**3.1 PREPARATION**

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .3 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4 Protect previous Work from staining.
- .5 Clean and remove stains prior to application for concrete finishes.
- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, and air temperature and test samples taken.
- .7 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Finishing and curing:
 - .1 Finish concrete in accordance with 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. Provide written declaration that compounds used are compatible.
- .3 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form expansion joints per OPSD Standards.
 - .4 Install joint filler.
 - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct following test as follows in accordance with Section 01 45 00 - Quality Control and submit report for the following:
 - .1 Concrete pours.
 - .2 Slump tests.
 - .3 Air Content.
 - .4 Compressive Strength at 7 and 28 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
- .4 Contractor will pay for costs of tests as specified in Section 01 29 00 - Payment Procedures for Testing Laboratory Services.
- .5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .7 Inspection or testing by Departmental Representative 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 00
 - .1 Divert unused concrete materials to local quarry.
 - .2 Provide appropriate area on job site where concrete trucks can be safely washed.
 - .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.
 - .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.
 - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams.
 - .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.
 - .7 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION

SPECIALITIES
DIVISION 10

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Traffic Control Plan.

1.2 RELATED SECTIONS

- .1 Section 32 17 24 – Painted Pavement Markings.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 Traffic Signs:
 - .1 Payment by Stipulated (Lump Sum) bid.
 - .2 Include in Lump Sum:
 - .1 Sign board and Post
 - .2 Necessary hardware to attach signs at specified locations.
 - .3 Labour, materials, equipment, and other related work.

1.4 REFERENCES

- .1 MPI (Master Painters Institute) – Architectural Painting Specifications Manual and Maintenance Repainting Manual.
- .2 SSPC (The Society for Protective Coatings) - Steel Structures Painting Manual.
- .3 OTM (Ontario Traffic Manual – Books -7)
- .4 Provincial or municipal standards relevant to the place of the Work.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project managing and coordination.

1.6 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submittal procedures.
- .2 Product Data: Provide data on sign materials, reflective finish and colours, posts and attachments required.

1.7 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal procedures.
- .2 Installation Data: Manufacturer's special installation requirements.
- .3 Sustainable Design:
 - .1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.8 QUALITY ASSURANCE

- .1 Perform Work to OTM (Ontario Traffic Manual – Books -7)
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years of documented experience.

1.9 REGULATORY REQUIREMENTS

- .1 Conform to applicable Ontario Traffic Manual (Book 7) for traffic control signage requirements.

1.10 DELIVERY, STORAGE, AND PROTECTION

- .1 Transport, handle, store, and protect products.
- .2 Protect sign surfaces with wrapping.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Reflective Sheeting: High intensity reflective sheeting.

2.2 COMPONENTS

- .1 Signs and Posts: Type, size, and colour required to conform to Ontario Traffic Manual, suitable strength for anticipated wind loads.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify sign locations and quantities.

3.2 INSTALLATION

- .1 Install signs where indicated on Traffic Control Plan.
- .2 Install signs at a minimum of 2 m above grade level.

3.3 CLEANING

- .1 Remove protective material from surfaces.
- .2 Wipe surfaces clean.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Removal of Signs.
- .2 Relocation of Signs.
- .3 Erection of Permanent Signs.

1.2 RELATED SECTIONS

- .1 Section 32 17 24 – Painted Pavement Markings.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 Sign boards: Supply and installation on a per lump sum basis.
 - .2 Posts and Bases: Supply and installation on a per lump sum basis, including all connection hardware.
 - .3 Standard Posts: Supply and installation on a per lump sum basis.

1.4 REFERENCES

- .1 ASTM A53/A53M-12 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .2 MPI (Master Painters Institute) – Architectural Painting Specifications Manual and Maintenance Repainting Manual.
- .3 SSPC (The Society for Protective Coatings) - Steel Structures Painting Manual.
- .4 OTM (Ontario Traffic Manual – Books -2, 5, 6, 8, 10 & 11)
- .5 Ontario Provincial Standard Specifications OPSS 703 (November 2014).
- .6 Ontario Provincial Standard Specifications OPSS 2001 (November 2014).

1.5 REMOVAL OF SIGNS

- .1 Removal of existing signs shall include the sign board, post, and associated hardware and shall be removed according to OPSS 703.

1.6 RELOCATION OF SIGNS

- .1 Any sign designated for relocation shall be salvaged and remain the property of PCA and shall be maintained in a reasonable condition and stockpiled in a manner acceptable to the Departmental Representative or Delegate (DR/D). Existing removed signs that are not salvageable shall be delivered to the location specified by the Departmental Representative or Delegate (DR/D).
- .2 Any sign designated for salvage damaged by the Contractor's operations or lost by the Contractor at any time prior to re-use or stockpiling shall be replaced with new sign at the Contractor's expense.

- .3 Sign relocation shall be according to OPSS 703.

1.7 NEW SIGNS

- .1 New signs shall include the sign board, post(s), and associated hardware and shall be installed according to OPSS 703 and OTM.2.

1.8 PERFORMANCE REQUIREMENTS

- .1 Assembly of components include conformance to wind and suction loads as applicable to subject site as defined in applicable manuals/standards.
- .2 Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable code for location of installation.
- .3 Moisture Leakage Allowed into Signage Assembly: Immediately drained to exterior.

1.9 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate the Work of this section and directly related sections, with installation of pavement markings and finish grading.

1.10 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submittal procedures.
- .2 Shop Drawings:
 - .1 Supply layout proofs of signs for review prior to manufacture.
 - .2 Provide location plan for review prior to installation.

1.11 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal procedures.
- .2 Installation Data: Manufacturer's special installation requirements.
- .3 Sustainable Design:
 - .1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.12 CLOSEOUT SUBMITTALS

- .1 Section 01 33 00 & Section 01 78 10 - Submittal procedures and this Section.

1.13 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.
- .3 Rejection:
 - .1 Signs bearing non-uniform letters or numerals, crooked borders, chipping of finish, flattening of materials, or other visible defects will be rejected.
 - .2 Remove all sharp edges and debris.

1.14 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for signage type and sign placement requirements.
- .2 Signing: To Ontario Traffic Manual – Books -2, 5, 6, 8, 10 & 11.

1.15 DELIVERY, STORAGE, AND PROTECTION

- .1 Transport, handle, store, and protect products.
- .2 Protect pre-finished surfaces with wrapping or strippable coating.

1.16 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Do not install components when ambient temperature is less than 5 degrees C or 40 degrees. Maintain this minimum temperature during and after installation of adhesives and sealants.
 - .2 Do not install posts or framing into frozen soil or subsoil.

1.17 WARRANTY

- .1 Section 01 78 10: Closeout Submittals.
- .2 Provide five (5) year warranty to include coverage for failure to meet specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS & COMPONENTS

- .1 Sign boards & Posts: As per OPSS 703 and OPSS 2001

2.2 FABRICATION

AS PER OTM, BOOK 2

2.3 FINISHES

- .1 Steel Signs:
 - .1 Posts and Bases: Galvanized.
 - .2 Touch-Up Primer for Galvanized Steel Surfaces: zinc-rich primer.
 - .3 Apply two (2) coats of bituminous paint to concealed metal surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify dimensions, tolerances, and method of attachment with other work.

3.2 INSTALLATION

- .1 As per OPSS 703 and OTM book 2.

3.3 ERECTION TOLERANCES

- .1 Section 01 73 00: Execution (Tolerances).
- .2 Maximum Variation from Plumb or Level: 3 mm.

3.4 CLEANING

- .1 Section 01 74 00: Cleaning installed work.
- .2 Remove protective material from surfaces.
- .3 Wash down surfaces exposed to dirt or grime.

3.5 PROTECTION OF FINISHED WORK

- .1 Protect specially finished or fragile Work from damage.

END OF SECTION

ELECTRICAL
DIVISION 26

DEFINITIONS

For the purpose of this specification, the following abbreviations apply:

AISI - American Institute of Steel and Iron

ASTM - American Society for Testing and Materials International

BCD - Bolt Circle Diameter

CSA – Canadian Standards Association

EEMAC - Electrical Equipment Manufacturers Association of Canada

EIA - Electronic Industries Association

ESA – Electrical Safety Authority

IEEE - Institute of Electrical and Electronic Engineers

IES - Illuminating Engineering Society of North America

IMSA - International Municipal Signal Association

ITE - Institute of Transportation Engineers

MTO - Ministry of Transportation of Ontario

NEMA - National Electrical Manufacturers Association

OPSS - Ontario Provincial Standard Specifications

OPSD - Ontario Provincial Standard Drawings

OACETT - Ontario Association of Certified Engineering Technicians and Technologists

PEO - Professional Engineers of Ontario

ULC - Underwriters' Laboratories of Canada

For the purpose of this specification, the following definitions apply:

Contract Administrator: means the person, partnership or corporation designated by the Owner to be the Owner's representative for purposes of the Contract.

Contractor: means the person, partnership or corporation undertaking the Work as identified in the Agreement.

ELECTRICAL WORK - General

SCOPE:

UNDERGROUND WORK

The underground work consists of the supply of all labour, equipment and materials for the installation of conduit, concrete pole bases, communication chambers, electrical chambers, service boxes, splice cabinet and any other items as shown on the Contract Drawings. The quantities listed in the contract documents may be subject to change; therefore, the Contractor must be willing to perform additional work using the same unit prices.

ABOVEGROUND WORK

The aboveground work consists of the supply of all labour, equipment and materials required for the aboveground installation of roadway lighting devices and RV Outlet work. These installations shall be made as shown on the Contract Drawings. The quantities listed in the contract documents may be subject to change; therefore, the Contractor must be willing to perform additional work using the same unit prices.

SUBMISSION AND DESIGN REQUIREMENTS

Electrical Equipment Working (Shop) Drawings

01 Drawing Requirements

Working Drawings for the following electrical equipment are required:

- a) Poles,
- b) Luminaires,
- c) Luminaire Photo Control Units,
- d) Anchorage Assemblies,
- e) Electrical Chambers,
- f) RV Outlet Unit,
- g) Energy Meter for RV outlet unit

Working Drawings for luminaires shall consist of manufacturer's catalogue information and photometric data. Working Drawings for all other items shall include all information required in the applicable material specification.

02 Submission of Drawings

Three sets of electrical equipment Working Drawings shall be submitted to the Contractor Administrator prior to the commencement of fabrication.

03 Return of Submissions

Each submission or resubmission shall be reviewed and returned within 4 weeks.

Three copies of the electrical equipment Working Drawings to be returned shall be marked as one of the following:

- a) Stamped with wording that allows for “Permission to Construct”.

In this case, the Contractor shall then submit another seven copies of these final drawings to the Contract Administrator, who shall stamp them with wording that allows for “Permission to Construct”. Work can commence on receipt of the drawings by the Contractor.

- a) Showing only required changes.

In this case, the drawings shall be updated as required and the submission process repeated.

Once fabrication of the electrical equipment has commenced, materials and dimensions shown on the final Working Drawings shall not be changed.

MATERIALS

Unless otherwise specified in the Contract Documents or by the Contract Administrator, all electrical materials shall be new, of uniform pattern throughout the work and fabricated and supplied by recognized equipment manufacturers to meet the requirements of the Operating Authority. All electrical materials, components or completed assemblies of components shall be approved and certified by either:

- a) Canadian Standard Association,
- b) An organization that has been accredited by the Standards Council of Canada, or
- c) Electrical Safety Authority.

All materials shall be stored in accordance with manufacturer’s instructions to prevent damage, soiling, or finish spoilage. New poles shall be stacked to prevent bending or warping and shall be protected against any condition that may cause chipping or pitting in the finish.

The Contractor shall supply all materials as specified in the contract documents and any miscellaneous hardware and material (electrical tape, barrettes, connectors, etc.), required for each installation.

If the Contractor is unable to comply with all items in this specification but still wishes to submit a bid, all variances from this specification must be submitted in writing to the Contract Administrator.

CONSTRUCTION

01 Qualification of Workmen

Electrical Contractor should have minimum of five (5) previous years’ experience in the construction of street lighting systems.

02 Contractor’s Workers

The Contractor shall have a licensed master electrician on staff and shall use workers qualified to do the electrical work in accordance with the following:

- a) All electrical work shall be performed under the supervision of a licensed (Construction and Maintenance, 309A) electrician.

- b) Personnel certified under “The Apprenticeship and Tradesman’s Qualification Act” shall perform all electrical work. All personnel performing electrical work shall carry proof of their certification under the Act on their person at all times while on the work site.
- c) Personnel shall have related experience in the overall fields of street lighting installations.
- d) A qualified representative must be present and on-site whenever work is being carried out under the Contract.
- e) All testing and inspection work shall be performed by an Electrician.

The Contractor shall provide proof that the individuals performing the electrical work are currently certified.

The Contract Administrator may direct the Contractor to cease all electrical work until a licensed electrician, with proof of such, is on site to do or supervise the electrical work.

Where the Contract administrator directs the removal of staff or the cessation of Electrical Work, no additional payment will be made for any costs incurred by the Contractor as a result of such direction.

03 Work to be Inspected by Electrical Safety Authority

All electrical work is subject to inspection by the Electrical Safety Authority. The Contractor shall perform all work associated with inspection or re-inspection by the Electrical Safety Authority. This work includes, but is not limited to:

- a) Arranging and coordinating all visits to the construction site by the ESA’s inspectors.
- b) Correcting all defects identified by the ESA.
- c) Submitting all applications for inspection.
- d) Obtaining all permits.
- e) Obtaining all certificates.
- f) Obtaining all connection authorizations from the ESA.
- g) Payment of fees; and
- h) Performing any other work that may be required under the Code.

No additional payment will be made by the Owner for the work associated with inspection or re-inspection by the Electrical Safety Authority except for correcting defects that are the direct result of compliance with the Owner’s design of the work.

No additional payment will be made by the Owner for any work resulting from any direction, action or omission by the Electrical Safety Authority.

04 Layout of Equipment

Equipment shall be located in accordance with the listed stations, offsets, elevations and dimensions, Northings and Eastings shown in the Contract Drawings or to the lines and grades as set out by the Contract Administrator. The layout of equipment shown in the Contract Drawings a schematic indication of the general requirements only as the symbolization may not be true scale in relation to the intersection geometrics. The Contract Administrator, at his option, may revise the locations of equipment as required by field conditions, prior to installation.

05 Test Results and Inspection Reports

Test results and inspection reports, including any required verifications and certifications shall be submitted to the Contract Administrator within 48 hours of completion of the inspection or test. Inspection reports shall include the completed checklist and any observations made of the material at the time of the inspection.

The documentation shall include the method of testing and inspecting employed of each item. The method of testing and inspecting shall ensure that the functional, physical, and environmental aspects of the Contract specifications are demonstrated.

The documentation shall include all quantitative information generated as part of the testing and inspecting work, including meter readings, screen displays, charts, and any other numerical or graphical data.

The documentation shall include all applicable verifications and certifications. The documentation shall demonstrate the results of all tests and inspections in a format that is logical and easily understood.

The Contractor shall provide all necessary instruments, equipment and personnel required to satisfactorily carry out prescribed tests at his own expense.

The following tests shall be performed as directed by the Contract Administrator:

- a) All conduits and duct systems shall be proven free of stones, dirt, water or other debris by pulling a test mandrel 6mm (¼") smaller in diameter than the nominal conduit or duct size through each individual conduit or duct.
- b) All circuits shall be proven continuous and free of short circuits or ground faults.
- c) All circuits shall be proven free of unspecified grounds and the resistance to ground of all circuits shall be no less than fifty (50) megohms.
- d) All circuits shall be proven operable. Each control or switching device shall be operated no less than ten (10) times and each circuit no less than eight (8) hours.
- e) The resistance to ground for all grounded equipment shall be proven to not exceed ten (10) ohms.

In addition to the above tests, the Contractor shall, where directed by the Contract Administrator, perform any tests called for where performance of the electrical system indicates a deficiency.

The Contract Administrator shall provide for tests on materials other than electrical measurements. The Contractor shall repair or replace the faulty equipment at his own expense, and to the satisfaction of the Contract Administrator.

All installations shall be made in a workmanlike manner to the satisfaction of the Contract Administrator. The Contractor shall take all necessary measurements in the field in order to enable him to completely dimension all Drawings. The Contractor shall demonstrate that the material supplied meets the standards set forth in the specifications. The Contractor at his expense shall correct all defects.

The Contractor shall provide an unconditional warranty on the work done by the Contractor on both parts and labour for a period of one year from the date of acceptance by the Operating Authority.

REFERENCES

This specification refers to the following standards, specifications or publications:

Canadian Master Specification (CMS)	
Electrical Chambers	In accordance with latest version of OPSS 602
Duct Systems	In accordance with latest version of OPSS 603
Installation of Cable	In accordance with latest version of OPSS 604
Grounding Systems	In accordance with latest version of OPSS 609
Removal of Electrical Equipment	In accordance with latest version of OPSS 610
Erection of Poles	In accordance with latest version of OPSS 615
Footings & Pads for Electrical Equipment	In accordance with latest version of OPSS 616
Installation of Roadway Luminaires	In accordance with latest version of OPSS 617

Provincial Standard Drawings (OPSD)

All requirements of the latest revisions of the Ontario Provincial Standard Specification and the Ontario Provincial Standard Drawings shall apply to this contract, as defined. It shall be the Contractor's responsibility to obtain a copy of these standards for their use.

Others Applicable Standards:

- Canadian Electrical Safety Code, Current Edition
- Ontario Electrical Safety Code, Current Edition
- CAN/CSA Certificate Standards and Electrical Bulletins;

It shall be the Contractor's responsibility to obtain a copy of these current standards and standard drawings for their use.

Canadian Master Specification (CMS) Section 26 03 10 (16060) – MINOR ELECTRICAL DEMOLITION FOR REMODELLING is deleted in its entirety and is being replaced with the following Special Provision ‘SP-1’

SP-1 REMOVAL OF ELECTRICAL EQUIPMENT

The Contractor shall remove the existing traffic signal control device, street light fixtures and related electrical equipment, as indicated on the Contract Drawings. Any electrical equipment shall become the property of the Contractor, upon removal and shall be disposed of in an orderly and safe manner. The removal of the electrical equipment shall be done in accordance with OPSS 610

SP-1 01 Basis of Payment: Payment at the Contract price for the item “Removal of Electrical Equipment” shall include full compensation for all labour, equipment and materials required to do the work. The contractor shall provide a lump sum price for the necessary labour, equipment and materials required to complete the entire work for removal of existing electrical equipment as specified in the contract.

SP-2 ELECTRICAL CHAMBERS – PRECAST CONCRETE

This special provision covers the requirements for the supply and installation of the precast electrical chambers, indicated on the Contract Drawings. Electrical chambers and splicing service boxes shall be installed as shown on the Contract Drawings and in the following Standard Specification Drawings:

- OPSD 2111.020
- OPSD 2112.020
- OPSD 2112.040

SP-2 01 Installation: The installation of Precast Concrete chambers shall be in accordance to the applicable OPSD and in accordance with OPSS 602

SP-2 02 Grounding: Where a ground electrode is required adjacent to the electrical chamber, the system #6 AWG bare copper ground wire shall exit out of the electrical chamber to enable ground electrode connection, as indicated in the Contract.

SP-2 03 Basis of Payment: The basis of payment shall be per each unit item and in accordance with OPSS 602.

Canadian Master Specification (CMS) Section 26 05 33 (16152) – CONDUIT is deleted in its entirety and is being replaced with the following Special Provision ‘SP-3’

SP-3 RIGID CONDUITS, DIRECT BURIED IN BOULEVARD

RIGID CONDUITS, DIRECT BURIED UNDER ROADWAY

SP-3 01 Installation: The installation of Rigid conduits shall be installed in according with OPSS 604

Subsection 603.07.15 of OPSS 603 is deleted and replaced with the following:

603.07.15 Termination

All ducts shall be temporarily plugged or sealed until wiring is installed. All ducts, terminating in traffic signal control cabinets, power supply assemblies, with wiring installed, shall be sealed with expanding foam or duct fill compound.

When ducts are specified in the Contract Documents as spare or intended for future use, the duct ends shall be plugged with plastic plugs.

Subsection 603.07.16 of OPSS 603 is amended by adding the following:

603.07.16 Backfill

The bore pits in boulevards areas when the method of directional boring is used shall be backfilled with native material. Granular material shall be compacted to 100% Maximum Dry Density and earth to 95% Maximum Dry Density.

All grassed areas in boulevards will be reinstated with a minimum of 150mm of good topsoil and sod or seed as required under the Contract.

All sidewalk areas removed during the installation of conduit systems shall be reinstated with the respective asphalt or concrete surface material specified on the Contract Drawings and in accordance with the Operating Authority reinstatement policy and standards.

The bore pits in roadway surface areas when the method of directional boring is used shall be backfilled to the requirements of:

- a) OPSS Form 1010, for Granular “A” and Granular “B” Type 1 and compacted to 100% Maximum Dry Density. Granular “B” Type 1 backfill shall be used up to the elevation where Granular “A” is shown on the typical sections or elsewhere on the Contract Drawings. Granular “A” shall be used in the upper section as trench backfill; or
- b) In accordance with Standard Specification Drawings UTS 603.010, utilizing unshrinkable backfill material.

When existing pavement is encountered, the Contractor shall saw cut trench limits and remove asphalt pavement. The existing pavement shall be cold planed to a depth of 50mm and a 300mm width on both sides of the trench.

The trench shall be backfilled with an unshrinkable fill to bottom of existing asphalt. The unshrinkable fill material shall be placed at a slump of between 150mm and 200mm. The material shall flow into the excavation so that it fills the entire space. Care shall be taken to ensure that no air is entrapped beneath horizontal projections or in other locations within the excavation.

Where bracing, shoring and/or sheeting is used to support the sides of the excavation or to prevent movements that could damage other services or adjacent pavements, this support system shall be removed as backfilling proceeds. Where road traffic is to be accommodated, the backfilled excavation shall be covered with steel plates or other protection for users of the road allowance until the unshrinkable backfill will support the weight of an adult person.

Subsection 603.07.19.01 of OPSS 603 is amended to include the following:

603.07.19.01 Quality Control

The installation shall be made in a manner to the satisfaction of the Contract Administrator. All underground work must be inspected and approved by an Operating Authority representative, prior to proceeding with the installation of the above ground facilities.

The above ground installation shall not proceed until all deficiencies noted in the underground inspection have been corrected. On completion of the installation, the Contractor shall test all cable, signal heads, pedestrian heads and loops to ensure that there are no short circuits or open circuits and that all exposed equipment components are properly grounded.

The Contractor at his expense shall correct all defects disclosed by testing until all of the equipment is accepted as satisfactory by the Contract Administrator. Installation of the controller cabinet shall not proceed until all deficiencies have been corrected.

The Contract Administrator prior to the installation must approve any variations from this specification in writing.

SP-3 02 Basis of Payment: Basis of Payment

Payment for conduit shall be per meter of conduit placed and shall include the supply and installation of the conduit, fish line, all bends, risers, caps, spacers, concrete, excavation of trenches, removal and disposal of materials, bedding, backfill and compaction.

Canadian Master Specification (CMS) Section 26 56 29 (16530) – SITE LIGHTING , Part 3.1.1 Concrete Base is deleted in its entirety and is being replaced with the following Special Provision ‘SP-4’

SP-4 CONCRETE FOOTINGS IN EARTH (C/W ANCHORAGE ASSEMBLIES) FOR BASE MOUNTED POLES

SP-4 01 Installation: The installation of Concrete Footings (c/w Anchorage Assemblies) and shall be installed in according with OPSS 616 and applicable OPSD

SP-4 02 Basis of Payment: The basis of payment shall be per each unit item and in accordance with OPSS 616.

Canadian Master Specification (CMS) Section 26 05 80 (16195) – WIRING is deleted in its entirety and is being replaced with the following Special Provision ‘SP-5’

SP-5 LOW VOLTAGE CABLES IN DUCTS

SP-5 01 General: Low voltage multi-conductor cables shall be according to CSA C22.2 No. 239.

Low voltage single conductor cables shall be type RWU90 cross-linked polyethylene, according to CSA C22.2 No. 38.

AWG size of the conductors as specified in Contract Drawings

Low voltage neutral supported cables with one, two, or three insulated aluminum conductors and ACSR neutral shall be 300 V type NS-1 or 600 V type NSF-2 and shall be according to CSA C22.2 No. 129.

SP-5 02 Installation: The installation of Cables shall be installed in according with OPSS 604

The installation of cables shall be carried out in the following manner and according to construction drawings:

- a) The Contract Administrator must approve materials used to facilitate the pulling of cables in conduit. Cable shall not be pulled at temperatures below -6 degrees C.
- b) Cable runs shall be continuous between poles.
- c) No cable splices are permitted below ground level.
- d) Sufficient length of free cable shall be left in pole hand holes or junction boxes to permit proper connection to be made with cable coming from signal and/or pedestrian heads.
- e) Cable type and sequential length markings shall be printed every one (1) meter on the surface of the outer jacket.

If, in the opinion of the Contract Administrator, any material used in the construction of any part of the cable is defective, or otherwise unsuitable, or if, in their opinion, the workmanship does not conform to accepted standards, the supplier shall replace such defective cable at his own expense.

Any errors or omissions in, or misinterpretation of the specifications, or order shall not relieve the supplier of the responsibility of providing cable conforming to modern practices and the best workmanship.

The Contractor must provide the Contract Administrator a schedule of the material suppliers’ delivery dates.

The Contract Administrator / Inspector shall confirm the markings of the cable and conductors conform to this specification.

SP-5 03 Basis of Payment: The basis of payment shall be per linear meter length and in accordance with OPSS 604.

Canadian Master Specification (CMS) Section 26 28 13 (16346) – CIRCUIT BREAKER SWITCHGEAR is deleted in its entirety and is being replaced with the following Special Provision ‘SP-6’

SP-6 CIRCUIT BREAKER SWITCHGEAR

SP-6 01 General: The circuit breaker switchgear size and type as indicated on the contract drawings.

SP-6 02 Installation: The installation of circuit breaker switchgear in the Transformer shall be installed in according with OPSS 614 and Manufacturer’s recommendation. Contractor must have early communication with the respective Electrical Safety Authority representative to ensure that the requirements (i.e., permits and inspection) have been satisfied.

SP-6 03 Basis of Payment: The basis of payment shall be per each unit item and in accordance with OPSS 614.

Canadian Master Specification (CMS) Section 26 05 26 (16170) – GROUNDING AND BONDING is deleted in its entirety and is being replaced with the following Special Provision ‘SP-7’

SP-7 GROUND WIRE & GROUND ELECTRODES

SP-7 01 General/Installation/Basis of Payment:

SP-7 01.01 Ground Wire: The Grounding System-Ground Wire shall be in accordance to OPSS609. The Contractor shall supply and install a continuous #6 AWG TWU green, stranded copper ground wire through the entire main conduit system for Street lighting. The Contractor shall supply and install a continuous #4 AWG TWU green, stranded copper ground wire through the entire main conduit system for RV Outlet system. The ground wire shall be connected to all steel poles, the junction boxes on wood poles, the ground lug attached to the cover and frame in the electrical chambers and the proposed ground rods in the chambers/poles/RV outlets, in the locations as shown on the Drawings. A continuous #6 AWG TWU green, stranded copper ground wire shall be installed from the ground lug in the pole to the ground rod located adjacent to this pole.

Basis of Payment: The basis of payment shall be per linear meter length and in accordance with OPSS 609.

SP-7 01.02 Ground Rods: The Grounding System-Ground Wire shall be in accordance to OPSS609. The Contractor shall supply and install a 20 mm x 3.0 m copper clad ground rod in the location shown on the Drawings. The ground rod driven into the ground shall be buried so that the top of the ground rod is 300 mm below the finished grade

Basis of Payment: The basis of payment shall be per each unit item and in accordance with OPSS 609.

Canadian Master Specification (CMS) Section 26 56 29 (16530) – SITE LIGHTING, Part 1.1.5 Poles is deleted in its entirety and is being replaced with the following Special Provision ‘SP-8’

SP-8 STEEL POLES

SP-8 01 General: The Steel Poles shall be in accordance to OPSS 615. The contractor shall supply and Install 4.9m (16’) - ‘RSS-S SERIES ROUND STRAIGHT STEEL POLE’ from Spaulding Lighting. The Catalog # **RSS-S-16-40-A-1-S2-FG** for single luminaire pole installation and Catalog # **RSS-S-16-40-A-2-S2-FG** for twin luminaires (*180 degrees*) pole installation

SP-8 02 Pole Erection: Base mounted lighting poles shall be installed in accordance to OPSS 615 and Manufacturer’s recommendations as per the Contract Drawings and Standard Specification Drawings OPSD 2200.011 and OPSD 2215.02

SP-8 03 Basis of Payment: The basis of payment shall be per each unit item and in accordance with OPSS 615.

Canadian Master Specification (CMS) Section 26 56 29 (16530) – SITE LIGHTING , Part 1.1.1 Luminaires and Accessories is deleted in its entirety and is being replaced with the following Special Provision ‘SP-8’

SP-9 OUTDOOR LUMINAIRE C/W BRACKET ARM

SP-9 01 General: The Outdoor Luminaire c/w bracket arm shall be in accordance to OPSS 617. The contractor shall supply and Install 38W LED fixture by Hubbell Canada complete with Bracket Arm and Individually controlled Photocell.

- Details of luminaire
 - 38.0W Cimarron High Performance LED,
Catalog # “CL1S-A-16L-U-4K-4 -FG-PR(U)
Photometric file : *CLIS-A-16LU-4K-4.ies*
- Details of Bracket Arm
 - CR1-RPA3 (Cimarron Bracket by Hubbell Ltg (Spaulding))

SP-9 02 Installation: The installation of luminaire shall be in accordance with OPSS 615.

SP-9 03 Basis of Payment: The basis of payment shall be per each unit item (*for the whole luminaire c/w bracket arm and individual photo control cell*) and in accordance with OPSS 615.

SP-10 RV OUTLET UNIT C/W ENERGY METER

SP-10 01 General: The contractor shall supply and Install Complete 200 Amp RV Pedestal – Earth Burial complete with a 120-208V 1 PH, 3W – Energy Meter (*which is fully compatible with the RV Pedestal unit.*) The Catalog Number for the RV Pedestal is M275CP6010 and the manufacturer is Midwest Electric Product. All the listed items in the catalogue should be part of the unit to be installed.

SP-10 02 RV unit Erection: RV pedestal unit shall be installed in accordance to Manufacturer's recommendations and laid on the site as per the Contract Drawings.

SP-10 03 Basis of Payment: The basis of payment shall be per each unit item (*for the whole RV Pedestal unit c/w energy meter*)

**EARTHWORKS AND ROCK
EXCAVATION
DIVISION 31**

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Subsoil materials.

1.2 RELATED SECTIONS

- .1 Document 00 31 34 – Subsurface Investigation Report: Geotechnical report; borehole locations and findings of subsurface materials.
- .2 Section 01 29 00 – Payment Procedures: Requirements applicable to lump sum price for the work of this section.
- .3 Section 01 45 00 – Quality Control.
- .4 Section 01 57 13 – Temporary Erosion and Sediment Control.
- .5 Section 31 05 16 – Aggregate Materials.
- .6 Section 31 22 13 – Rough Grading.
- .7 Section 31 22 19 – Finish Grading.
- .8 Section 31 23 18 – Trenching.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated Price: Section 01 29 00 - payment procedures affecting this section.
- .2 Subsoil: Measured by the cubic metre. Includes excavating existing subsoil, and stockpiling.

1.4 REFERENCES

- .1 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .2 Occupational Health and Safety Act, O. Reg. 213/91 Construction Projects
- .3 OPSS 802 Construction Specification for Topsoil
- .4 MTO LS-706 Moisture Density Relationship of Soils using 2.5 kg Rammer and 305 mm Drop
- .5 MTO LS-707 Moisture Density Relationship of Soils using 4.5 kg Rammer and 457 mm Drop
- .6 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- .7 MTO LS-701 Moisture Content of Soils
- .8 MTO LS-702 Particle Size Analysis of Soils
- .9 MTO LS-703 Liquid Limit, and Plasticity Index of Soils
- .10 MTO LS-704 Plastic Limit and Plasticity Index of Soils

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submittal procedures.

- .2 Samples: Submit, in air-tight containers, 4.5 kg sample of each type of subsoil fill to testing laboratory.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal procedures.
- .2 Materials Source: Submit name of imported materials source.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 77 00 & 01 78 10.

1.8 QUALITY ASSURANCE

- .1 Perform Work in accordance with the Ontario Provincial Standard Specification (OPSS). Maintain one (1) copy of document on site.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

- .1 Subsoil Type: (SP) Sand Conforming to ASTM 2487.
- .2 Considered Type 3 soil under the Ontario Health and Safety Act, Regulations for Construction Projects (O.Reg. 213/91, when encountered above the water table.
- .3 Considered Type 4 soil under the Ontario Health and Safety Act, Regulations for Construction Projects (O.Reg. 213/91, when encountered below the water table
- .4 Subsoil Type: Topsoil, Conforming to Ontario Provincial Standard Specification (OPSS) 802

2.2 SOURCE QUALITY CONTROL

- .1 Section 01 45 00: Testing and analysis of soil material.
- .2 Testing and Analysis of Subsoil Material: Perform to MTO LS-706, MTO LS-707ASTM D6938, MTO LS-701, MTO LS-702, MTO LS-703, MTO LS-704.
- .3 Testing and Analysis of Topsoil Material: Perform to OPSS 802.
- .4 If tests indicate materials do not meet specified requirements, change material and retest.
- .5 Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 SOIL REMOVAL

- .1 Remove lumped soil, and boulders.
- .2 Stockpile excavated material in area designated on site and remove excess material not being used, from site.

3.2 STOCKPILING

- .1 Stockpile materials on site at locations designated by Departmental Representative or Delegate (DR/D).
- .2 Stockpile in sufficient quantities to meet Project schedule and requirements.
- .3 Separate differing materials with dividers or stockpile apart to prevent mixing.
- .4 Prevent intermixing of soil types or contamination.
- .5 Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

- .1 Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.
- .2 Leave unused materials in a neat, compact stockpile.
- .3 If a borrow area is indicated, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Aggregate materials.

1.2 RELATED SECTIONS

- .1 Document 00 31 34 - Subsurface Investigation Report: Geotechnical report; borehole locations and findings of subsurface materials.
- .2 Section 01 29 00 - Payment Procedures: Requirements applicable to lump sum price for the work of this section.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 57 13 - Temporary Erosion and Sediment Control.
- .5 Section 31 05 13 - Soil Materials.
- .6 Section 31 23 18 - Trenching.
- .7 Section 32 11 23 - Aggregate Base Courses.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated Price: Section 01 29 00 - payment procedures affecting this section.
- .2 Aggregate: measured by the tonnage. Includes supplying aggregate materials, stockpiling.

1.4 REFERENCES

- .1 OPSS.PROV 1010 Material Specification for Aggregates – Base Subbase, Select Subgrade and Backfill Material
- .2 OPSS.PROV 1004 Material Specification for Aggregates – Miscellaneous
- .3 MTO LS-602 Sieve and Analysis of Aggregates
- .4 MTO LS-607 Percent Crushed Particles in Processed Course Aggregate
- .5 MTO LS-618 Resistance of Course Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
- .6 MTO LS-619 Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
- .7 MTO LS-621 Amount of Asphalt Coated Particles in Course Aggregate
- .8 MTO LS-630 Amount of Contamination of Course Aggregate
- .9 MTO LS-631 Presence of Plastic Fines in Aggregate
- .10 MTO LS-706 Moisture Density Relationship of Soils using 2.5 kg Rammer and 305 mm Drop
- .11 MTO LS-707 Moisture Density Relationship of Soils using 4.5 kg Rammer and 457 mm Drop
- .12 ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- .13 MTO LS-709 Permeability of Granular Soils

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submittal procedures.
- .2 Samples: Submit, in air-tight containers, 4.5 kg sample of Granular Materials fill to testing laboratory.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal procedures.
- .2 Materials Source: Submit name of imported materials suppliers.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 77 00 & 01 78 10.

1.8 QUALITY ASSURANCE

- .1 Perform Work in accordance with the Ontario Provincial Standard Specifications (OPSS). Maintain one (1) copy of document on site.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- .1 Coarse Aggregate Type Granular A: Conforming to OPSS.PROV 1010 Granular A.
- .2 Coarse Aggregate Type Granular B Type I: Conforming to OPSS.PROV 1010 Granular B Type I.
- .3 Coarse Aggregate Type Select Subgrade Material: Conforming to OPSS.PROV 1010 Select Subgrade Material.

2.2 FINE AGGREGATE MATERIALS

- .1 Fine Aggregate Type Winter Sand: Conforming to OPSS.PROV 1004 Winter Sand

2.3 SOURCE QUALITY CONTROL

- .1 Section 01 45 00: Quality Control.
- .2 Course Aggregate Material – Testing and Analysis: Perform in accordance with MTO LS-602, MTO LS-607, MTO LS-621, MTO LS-618, MTO LS-619, MTO LS-630, MTO LS-631, MTO LS-706, MTO LS-707, ASTM D6938, MTO LS-709
- .3 Fine Aggregate Material - Testing and Analysis: Perform in accordance with MTO LS-602, MTO LS-619, MTO LS-706, MTO LS-707, ASTM D6938.
- .4 If tests indicate materials do not meet specified requirements, change material or material source and retest.
- .5 Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 STOCKPILING

- .1 Stockpile materials on site at locations designated by Departmental Representative or Delegate (DR/D).
- .2 Stockpile in sufficient quantities to meet Project schedule and requirements.
- .3 Separate differing materials with dividers or stockpile apart to prevent mixing.
- .4 Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

3.2 STOCKPILE CLEANUP

- .1 Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.
- .2 Leave unused materials in a neat, compact stockpile.
- .3 If a borrow area is indicated, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 35 26 – Environmental and Wildlife Protection
- .2 Section 31 22 13 – Rough Grading
- .3 Section 31 23 16 – Excavating
- .4 Section 32 01 90.33 – Tree and Shrub Preservation

1.2 DEFINITIONS

- .1 Close-cut clearing consists of cutting off or removing at or near flush with original ground surface standing trees, brush, scrub, roots, stumps, and embedded logs and disposing of fallen timber and surface debris.
- .2 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .3 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50mm trunk diameter and disposing of all fallen timber and surface debris.
- .4 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments to not less than a specified depth below original ground surface.

1.3 STORAGE AND PROTECTION

- .1 Prevent damage to fencing, trees, landscaping, natural features, benchmarks, existing buildings, existing pavement, utility lines, site appurtenances, and root systems of trees, which are to remain. Make good damage.
- .2 Do not apply tree paint to cuts or scars suffered by vegetation designated to remain.

PART 2 PRODUCTS

2.1 EQUIPMENT

- .1 Equipment appropriate to perform work as specified.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Inspect site and verify with Contract Administrator, items designated to remain.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.
- .3 Notify utility authorities before starting.

3.2 CLEARING

- .1 Clear dead trees, not designated to remain on site.
- .2 Cut off trees, to a height of 300mm above ground.

3.3 ISOLATED TREES

- .1 Cut off isolated trees as indicated by Consultant at height of not more than 300 mm ground surface.

3.4 GRUBBING

- .1 Grub out stumps and roots to not less than 200mm below existing grade.

3.5 REMOVAL AND DISPOSAL

- .1 Chip limbs and timer into mulch, store on site for reuse.
- .2 Chip and grind roots and stumps into mulch, store on site for reuse.

3.6 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for construction operation.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Topsoil Stripping and Stockpiling.

1.2 RELATED REQUIREMENTS

- .1 Section 01 74 00 – Cleaning and Waste Processing.
- .2 Section 01 74 20 – Waste Managing and Disposal.
- .3 Section 31 11 00 – Clearing and Grubbing.
- .4 Section 31 22 13 – Rough Grading.
- .5 Section 32 15 60 – Roadway Dust Control.

1.3 REFERENCES

- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
 - .1 PN1340-2005, Guidelines for Compost Quality.

PART 2 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- .2 Direct overland flow generated from runoff/precipitation within the site towards silt fence (sediment removal treatment features).
- .3 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .4 Designate an area within the working limits and 30 m away from any watercourse to be used exclusively for fueling construction equipment.
- .5 Have an emergency spill plan and kit on site to prevent any contaminants from entering Black Rapids Creek. Submit Emergency spill plan as per section 01 33 00.
- .6 Develop and implement an Emergency Response Plan in the event of a sediment release or spill of a deleterious substance. Submit Emergency Response Plan as per section 01 33 00.
- .7 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .8 Inspect, clean, maintain, and repair equipment periodically to ensure proper function.
- .9 Avoid unnecessary idling of vehicles.
- .10 Install silt fence to prevent reptiles and amphibians from accessing the construction site.

3.2 STRIPPING OF TOPSOIL

- .1 Remove topsoil within widening areas only.

- .2 Handle topsoil only when it is dry and warm.
- .3 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation off-site.
- .4 Remove brush from targeted area by non-chemical means and dispose of off-site. Do not bury rubbish and waste materials on site.
- .6 Dispose of topsoil off-site.

3.3 STOCKPILING OF TOPSOIL

- .1 Stockpile topsoil on site in locations as directed by Departmental Representative or Delegate (DR/D). Do not stockpile on completed pavement surfaces.
- .2 Stockpile excavated material in a proper shape and cover or stabilize to avoid dust generation. Stockpile height not to exceed 2m.
- .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
- .5 Suppress dust from exposed topsoil and excavated areas with water.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Processing.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Cutting, grading, filling, rough contouring and compacting the site.

1.2 RELATED SECTIONS

- .1 Section 01 29 00 – Payment Procedures: Requirements applicable to lump sum price for the work of this section.
- .2 Section 01 45 00 – Quality Control.
- .3 Section 02 41 13.15 – Site Work Demolition and Removals.
- .4 Section 31 05 13 – Soil Materials.
- .5 Section 31 05 16 – Aggregate Materials.
- .6 Section 31 22 19 – Finish Grading.
- .7 Section 31 23 17 – Rock Removal.
- .8 Section 31 23 18 – Trenching.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated Prices: Section 01 29 00 - Measurement of quantities and payment procedures affecting this section.
- .2 Subsoil Fill Type: Soil materials and/or Select Subgrade Material: Measured in cubic metres. Includes excavating existing soil, supplying soil materials, stockpiling, scarifying substrate surface and placing where required, and compacting.

1.4 REFERENCES

- .1 AASHTO T 180-15 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .2 OPSS.PROV 206 Construction Specifications for Grading
- .3 OPSS.PROV 501 (November 2014) Construction Specification for Compacting
- .4 MTO LS-602 Sieve and Analysis of Aggregates
- .5 MTO LS-706 Moisture Density Relationship of Soils using 2.5 kg Rammer and 305 mm Drop
- .6 MTO LS-707 Moisture Density Relationship of Soils using 4.5 kg Rammer and 457 mm Drop
- .7 ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- .8 MTO LS-709 Permeability of Granular Soils

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal procedures.

1.6 CLOSEOUT SUBMITTALS

- .1 Section 01 77 00 & 01 78 10: Closeout Procedures and Submittals.
- .2 Record Documentation: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.7 QUALITY ASSURANCE

- .1 Perform Work to OPSS.PROV 206, OPSS.PROV 501. Maintain one (1) copy of document on site.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Subsoil Fill: Soil Materials and/or Select Subgrade Material as specified in Sections – 31 05 13 and 31 05 16.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

- .1 Identify required lines, levels, contours, and datum.
- .2 Stake and flag locations of known utilities.
- .3 Locate, identify, and protect utilities that remain, from damage.
- .4 Notify utility company or Contract Administrator to remove and relocate utilities.
- .5 Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- .6 Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, curbs from excavating equipment and vehicular traffic.

3.3 SUBSOIL EXCAVATION

- .1 Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- .2 Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.
- .3 When excavating through roots, perform work by hand and cut roots with sharp axe.
- .4 Stockpile in area designated on site to depth not exceeding 2.5 m and protect from erosion. Remove from site, subsoil not being reused.
- .5 Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key placed fill material to slope to provide firm bearing.

- .6 Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 FILLING

- .1 Place fill in accordance with the Ontario Provincial Standard Specifications (OPSS).
- .2 Fill areas to contours and elevations with unfrozen materials.
- .3 Place fill material on continuous layers and compact in accordance with the schedule at end of this section.
- .4 Maintain optimum moisture content of fill materials to attain required compaction density.
- .5 Slope grade away from building minimum 1.5:100 or 2 inches in 10 ft, unless noted otherwise.
- .6 Make grade changes gradual. Blend slope into level areas.
- .7 Remove surplus fill materials from site.

3.5 TOLERANCES

- .1 Top Surface of Subgrade: Plus or minus 30 mm from required elevation.

3.6 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Quality Control
- .2 Testing: To MTO LS-602, MTO LS-706, MTO LS-707, ASTM D6938.
- .3 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- .4 Frequency of Tests: To conform to specifications in OPSS.PROV 501.

3.7 SCHEDULES

- .1 Subsoil Fill (Widening Areas):
 - .1 Soil materials and/or Select Subgrade Material, maximum 200 mm of compacted depth.
 - .2 Compact to minimum 95% of maximum density.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Final grade topsoil for finish landscaping (PROVISIONAL).

1.2 RELATED SECTIONS

- .1 Section 01 29 00 – Price and Payment Procedures: Requirements applicable to lump sum price for the work of this Section.
- .2 Section 01 45 00 – Quality Control.
- .3 Section 31 05 13 – Soil Materials.
- .4 Section 31 22 13 – Rough Grading.
- .5 Section 31 23 18 – Trenching.
- .6 Section 32 13 13 – Concrete Paving.
- .7 Section 32 12 16 – Asphalt Paving.
- .8 Section 32 92 19 – Seeding: Finish ground cover.
- .9 Section 32 93 10 – Trees, Shrubs And Ground Cover Planting.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated Price: Section 01 29 00 - Measurement of quantities and payment procedures affecting this section
- .2 Topsoil: Measure by the cubic metre. Includes supplying topsoil materials from stockpiling and/or importing, preparing and scarifying substrate surface, placing where required, and rolling.

PART 2 PRODUCTS

2.1 MATERIAL

- .1 Topsoil: As specified in Section 31 05 13.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify trench backfilling have been inspected.
- .3 Verify substrate base has been contoured and compacted.

3.2 SUBSTRATE PREPARATION

- .1 Eliminate uneven areas and low spots.
- .2 Remove debris, roots, branches, stones, in excess of 13 mm in size. Remove subsoil contaminated with petroleum products.

- .3 Scarify surface to depth of 75 mm where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL

- .1 Place topsoil in areas where planting, and sodding is required to a nominal depth of 100mm. Place topsoil during dry weather.
- .2 Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- .3 Remove roots, weeds, rocks, and foreign material while spreading.
- .4 Manually spread topsoil close to plant life and building to prevent damage.
- .5 Lightly compact or Roll placed topsoil.
- .6 Leave stockpile area and site clean and raked, ready to receive landscaping.

3.4 TOLERANCES

- .1 Section 01 73 00: Execution (Tolerances).
- .2 Top of Topsoil: Plus or minus 13 mm.

3.5 PROTECTION OF FINISHED WORK

- .1 Protect landscaping and other features remaining as final work.
- .2 Protect existing structures, fences, sidewalks, utilities, paving and curbs.

3.6 SCHEDULES

- .1 Section 32 92 19: Seeding.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Excavating for widening, ditching, paving and landscaping.

1.2 RELATED SECTIONS

- .1 Document 00 31 34 - Subsurface Investigation Report: Geotechnical report; borehole locations and findings of subsurface materials.
- .2 Section 01 57 13 - Temporary Erosion and Sediment Control
- .3 Section 31 22 13 - Rough Grading.
- .4 Section 31 23 17 - Rock Removal.
- .5 Section 31 23 18 - Trenching.
- .6 Section 33 79 21 - Site Grounding - Cathodic Protection (To be obtained by Contractor from the National Master Specifications (NMS) document).

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated Price: Section 01 29 00 - Measurement of quantities and payment procedures affecting this section.
- .2 Excavating Soil Materials: measured by the cubic metre. Includes general excavating to required elevations, loading and placing materials in stockpile and removing from site.
- .3 Over Excavating: Payment will not be made for over excavated work nor for replacement materials.

PART 2 EXECUTION

2.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify that survey bench mark and intended elevations for the Work are as indicated.

2.2 PREPARATION

- .1 Identify required lines, levels, contours, and datum locations.
- .2 Locate, identify, and protect utilities that remain from damage.
- .3 Notify utility company or owner to remove and relocate utilities.
- .4 Protect plant life, lawns, rock outcroppings and other features remaining as a portion of final landscaping.
- .5 Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

2.3 EXCAVATING

- .1 Excavate subsoil to accommodate for grading, widening, ditching, paving, and construction operations.
- .2 Slope banks with machine to angle of repose or less until shored.
- .3 Grade top perimeter of excavation to prevent surface water from draining into excavation.
- .4 Trim excavation. Remove loose matter.
- .5 Remove lumped subsoil, boulders, and rock up to 0.25 cu m measured by volume. Larger material will be removed under Section 31 23 17.
- .6 Notify Contract Administrator of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- .7 Correct over excavated areas to actual design elevations and backfill with granular 'A' at the Contractor expense.
- .8 Stockpile excavated material in area designated on site as specified in Section 31 05 13; remove excess or unsuitable material from site.

2.4 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Quality Control.
- .2 Provide for visual inspection of bearing surfaces.

2.5 PROTECTION OF FINISHED WORK

- .1 Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- .2 Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Removal of identified or discovered rock during excavation.
- .2 Tools and Explosives to assist rock removal.

1.2 RELATED SECTIONS

- .1 Section 01 29 00 - Payment Procedures: Requirements applicable to lump sum price for the work of this section.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 31 22 13 - Rough Grading.
- .4 Section 31 23 18 - Trenching.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated Price: Section 01 29 00 - Measurement of quantities and payment procedures affecting this section.
- .2 Site Rock Removal (Drill and Blast Rock in Ditches): By the lineal metre measured before removal. Includes preparation of rock for removal, use of explosive or mechanical disintegration of rock, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work or for replacement materials.
- .3 Trench Rock Removal: By the cubic metre measured before removal. Includes preparation of rock for removal, use of explosive or mechanical disintegration of rock, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work or for replacement materials.

1.4 REFERENCES

- .1 NFPA 495 - Explosive Materials Code, 2013 Edition.

1.5 DEFINITIONS

- .1 Site Rock: Solid mineral material with a volume in excess of 0.25 cu m or solid material that cannot be removed with a 0.57 cu m capacity power shovel.
- .2 Trench Rock: Solid mineral material with a volume in excess of 0.13 cu m or solid material that cannot be removed with 0.57 cu m capacity power shovel.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination.
- .2 Scheduling: Schedule Work to avoid disruption to working hours of occupied buildings nearby.

1.7 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submittal procedures.
- .2 Shop Drawings: Indicate the proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock removal method.

1.8 QUALITY ASSURANCE

- .1 Seismic Survey Firm: Company specializing in seismic surveys with five (5) years of documented experience.
- .2 Explosives Firm: Company specializing in explosives for disintegration of rock, with five (5) years of documented experience.

1.9 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for explosive disintegration of rock and to NFPA 495 for handling explosive materials.
- .2 Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.

1.10 PROJECT CONDITIONS

- .1 Conduct survey and document conditions of buildings near locations of rock removal, prior to blasting, and photograph existing conditions identifying existing irregularities.
- .2 Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations.
- .3 Obtain a seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Explosives: Type recommended by explosive firm following seismic survey and required by authorities having jurisdiction.
- .2 Delay Device: Type recommended by explosives firm.
- .3 Blast Mat Materials: Type recommended by explosives firm.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify site conditions and note subsurface irregularities affecting work of this section.

3.2 PREPARATION

- .1 Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY A MECHANICAL METHOD

- .1 Excavate and remove rock by the mechanical method.
- .2 Drill holes and utilize mechanical disintegration compound to fracture rock.
- .3 Cut away rock at bottom of excavation to form level bearing.
- .4 Remove shaled layers to provide sound and unshattered base for footings.
- .5 In utility trenches, excavate to 150 mm below invert elevation of pipe and 600 mm min. wider than pipe diameter.
- .6 Remove excavated material from site.
- .7 Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 22 13 & 31 23 18 with lean concrete fill as specified in Section 03 30 00 and to the direction of Departmental Representative or Delegate (DR/D).

3.4 ROCK REMOVAL BY EXPLOSIVE METHODS

- .1 Provide seismographic monitoring during progress of blasting operations.
- .2 Drill blasting holes within 4 m of finished slope.
- .3 Disintegrate rock and remove from excavation.
- .4 Remove rock at excavation bottom to form level bearing.
- .5 Remove shaled layers to provide a sound and unshattered base for footings.
- .6 In utility trenches, excavate to 150 mm below invert elevation of pipe and 600 mm min wider than pipe diameter.
- .7 Remove excavated material from site.
- .8 Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 22 13 & 31 23 18 with lean concrete fill as specified in Section 03 30 00 and to the direction of Departmental Representative or Delegate (DR/D).

3.5 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Quality Control
- .2 Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Excavating trenches for sanitary sewers, forcemains and other utilities.
- .2 Dewatering for trenching excavation.
- .3 Backfilling and compaction from top of utility bedding to subgrade elevations.

1.2 RELATED SECTIONS

- .1 Document 00 31 34 - Subsurface Investigation Report: Geotechnical report; borehole locations and findings of subsurface materials.
- .2 Section 01 29 00 - Payment Procedures: Requirements applicable to lump sum for the work of this section.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 31 05 13 - Soil Materials.
- .5 Section 31 05 16 - Aggregate Materials.
- .6 Section 31 22 13 - Rough Grading.
- .7 Section 31 23 17 - Rock Removal.
- .8 Section 33 31 13 - Sanitary Piping: Sanitary sewer piping and bedding from building to utility service.
- .9 Section 33 34 00 - Sanitary force main.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated Price: Section 01 29 00 - Measurement of quantities and payment procedures affecting this section.
- .2 Excavating Subsoil Materials: measured by the cubic metre. Includes excavating to required elevations, loading and removing from site or placing materials in stockpile.
- .3 Over Excavating: Payment is not made for over excavated work nor for replacement materials.
- .4 Dewatering: measured by lump sum. Includes and not limited to pumping, truck hauling, filtration, and erosion and sedimentation control.
- .5 Backfill Type: Native backfill, Winter Sand or as specified: Measured by the cubic metres or tonnage as applicable. Includes supplying fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.4 REFERENCES

- .1 MTO LS-602 Sieve and Analysis of Aggregates
- .2 MTO LS-706 Moisture Density Relationship of Soils using 2.5 kg Rammer and 305 mm Drop
- .3 MTO LS-707 Moisture Density Relationship of Soils using 4.5 kg Rammer and 457 mm Drop

- .4 ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- .5 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 518 (November 2011) Construction Specification for Control of Water from Dewatering Operations
 - .2 OPSS.PROV 501 (November 2014) Construction Specifications for Compacting

1.5 DEFINITIONS

- .1 Utility: Any buried pipe, duct, conduit, or cable.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

1.7 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal procedures.

1.8 CLOSEOUT SUBMITTALS

- .1 Section 01 77 00 & 01 78 10: Closeout Procedure and Submittals.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- .1 Native backfill and/or Winter Sand. As specified in Sections 31 05 13 and 31 05 16.
- .2 Concrete: Lean concrete.

2.2 ACCESSORIES

- .1 Geotextile Fabric: Class II, non-woven geotextile with FOS in the range of 5 um to 75 um.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify that survey bench mark, control point, and intended elevations for the Work are as shown on drawings.

3.2 PREPARATION

- .1 Identify required lines, levels, contours, and datum locations.
- .2 Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- .3 Protect bench marks, existing structures, fences, sidewalks, paving, curbs from excavating equipment and vehicular traffic.
- .4 Maintain and protect above and below grade utilities which are to remain.
- .5 Cut out soft areas of subgrade not capable of compaction in place. Backfill with Select Subgrade Material and/or native backfill and compact to density equal to 95% standard proctor.

3.3 EXCAVATING

- .1 Cut trenches as specified or sufficiently wide to enable installation and inspection of new utilities.
- .2 Remove lumped subsoil, boulders, and rock up to 0.25 cu m, measured by volume. Larger material will be removed under Section 31 23 17.
- .3 Correct over excavated areas in accordance with Section 31 23 16.
- .4 Stockpile excavated material in area designated on site and remove excess material not being used, from site.

3.4 DEWATERING

- .1 Where water is encountered during excavation of trenching, dewatering is required. The Contractor shall be responsible for the design of the dewatering scheme for the intended purpose and the scheme shall be approved by the Contract Administrator prior to implementation.
- .2 Until backfilling has been completed and to permit the placing of the new sewer pipes, the Contractor shall carry out all work necessary to control the flow of water into the excavation and to prevent disturbance of the founding material.
- .3 Control of water shall be according to OPSS 518.
- .4 All temporary dewatering shall remain the property of the Contractor and shall be removed from the right-of-way when they are no longer required.

3.5 BACKFILLING

- .1 Backfill trenches to required elevations with unfrozen fill materials.
- .2 Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- .3 Place granular A bedding and compact followed by placing native backfill and/or sand winter.
- .4 Employ a placement method that does not disturb or damage foundation perimeter drainage, or utilities in trench.
- .5 Maintain optimum moisture content of fill materials to attain required compaction density.
- .6 Remove surplus fill materials from site.

3.6 TOLERANCES

- .1 Section 01 73 00: Execution (Tolerances).
- .2 Top Surface of Backfilling under Paved Areas: Plus or minus 25 mm from required elevations.

3.7 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Quality Control
- .2 Compaction testing will be performed to OPSS.PROV 501, MTO LS-602, MTO LS-706, MTO LS-707, ASTM D6938.
- .3 If tests indicate Work does not meet specified requirements, remove work, replace, compact, and retest, refer to Section 01 20 13 for defect assessment.
- .4 Frequency of Tests: To conform to specifications in OPSS.PROV 501.

3.8 PROTECTION OF FINISHED WORK

- .1 Reshape and re-compact fills subjected to vehicular traffic during construction.

3.9 SCHEDULES

- .1 Pipe and Bedding:
 - .1 Cover pipe with Granular A bedding as specified on drawings, in 150mm lifts, compacted to 95%.
 - .2 Follow with native backfill and/or Winter Sand in 200 mm lifts, compacted to 95%.

END OF SECTION

EXTERIOR IMPROVEMENTS
DIVISION 32

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 This work item includes the installation of snow fences to protect existing trees from damage during construction and methods to be used for compensation due to damage.

1.2 RELATED SECTIONS

- .1 Section 31 11 00 – Clearing and Grubbing.
- .2 Section 31 22 13 – Rough Grading.
- .3 Section 31 22 19 – Finish Grading.

PART 2 PRODUCTS

2.1 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative or Delegate (DR/D) of new plant material at source prior to planting.
- .2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to federal and provincial regulations.
- .3 Emerald Ash Borer: (*Agrilus planipennis* Fairmaire)
 - .1 NO Ash trees or products, including mulch will be allowed on site.
- .4 Any fertilizing of plant material applied on site, cannot contain more than 1% of phosphates (P205) by weight, unless it is during the first year, in which turf or managed grasses have been established (either by seed or sod).

PART 3 EXECUTION

3.1 IDENTIFICATION AND PROTECTION

- .1 Identify plants and limits of root systems to be preserved to the satisfaction of the Departmental Representative or Delegate (DR/D).
- .2 Protect plant and root systems from damage, compaction, and contamination resulting from construction to the satisfaction of the Departmental Representative or Delegate (DR/D).

3.2 ROOT PRUNING

- .1 In locations where the grade will be lower than the adjacent existing trees, the Contractor will expedite the work of this section to reduce the exposure of the root system.
- .2 Cut roots over 12 mm in diameter with a clean pruning instrument. Do not paint.
- .3 Any exposed roots more than 12 mm that will be exposed longer than 48 hours, before backfilling will be covered with a landscape fabric and watered daily.
- .4 Selectively remove tree branches to reduce transpiration and compensate for damage to root system. Receive approval of branches to be removed by Departmental Representative or Delegate (DR/D) before commencement of work.
- .5 Do not remove more than one-third of the total branching at a single operation.

- .6 Prune all branches with a diameter more than 75 mm, but only at the direction of the Departmental Representative or Delegate (DR/D).

3.3 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by the Departmental Representative or Delegate (DR/D) to end of warranty period, do the following maintenance operations.
 - .1 Water plants to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion to the soil.
 - .2 Apply pesticides according to national Standard for Pesticide Education, Training, and Certification in Canada, Federal, Provincial and Municipal regulations as and when required to control insects, fungus, and disease. Obtain product approval from Departmental Representative or Delegate (DR/D) before application.
 - .3 Apply fertilizer in early spring at the rate of 0.025 kg of nitrogen/m² or manufacturer's suggested rate.
 - .4 Remove dead, broken, or hazardous branches from plant material. Dispose of debris.

3.4 DAMAGES

- .1 The Contractor will compensate the client for any trees damaged by the Contractor during construction.
- .2 Damages will include:
 - .1 Any physical damage on tree bark;
 - .2 Any broken branches;
 - .3 Equipment and materials stored within the protected areas and beyond the limits of the contract.
 - .4 Refuelling of equipment within the protected areas.
- .3 The Contractor will supply, install, maintain, and warranty trees of the same species to every one tree damaged, as indicated by the Departmental Representative or Delegate (DR/D).
 - .1 Coniferous Trees: 2.1 metre height
 - .2 Deciduous Trees: 70 mm cal.
- .4 In addition the Owner reserves the right to charge the Contractor a maximum of \$1,000 (one thousand dollars) per damaged tree should the Contractor not comply with directions from the Departmental Representative or Delegate (DR/D) to protect existing trees.
- .5 The exact location of the replacement trees will be staked out to the approval of the Departmental Representative or Delegate (DR/D) before commencement of work.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Granular 'A'

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 00 – Cleaning and Waste Processing
- .4 Section 01 74 20 – Waste Managing and Disposal
- .5 Section 31 05 16 – Aggregate Materials

1.3 MEASUREMENT AND PAYMENT

- .1 Measure granular base in tonnage of material incorporated into Work and accepted in writing by Departmental Representative or Delegate (DR/D).
- .2 Stipulated Price: Section 01 29 00 - payment procedures affecting this section.

1.4 REFERENCES

- .1 ASTM International
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small- Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 206 - November 2013, Construction Specification for Grading.
 - .2 OPSS 501- November 2014, Construction Specification for Compacting.
 - .3 OPSS 1001 - November 2013, Material Specification for Aggregates - General.
 - .4 OPSS 1010 - November 2013, Material Specification for Aggregates - Base,

Subbase, Select Subgrade, and Backfill Material.

- .4 Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation Report, Pukaskwa National Park, Heron Bay, Ontario, dated June 13, 2016 Report Number: 1545167, prepared by Golder Associates.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 31 05 16 - Aggregate Materials.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and OPSS.MUNI 1010.
 - .1 Crushed stone or gravel to OPSS Granular 'A' specifications.
 - .2 Gradations to be within OPSS limits.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
 - .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 PLACEMENT AND INSTALLATION

- .1 Placing:
 - .1 Place granular base after subgrade or sub-base surface is inspected and approved in writing by Departmental Representative or Delegate (DR/D).
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
 - .5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative or Delegate (DR/D) may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .6 Shape each layer to smooth contour and compact to specify density before succeeding layer is placed.
 - .7 Remove and replace that portion of layer in which material becomes segregated during spreading.

- .2 Compaction Equipment:
 - .1 Ensure compaction equipment is capable of obtaining required material densities.
- .3 Compacting:
 - .1 Compact to density not less than 100% maximum dry density in accordance with ASTM D698/D1557.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative or Delegate (DR/D).
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .4 Proof rolling:
 - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
 - .2 Obtain written approval from Departmental Representative or Delegate (DR/D) to use non-standard proof rolling equipment.
 - .3 Proof roll at level in granular base as indicated.
 - .1 If use of non-standard proof rolling equipment is approved, Departmental Representative or Delegate (DR/D) to determine level of proof rolling.
 - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to a depth as directed by Departmental Representative or Delegate (DR/D).
 - .2 Backfill excavated subgrade and sub-base materials with base material and compact in accordance with Section 32 11 23 - Aggregate Base Course.
 - .3 Replace base material and compact in accordance with this Section.

3.3 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing
 - .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 00 – Cleaning and Waste Processing.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 - Waste Managing and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert unused granular material from landfill to local facility approved by

Departmental Representative or Delegate (DR/D).

3.5 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative or Delegate (DR/D).

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Supply all labour, materials, and equipment to design, engineer, and install flagstone paving, sealing, and grouting of joints.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete

1.3 QUALITY ASSURANCE

- .1 Install at a designated location on the job site mock-up of flagstone paving 3 m x 3 m for Departmental Representative or Delegate (DR/D) inspection.
- .2 Work will be inspected to ensure proper pattern layout, grouting, joints and standard of quality.
- .3 Work shall meet or exceed quality of work-up.

1.4 REFERENCES

- .1 ASTM International
 - .1 ASTM C150/C150M-12 ‘Standard Specification for Portland Cement’.
- .2 Canadian General Standards Board
 - .1 CAN/CGSB 19.24-M90 ‘Multicomponent, Chemical-Curing Sealing Compound’.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings for review by Consultant before proceeding with this section of work, showing cutting and drilling for other sections of work, layout, and dimensioning and relevant details.
- .2 Include necessary sections and details drawn to scale.
- .3 In general, follow profiles, elevations, and sizes shown on the drawings.
- .4 The exposed components of the flagstone systems shall have a uniform appearance.
- .5 Locate sealants and drainage slots as required and as shown on shop drawings.
- .6 Provide accessories required and necessary to complete the work.

1.6 SAMPLES

- .1 Provide three (3) samples 300 mm x 300 mm flagstone paving as specified, for Departmental Representative or Delegate (DR/D) inspection and acceptance prior to production.
- .2 Ensure samples demonstrate colour range of specified flagstone.
- .3 Submit samples of dowels and anchors for Departmental Representative or Delegate (DR/D) review.

- .4 Retain marked, approved samples on site for Departmental Representative or Delegate (DR/D) reference.
- .5 Finished flagstone in place, shall match approved sample as determined by Departmental Representative or Delegate (DR/D).
- .6 Neither cut nor finish flagstone until Departmental Representative or Delegate (DR/D) has approved samples and shop drawings.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Provide necessary protection and care in shipping, handling, and storage to prevent damage or soiling of flagstone.
- .2 Do not permit flagstone to contact earth or other staining influences or to rest on corners.
- .3 Protect stockpiles against inclement weather, on wooden pallets in designated locations.

1.8 WARRANTY

- .1 Without restricting generality of warranty, defects shall include crazing, spalling, cracking, pitting, splitting, deformation, failure to maintain true line, plumbness, and weather-tightness, failure of anchorage system, and failure of sealant.
- .2 Provide a five-year written warranty that all labour and materials provided are in accordance with the specifications. Warrant that defects listed in section 1.6.1 shall be made good at the convenience of and without expense to the owner.

Part 2 MATERIALS

2.1 FLAGSTONE

- .1 Thickness shall be 50 mm for regular flagstone paving. Cut to suite edge, drainage, projection and other conditions. Finish all edges to be exposed. Design actual sizes to accommodate jointing and modularity as indicated on the drawings.

2.2 MORTAR

- .1 Cement: Portland, ASTM C150/C150M-09.
- .2 Sand: Clean, washed, sharp masonry sand.
- .3 Additive: Sealtight Intralok Bonding Agent manufactured by W.R. Meadows of Canada Ltd. Supplier Merkley Supply, 100 Bayview Road, Ottawa, Ontario K1Y 4L6 Phone: (613)728-2693, Fax: (613) 722-2984 or approved equal.
- .4 Water: potable.

2.3 GROUT

- .1 Cement: Medusa, non-staining white.
- .2 Sand: White Silica, clean washed, sharp.
- .3 Water: potable.

- .4 Colour Pigments: high purity, non-staining mineral oxides especially prepared for use in point mortar. Colour to be selected by Departmental Representative or Delegate (DR/D).
- .5 Additive: as per 2.2.3.

2.4 SEALANT

- .1 Sealant: polysulphide two component, CAN/CGSB-19.24 'Multicomponent, Chemical-Curing Sealing Compound' coloured to match flagstone as required, Plykol by Thornhill Sales Ltd., tested for non-staining of stone. Submit copy of non-staining test report for sealant.

PART 3 EXECUTION

3.1 GENERAL

- .1 Execute flagstone work accurately, true to dimension, in true planes free from warp, twist, cracks, checks, and broken edges. Keep lines straight and true.
- .2 Set units plumb and square with joints parallel and uniform. Keep units clean as work progresses and avoid staining of exposed faces. Should stains occur, remove them immediately with sponge and clean water.
- .3 Install flagstone to pattern on approved shop drawings and in accordance with approved job mock-up. Leave no voids between flagstone and setting bed.

3.2 PAVERS

- .1 Prepare concrete base as per Section 03 30 00.
- .2 Examine the work of other sections to which the flagstone work will be attached or applied. Report immediately in writing to the project manager any discrepancies, which will adversely affect the installation or permanency of the work of this section.
- .3 Commencement of work shall indicate acceptance of the work of other sections, upon which the work of this section depends.
- .4 Mix and spread mortar-setting bed to manufacturer's specifications. Mix only enough mortar for 30 - 40 minimum work life. Mix thoroughly to remove lumps, avoid air entrapment, do not retemper.
- .5 Butter back of stone units with mortar slurry.
- .6 Lay flagstone to line, grade, and pattern shown on drawings. Ensure flagstone is embedded 100% into setting bed. Level each paver one to the next. All edges to be flush one to the other.
- .7 Joints between stones should be 10–25 mm.
- .8 Mask edges of joints prior to grouting and painting.
- .9 Grout joints solid with grouting compound. Paint joints remove masking.
- .10 Clean flagstone in accordance with manufacturer's instructions. Paint open joints.

3.3 EXPANSION JOINTS

- .1 Clean, prime, apply backing and sealant to joints in accordance with sealant manufacturer's instructions.
- .2 Where surfaces adjacent to joints are likely to become coated with sealant during application, mask these surfaces with masking tape prior to priming and sealing.
- .3 Apply sealant so as to assure positive adhesion to sides of joints and to fill voids in joint. Surface of sealant shall be smooth, free from ridges, wrinkles, sags, air pockets and embedded impurities. After joints have been filled, tool them flush with adjoining surfaces.
- .4 Remove masking tape, soils, and sealant, which may have been deposited on surfaces near joint.
- .5 Maintain in stock, for duration of warranty period, a supply of stone for replacement.

3.4 CLEANING

- .1 Remove cracked, chipped, broken, or otherwise damaged materials from site immediately.
- .2 On completion, clean material furnished under this section using only materials and methods recommended by flagstone producer, and leave flagstone ready for general cleaning.

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 01 74 11 – Cleaning and Waste Processing
- .4 Section 01 74 21 – Waste Managing and Disposal
- .5 Section 31 05 16 – Aggregate Materials

1.2 MEASUREMENT AND PAYMENT

- .1 Measure asphalt from surface area in square meters as shown on plans and multiply by thickness, then convert to tonnes.
- .2 Stipulated Price: Section 01 29 00 - payment procedures affecting this section.

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .2 ASTM D2041, Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
- .2 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 310 - November 2012, Construction Specification for Hot Mix Asphalt.
 - .2 OPSS.MUNI 1010-November 2013, Material Specification for Aggregates – Base, Subbase, Select Subgrade and Backfill Material.
 - .3 OPSS 1150-November 2010, Material Specification for Hot Mixed Asphalt.
- .3 Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation Report, Pukaskwa National Park, Heron Bay, Ontario, dated June 13, 2016 Report Number: 1545167, prepared by Golder Associates.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data: per Section 01 33 00 Submittal Procedures
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4 weeks prior to beginning Work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials. Stockpile minimum 50 % of total amount of aggregate required before beginning asphalt

- mixing operation.
- .3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.
 - .4 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.
 - .5 Provide approved storage, heating tanks and pumping facilities for asphalt cement.
 - .6 Submit to Departmental Representative or Delegate (DR/D) copies of freight and waybills for asphalt cement as shipments are received.
 - .1 Departmental Representative or Delegate (DR/D) reserves right to check weights as material is received.
 - .7 Stockpile crushed RAP separately in accordance with Section 31 05 16 - Aggregate Materials.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Aggregates to: OPSS.MUNI 1010.
- .2 Asphalt to OPSS 1150 and 310.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
 - .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 Widening:
 1. The pavement should be widened, sub-excavated to subgrade level and should be properly shaped, crowned, then proof rolled with a heavy vibratory roller.
 2. Any soft or spongy subgrade areas detected should be sub-excavated and properly replaced with suitable backfill compacted to 95% SPMDD (ASTM D698).
 3. Place granular sub-base and base materials as per Sections 32 11 16.01 and 32 11 23.
 4. Prior to laying mix, clean surfaces of loose and foreign material.
- .3 Pulverization and Mixing:
 - .1 Use pulverization equipment and break up existing asphalt pavement to lines and grades as indicated on contract drawings. The in-situ pulverization should be carried out in accordance with OPSS.MUNI 330.
 - .2 Mix existing asphaltic concrete and granular base. Carried out to a depth of about 150mm. The blend material should contain a maximum of 50% by volume of

bituminous material.

3.2 PLACING

- .1 Obtain Departmental Representative or Delegate (DR/D)'s approval of base prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated on contract drawings.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Place individual strips no longer than 500 m.
- .5 Spread and strike off mixture with self-propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings.
 - .1 Departmental Representative or Delegate (DR/D) to establish lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.
 - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver.
 - .1 Work pavers as close together as possible and in no case permit them to be more than 30 m apart.
 - .3 Maintain constant head of mix in auger chamber of paver during placing.
 - .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .6 Correct irregularities in surface of pavement course directly behind paver.
 - .1 Remove excess material forming high spots using shovel or lute.
 - .1 Fill and smooth indented areas with hot mix.
 - .2 Do not broadcast material over such areas.
 - .7 Do not throw surplus material on freshly screeded surfaces.
 - .6 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.
 - .1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .2 Distribute material uniformly without broad casting material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.
 - .1 Reject material that has formed into lumps and does not break down readily.
 - .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .5 Provide heating equipment to keep hand tools free from asphalt.
 - .1 Control temperature to avoid burning material.
 - .2 Do not use tools at higher temperature than temperature of mix being placed.

3.3 COMPACTING

- .1 Do not change rolling pattern unless mix changes or lift thickness changes.
 - .1 Change rolling pattern only as directed by Departmental Representative or Delegate (DR/D).
- .2 General:
 - .1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
 - .4 Use static compaction for levelling coarse less than 25 mm thick.
 - .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
 - .6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.
 - .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
 - .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
 - .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
 - .11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
 - .12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .3 Breakdown rolling:
 - .1 Begin breakdown rolling with vibratory roller immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by Departmental Representative or Delegate (DR/D).
 - .4 Use only experienced roller operators.
- .4 Intermediate rolling:
 - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly

- compacted.
- .5 Finish rolling:
 - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
 - .1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Departmental Representative.
 - .2 Conduct rolling operations in close sequence.
- .6 Dust entire area of sheet asphalt pavements immediately after rolling to eliminate tendency to pick-up under traffic.

3.4 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip.
 - .1 Do not deposit on surface of freshly laid strip.
 - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
 - .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 For airfield runway paving, avoid cold joint construction in mid-30 m of runway.
 - .2 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

3.5 FINISH TOLERANCES

- .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.

3.6 DEFECTIVE WORK

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

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing
 - .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 00 – Cleaning and Waste Processing.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 - Waste Managing and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 GENERAL**1.1 SCOPE OF WORK**

- .1 Work includes but is not necessarily limited to the supply of labour material, tools and equipment to complete all portions of the work.
 - .1 Supply and install all concrete paving.
 - .2 Rake and smooth granular base.
 - .3 Supply and install all expansion joints.
 - .4 Saw cutting at expansion joints and for patterning.
 - .5 Supply and install all joint sealants.

1.2 RELATED SECTIONS

- .1 Section 02 41 13.15 – Site work Demolition and Removals
- .2 Section 03 10 00 – Concrete Forming and Accessories (Contractor to obtain Section from NMS).
- .3 Section 03 20 00 – Concrete Reinforcing (Contractor to obtain Section from NMS).
- .4 Section 03 30 00 – Cast-in-Place Concrete
- .5 Section 32 11 23 – Aggregate Base Courses

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM D1751-04(2013)e1 ‘Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)’.
- .2 CSA Group
 - .1 CSA A23.1-14/A23.2-14 ‘Precast Concrete – Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products’.
 - .2 CSA A23.3-14 ‘Design of Concrete Structures’.
 - .3 CSA A23.4-16 ‘Precast Concrete – Materials and Construction Update No. 1 (July 2010)’.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 19.24.M90 ‘Sealing Compound, Multi-Component, Chemical Curing’.
- .4 Design all units to withstand all stresses due to temperature, handling, wind and earthquake.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with CSA-A23.4 and this project specification.
- .2 Shop drawings will be prepared for approval prior to commencement of work and will include:
 - .1 All materials
 - .2 Method of construction
 - .3 Dimensions, anchorage and connection details.

- .3 Submit samples to provide true representation of colour, texture and surface finish.
- .4 The Departmental Representative or Delegate (DR/D) prior to fabrication of the remaining units will approve the first unit from the production, after the approval of the colour/texture/finish sample.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Store precast work to clear ground or other bearing surfaces.
- .2 Protection: take particular care to protect finished surfaces from droppings and smears. Protect work from damage from welding by use of non-combustible shielding.

1.6 SAMPLES

- .1 Submit samples to provide true representation of colour, texture and surface finish.
- .2 The Departmental Representative or Delegate (DR/D) prior to fabrication of the remaining units will approve the first unit from the production, after the approval of the colour/texture/finish sample.

1.7 FORMS

- .1 Steel forms for bollards, bench bases, waste receptacles, light bases, and sign bases ha.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Concrete Mixes and Materials: to Section 03 30 00 – Cast-in-place Concrete.
- .2 Granular Base: to Section 32 11 23 – Aggregate Base Courses
- .3 Caulking: polysulphide two component, CAN/CGSB 19.24M base colored to match granite as required, Plykol by Thornhill Sales Ltd., tested for non-staining of granite. Submit copy of non-staining test report for sealant.
- .4 Reinforcing Steel: to Section 03 20 00 – Concrete Reinforcing (Contractor to obtain from NMS).
- .5 Joint Filler: to Section 03 30 00 – Cast-in-Place Concrete
 - .1 Expansion joint material should be performed non-extruding and resilient bituminous fibre of 10 mm thick and conform to ASTM D1751.
 - .2 “Snap-Cap” expansion joint inserts as supplied by Givisco Ottawa or an approved equal.
- .6 Forms: to Section 03 10 00 – Concrete Forming and Accessories (Contractor to obtain from NMS).
- .7 Curing compound: to CAN/CGSB 19.24.M.

PART 3 EXECUTION

3.1 SUBGRADE

- .1 Check finished subgrade for conformity with elevations and sections and obtain approval from the Departmental Representative or Delegate (DR/D) before placing granular bases.

3.2 GRANULAR BASE

- .1 Place granular base and compact to depths and elevations shown on drawings.

3.3 FORMWORK

- .1 Do formwork in accordance with Section 03 10 00 – Concrete Formwork and Accessories (Contractor to obtain Section from NMS).

3.4 REINFORCING STEEL

- .1 Place reinforcing steel in accordance with Section 03 20 00 – Concrete Reinforcing (Contractor to obtain Section from NMS) and as indicated on contract drawings.

3.5 CONCRETE PLACEMENT

- .1 Place concrete in accordance with Section 03 30 00 – Cast-in-Place Concrete to lines grades and depths indicated on contract drawings.

3.6 CONCRETE FINISHING

- .1 Finish concrete to required levels, in accordance with Section 22 of CSA-A23.1. Carry out test area for review by Consultant, prior to proceeding.
- .2 Cure and protect concrete in accordance with Section 21 of CSA-A23.1.
- .3 A steel trowel or wood trowel should be used to finish surfaces to provide non-skid surface texture, except where specified otherwise.
- .4 Finish surfaces to within 5 mm to 3 m line, level or grade as measured with a straight edge placed on the surface.
- .5 Finish concrete 2 over top of expansion joints running perpendicular to building face.

3.7 JOINTS

- .1 Joints will be constructed of the type and at locations shown on drawings.
- .2 Concrete adjacent to all formwork and joints will be finished smooth with top of form. Edges will be eased with edging tools but no lines will be left on the surface.
- .3 Construction joints will be saw cut to line and pattern as shown on drawings, within two days of finishing concrete surface.
- .4 Unless otherwise indicated on drawings expansion joints will be placed at area drains and along length adjacent to concrete curbs catchbasins, buildings or permanent surfaces.
- .5 Expansion joints will be for the full depth of the slab.
- .6 All joints will be sealed with expansion joint material in accordance with manufacturer's recommendations.
- .7 Caulk expansion joints as shown on drawings.
- .8 Saw cut expansion joints as indicated on plans and detail drawings.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Restore unpaved (existing gravel road) surfaces.
- .2 Place granular 'A' over existing (restored) gravel road.
- .3 Place surplus mix materials from 'In-place Processing' in lieu of granular A over Lagoon Access Road

1.2 RELATED SECTIONS

- .1 Section 31 05 16 – Aggregate Materials.
- .2 Section 31 23 16 – Excavating.
- .3 Section 31 23 18 – Trenching.
- .4 Section 01 33 00 – Submittal Procedures
- .5 Section 01 45 00 – Quality Control
- .6 Section 01 74 00 – Cleaning and Waste Processing
- .7 Section 01 74 20 – Waste Managing and Disposal
- .8 Section 32 11 23 – Aggregate Base Course

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Stipulated Price: Section 01 29 00 - Measurement of quantities and payment procedures affecting this section.
- .2 Restore unpaved roadway surfaces: Measured in square meters.
- .3 Re-gravel of restored roadway surfaces: Measured in tonnage of granular 'A' material incorporated into Work and accepted in writing by Departmental Representative or Delegate (DR/D).

1.1 REFERENCES

- .1 ASTM International
- .2 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .1 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small- Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .4 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .5 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .6 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and

Plasticity Index of Soils.

- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 206 - November 2013, Construction Specification for Grading.
 - .2 OPSS 301 - November 2009, Construction Specification for Restoring Unpaved Roadway Surfaces.
 - .3 OPSS 501- November 2014, Construction Specification for Compacting.
 - .4 OPSS 1001 - November 2013, Material Specification for Aggregates - General.
 - .5 OPSS 1010 - November 2013, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
- .4 Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation Report, Pukaskwa National Park, Heron Bay, Ontario, dated June 13, 2016 Report Number: 1545167, prepared by Golder Associates.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate the Work of this section and directly related sections, with Topsoil stripping, excavation, Trench excavation and backfilling and installation of ducts and other utilities.
- .3 Pre-installation Meetings: Convene one (1) week before starting work of this section.

1.5 REGULATORY REQUIREMENTS

- .1 Conform to applicable code or regulations for rock crushing, spillage on streets, load limits on streets, and other requirements.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and OPSS.MUNI 1010.
 - .1 Crushed stone or gravel to OPSS Granular 'A' specifications.
 - .2 Gradations to be within OPSS limits.

PART 3 EXECUTION**3.1 PREPARATION**

- .1 Temporary Erosion and Sedimentation Control:

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
- .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 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.

3.3 PLACEMENT

- .1 Prior to placing any material, the proposed roadway cross section width should be laid out including clearing and grubbing of trees, as required.
- .2 Remove debris, clay or any large pieces of rocks found along the roadway surface.
- .3 Restore roadway surfaces as per OPSS 301.
- .3 Place 200mm minimum of granular 'A' base to the lines and dimensions specified in the Contract Drawings and shape, fine grade and compact to final design grade.
- .4 Place surplus mix materials from 'In-place Processing' in lieu of granular 'A' over Lagoon Access Road.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 31 22 13 – Rough Grading
- .2 Section 32 11 23 – Aggregate Base Courses

1.2 REFERENCES

- .1 American Society of Testing and Materials (ASTM)
 - .1 ASTM D698-12 ‘Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).’

1.3 PROTECTION

- .1 Prevent damage to landscaping, curbs, sidewalks, trees, fences, roads, and adjacent property. Make good any damage.
- .2 Provide access to any buildings at all times. Co-ordinate paving schedule to minimize interference with normal use of premises.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Granular Subbase: crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Granular aggregate to meet following gradation:

<u>SIEVE NUMBER</u>	<u>PERCENT PASSING</u>
75 mm	100
0.425 mm	30 maximum
0.075 mm	8 maximum

- .2 Granular Base: crushed stone or gravel, hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Crushed aggregate to meet the following gradation.

<u>SIEVE NUMBER</u>	<u>PERCENT PASSING</u>
50 mm	100
19 mm	95-100
16 mm	75-100
9.5 mm	57-83
4.75 mm	37-61
1.18 mm	12-32
0.425 mm	8-23
0.075 mm	3-8

- .1 Granular Base - fraction passing 4.75 mm sieve to have liquid limit of 25 maximum, and plasticity index of 6 maximum.

- .3 Granular Topping:
 - .1 Screenings: hard, durable, crushed stone particles, free from clay lumps, cementation organic material, frozen material and other deleterious materials.
 - .2 Gradation: to meet following gradation:

<u>SIEVE NUMBER</u>	<u>PERCENT PASSING</u>
	100
9.5 mm	50-100
4.75 mm	20-55
1.18 mm	10-30
0.30 mm	12-32
0.075 mm	0-30

PART 3 EXECUTION

3.1 SUBGRADE

- .1 Ensure that subgrade preparation conforms to levels and compaction required to allow for installation of granular base.

3.2 GEOTEXTILE FILTER

- .1 Geotextile Fabric: Class II, non-woven geotextile with FOS in the range of 5 um to 75 um

3.3 GRANULAR SUB-BASE

- .1 Granular sub-base material minimum thickness: as indicated.

3.4 GRANULAR BASE

- .1 Granular base material minimum thickness: as indicated.
- .2 Spread and compact granular base material in uniform layers not exceeding 100 mm compaction thickness.
- .3 Compact to a density of not less than 100% Standard Density in accordance with ASTM D698.

3.5 EDGING

- .1 Install edging true to grade, in location, layout, and pattern as indicated.

3.6 INSPECTION

- .1 Verify graded subgrade for conformity with elevations sections before placing granular base material.
- .2 Proof roll grading subgrade surface with roller of approved mass and type.
 - .1 Check for unstable areas;
 - .2 Check for areas requiring additional compaction;
 - .3 Notify Consultant of unsatisfactory conditions.

3.7 BASE COURSE PLACEMENT

- .1 Place granular base to compacted thickness as indicated.
- .2 Place in layers not exceeding 150 mm compaction thickness. Compact each layer to 95% Standard Proctor density and correct as specified in Section 32 11 23 – Aggregate Base Courses.

3.8 GRANULAR TOPPING PLACEMENT

- .1 Place granular topping to compacted thickness as indicated.
- .2 Place in layers not exceeding 50 mm compaction thickness. Compact topping to 95% Standard Proctor density. Maintain stone dust at optimum water content during compaction operations.

3.9 FIELD QUALITY CONTROL

- .1 Inspection and testing of crushed stone paving will be carried out by designated testing laboratory.
- .2 Owner will pay costs of test under a Cash Allowance.

END OF SECTION

PART 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 01 74 00 – Cleaning and waste Processing
- .2 Section 02 41 13.14 – In Place Pavement Processing.
- .3 Section 02 41 13.15 – Site Work Demolition and Removals.
- .4 Section 31 11 00 – Clearing and Grubbing
- .5 Section 31 14 13 – Soil Stripping and Stockpiling
- .6 Section 31 22 13 – Rough Grading
- .7 Section 31 22 19 – Finish Grading
- .8 Section 31 23 16 – Excavating
- .9 Section 31 23 17 – Rock Removal
- .10 Section 31 23 18 – Trenching

1.2 MEASUREMENT AND PAYMENT

- .1 No measurement for payment will be made for the work of this section. All costs associated with the work of this section shall be deemed to be included in the Balance of Project.

1.3 REFERENCES

- .1 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 506 - November 2013, Construction Specification for Dust Suppressants.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-15.1-92, Calcium Chloride.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Supply calcium chloride in quantities and at times as directed by Departmental Representative or Delegate (DR/D).
 - .2 Deliver calcium chloride to site covered trucks. Indicate name of manufacturer, name of product, net weight or mass, and percentage of calcium chloride.
- .3 Storage and Handling Requirements:
 - .1 Store bags of calcium chloride in weather-proof enclosures.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Calcium chloride, Type I: to CAN/CGSB-15.1.
- .2 Water shall be free of contaminants that could adversely affect fill material or the environment, water shall be free of foreign material that would alter dust suppressant solution or cause blockage in the spray equipment.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.

3.2 APPLICATION

- .1 Apply calcium chloride and water with equipment approved by Departmental Representative or Delegate (DR/D).
 - .1 A pump capable of developing in the spray manifold a constant uniform pressure to sustain the required application.
 - .2 A pressure gauge indicating the pressure within the spray bar graduated in increments of 15 kPa or less and visible to the operator.
 - .3 A rear mounted spray bar having a cab-activated positive and instant shut off that can be set at variable heights parallel to the surface and to any spraying width from 1 to 3 m to spray any portion of the roadway surface, including the shoulders. The spray bar nozzles shall be:
 - .1 All of the same manufacture and size.
 - .2 Clean and in good working condition.
 - .3 Designed and set to ensure uniform fan shaped spray without atomization.
 - .4 Nozzles shall be set in the spray bar at an angle permitting each spray fan to overlap adjacent spray fans in such a manner that complete coverage of the spray area is maintained should there be a malfunction of one nozzle.
 - .5 A strainer installed in the feed system to prevent clogging of the spray bar nozzles.
 - .6 A device or method that allows the operator to determine the volume remaining in the tank to an accuracy of 200 litres.
 - .7 Splash guards or other approved devices for shoulder spraying that shall permit spraying immediately adjacent to the pavement without over-spraying the pavement surface.
 - .8 A system (e.g. meter, GPS device, ground speed sensors, or calibration charts) that allows the operator to determine the rate of application with accuracy while spreading dust suppressant.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00
 - .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 00.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Painted Pavement Marking.
- .2 Speed Bumps.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 23 – Health and Safety.
- .3 Section 01 74 00 – Cleaning and Waste Processing.
- .4 Section 01 74 20 – Waste Managing and Disposal.

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.5-99, Low Flash Petroleum Spirits Thinner.
 - .2 CAN/CGSB 1.74-01, Alkyd Traffic Paint.
- .2 Green Seal Environmental Standards (GS)
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
- .5 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 710 - November 2010, Construction Specification for Pavement Marking.

1.4 MEASUREMENT AND PAYMENT

- .1 Measurement for painted pavement marking is by the Lump Sum.
- .2 Stipulated Price: Section 01 29 00 - payment procedures affecting this section.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data: per Section 01 33 00 Submittal Procedures
 - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 23- Health and Safety.
- .2 Samples:
 - .1 Submit to Departmental Representative or Delegate (DR/D) following material sample quantities at least 4 weeks prior to commencing work.
 - .1 Two 1 L samples of each type of paint.
 - .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, MPI specification number and formulation number

and batch number.

1.6 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 dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Paint:
 - .1 To MPI -EXT 2.1B, Alkyd zone/traffic marking.
 - .2 Paints: in accordance with MPI recommendation for surface conditions.
 - .1 Paints: maximum VOC limit 100 g/L to SCAQMD Rule 1113 to GS-11.
 - .3 Colour: to MPI listed, yellow and white.
 - .4 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.
- .2 Thinner: to MPI listed manufacturer.
- .3 Rubber Speed Bump (200cm x 30cm x 5cm Guardian Modular Speed Bump):
 - .1 Weather resistant rubber.
 - .2 Yellow strips and embedded reflective beads for visibility
 - .3 For outdoor use.
- .4 Speed Bumps can be purchased from Barco Products Canada, 165 Summerlea Road, Brampton, ON L6T 4P6, **Phone:** +1 905-569-2202 or from an approved equivalent supplier.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.
 - .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.

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

3.2 EQUIPMENT REQUIREMENTS

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

3.3 APPLICATION

- .1 Pavement markings: laid out as indicated.
- .2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.
- .3 Apply traffic paint evenly at rate of 3 m²/L.
- .4 Do not thin paint unless approved by Departmental Representative.
- .5 Symbols and letters to conform to dimensions indicated on existing conditions.
- .6 Paint lines: of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different color.

3.4 TOLERANCE

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- .2 Remove incorrect markings as directed by Department Representative.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00
 - .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 00
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 SPEED BUMP

- .1 Speed bumps shall be installed where indicated on the Contract drawings as per the manufacture/supplier specifications.

3.7 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.
- .2 Repair damage to adjacent materials caused by pavement marking application.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Work under this section shall include the construction of the rock sitting walls.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories (Contractor to obtain from NMS).
- .2 Section 31 22 13 – Rough Grading
- .3 Section 32 91 19.13 – Topsoil Placement and Grading (Contractor to obtain from NMS).
- .4 Section 32 92 23 – Sodding (Contractor to obtain from NMS).

1.3 REFERENCES

- .1 Ontario Provincial Standards Specifications (OPSS)
 - .1 OPSS.MUNI Form 1010 ‘Material Specification for Aggregates – Base, Subbase, select Subgrade, and Backfill Material’,

1.4 PROTECTION

- .1 Adequately protect all adjacent landscape features through-out the work of this section. The contractor shall be responsible for rectifying any damaged caused to the approval of the Departmental Representative or Delegate (DR/D).

PART 2 PRODUCTS

2.1 BLAST ROCK

- .1 Rock shall be tough, sound, seasoned limestone, free from structural defects. The stones shall be approximately 0.4 m thick x 0.75 m wide x 1.0 m in length.
- .2 Ensure all sides are relatively flat to accommodate construction of rock sitting wall.
- .3 Receive approval from the Departmental Representative or Delegate (DR/D) prior to commencement of work.

2.2 FILTER FABRIC

- .1 Filter fabric shall be ultra-violet resistant non-woven synthetic filter fabric.

2.3 GRANULAR

- .1 Granular ‘A’ to meet requirements of OPSS.MUNI Form 1010.

PART 3 EXECUTION

3.1 APPROVALS

- .1 Stake out location of the rock sitting wall to the approval of the Departmental Representative or Delegate (DR/D).
- .2 Place rock on compacted granular base as per the detail.
- .3 Spread rock across site to allow visual inspection of each piece. Select rock such that each rock is approximately same thickness.
- .4 Lay down rock in even layers, to line and grades shown on drawings.
- .5 Wrap filter fabric at back of wall so as to prevent erosion of granular through cracks in wall. Backfill with Granular A and compact.
- .6 Take care to prevent mechanical damage to exposed surfaces.
- .7 Grind sharp exposed rock edges and surfaces sufficient to prevent skin abrasions.
- .8 Remove surplus material from site.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Contained in this section are materials and installation of standard manufactured catalogue items such as waste containers, benches, planters, tables, bike racks, playground equipment and animal proof waste containers.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 05 50 00 – Metal Fabrication (Contractor to obtain from NMS).
- .3 Section 32 13 13 – Concrete Paving

1.3 SHOP DRAWINGS

- .1 Submit shop drawings according to samples and mock-ups and product data.
- .2 Indicate dimensions, sizes, assembly, and anchorage and installation details for each furnishing specified.
- .3 Provide maintenance data for care and cleaning of waste receptacle for incorporation into manual.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for care and cleaning of site furnishings that may be incorporation into an Operation and Maintenance Manual.

1.5 GUARANTEE

- .1 Repairs to site furniture during the guarantee period will be carried out at no expense to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Benches:
 - .1 Dimensions:
 - .2 Finish:
 - .3 Acceptable Material:
- .2 Bicycle Racks:
 - .1 Dimensions:
 - .2 Finish:
- .3 Acceptable Material:
 - .1 Paint: exterior alkyd, flat finish, color selected by the Departmental Representative or Delegate (DR/D).
- .4 Animal Proof Garbage Container:

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Verify that the site conditions are acceptable for exterior site furnishing installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative or Delegate (DR/D) of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and with the approval of the Departmental Representative or Delegate (DR/D).

3.2 PREPARATION

- .1 Locate and protect utility lines.
 - .1 Notify and acquire written acknowledgment from utility authorities before beginning installation work.

3.3 INSTALLATION

- .1 Assemble furnishings according to manufacturer's instructions.
- .2 Install furnishings as per manufacturer's specifications.
- .3 Touch-up damaged finishes to the approval of the Departmental Representative or Delegate (DR/D).
- .4 Paint all exposed steel elements with two coats of exterior paint.

3.4 CLEANING

- .1 Leave work area clean at the end of each day.
- .2 Upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Separate waste materials for recycling; remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

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

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Work under this section includes the application of mulch and seed onto prepared beds.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Windflower seed will be Canada No.1 seed having a minimum germination of 75% and minimum purity of 97%.
- .2 Delivered seed must be in original container showing:
 - .1 Analysis of seed mixture;
 - .2 Percentage of pure seed;
 - .3 Year of production;
 - .4 Net weight;
 - .5 Date when bagged and location.
- .3 Mulch: a natural plant fibre, biodegradable, chopped, and natural in colour, supplied in unopened packages, each showing the manufacturer's analysis. Paper mulches are not to be used.
- .4 Water: potable

PART 3 EXECUTION**3.1 HYDRO-SEEDING**

- .1 Verify a seeding date with Departmental Representative or Delegate (DR/D) to ensure optimum germination and windflower establishment.
- .2 Before seeding, thoroughly work or disc all areas to be seeded to a depth of not less than 100 mm.
- .3 Obtain the Departmental Representative or Delegate (DR/D)'s approval of grade, and scarified soil surfaces prior to commencement of seeding.
- .4 Lightly loosen the surface of earth that has become compacted.
- .5 Rake off and remove any debris, tree roots, and stones larger than 50 mm. Leave area with a smooth surface to the full satisfaction of the Departmental Representative or Delegate (DR/D).
- .6 Mix windflower seed, mulch, and water thoroughly to obtain following mixture per hectare: seed 33kg, mulch 1400kg, water 15000 litres.
- .7 Distribute mixture uniformly over designated areas with an approved hydraulic seeder.
- .8 Apply only during calm weather.
- .9 Ensure that vehicles, buildings, signage, and trees are not in the path of the hydro seeder nozzle.
- .10 The Contractor will at his own expense, clean any vehicles, buildings, signage and trees, which are coated with the hydro seeding, mix. The Departmental Representative or Delegate (DR/D) will approve this cleaning.

- .11 Proposed method of seeding for specific areas is to be approved by Departmental Representative or Delegate (DR/D) before proceeding.
- .12 On slopes that are 2:1 and greater, the contractor must add Tackifier to slurry at the rate recommended by manufacturer.

3.2 MAINTENANCE AND ACCEPTANCE

- .1 Maintain seeded areas until wildflowers are well established.
- .2 Reseed all areas of poor catch when and as directed by the Departmental Representative or Delegate (DR/D).
- .3 Only areas showing a good catch and acceptable cover will be accepted.
- .4 After the first wildflower summer growing season, mow the dormant plants to a height of 100 mm. in the late fall or as directed by the Departmental Representative or Delegate (DR/D).

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Application of mulch and seed for roadways.

1.2 RELATED SECTIONS

- .1 Section 31 22 19 – Finish Grading

1.3 PAYMENT

- .1 Stipulated Price: Section 01 29 00 - payment procedures affecting this section.

1.4 PRODUCT DATA

- .1 Submit product data for:
 - .1 Seed
 - .2 Fertilizer

1.5 SCHEDULING

- .1 Seed between labor long weekend and September 15th.
- .2 Work must be scheduled so work is completed in one area before proceeding to next area.
- .3 Schedule the completion of work immediately prior to hydraulic mulching.

PART 2 PRODUCTS

2.1 GRASS SEED

- .1 Grass seed mixture: The use of indigenous grass seed mixture is preferred. Grass seed mix must be approved by Parks Canada before seeding.
- .2 Seed must be kept in containers with original tags.

2.2 WATER

- .1 Water must be free of impurities that would inhibit germination and growth.

2.3 FERTILIZER

- .1 Complete synthetic, slow release with maximum 35% water soluble nitrogen:
 - 12-6-6 for spring seeding
 - 10-10-10 for fall seeding

PART 3 EXECUTION

3.1 SEEDED AREA

- .1 All areas disturbed during construction shall be seeded and mulched.

3.2 WORKMANSHIP

- .1 Do not perform work under adverse field conditions such as frozen ground, ground covered with snow, ice or standing water.
- .2 Remove and dispose of weeds; debris; stones 50 mm in diameter and large; soil contaminated by oil, gasoline and other deleterious materials; off the site as directed by Departmental Representative or Delegate (DR/D).

3.3 SEED BED PREPARATION

- .1 Verify that grades are correct. If discrepancies occur, notify Departmental Representative or Delegate (DR/D) and do not commence work until further instructed.
- .2 Be a sure fine grade surface is free of humps and hollows and that it is a smooth, even grade, to contours and elevations indicated and to tolerance of plus or minus 15 mm, allowing the surface to drain naturally.
- .3 Cultivate fine grades approved by Departmental Representative or Delegate (DR/D) to 25 mm depths immediately prior to seeding.

3.4 SEEDING

- .1 Use equipment suitable for area to the approval of the Departmental Representative or Delegate (DR/D).
- .2 Sow seed uniformly at the rate of 150 kg/hectare.
- .3 Blend application into adjacent grass areas to form uniform surfaces.
- .4 Sow half of the required amount of seed in one direction and remainder at right angles.
- .5 Embed seed into soil to depth of 5 mm within one hour of sowing.
- .6 Roll area with equipment approved by Departmental Representative or Delegate (DR/D).
- .7 Water the seed with fine spray, avoiding washing out of seed. Apply enough water to ensure penetration of minimum 50mm.
- .8 Protect seeded areas against damage. Remove this protection after Departmental Representative or Delegate (DR/D) has accepted lawn areas.

3.5 FERTILIZING PROGRAM

- .1 Fertilize during establishment and warranty periods to following Program or submit a fertilization program to the Departmental Representative or Delegate (DR/D) for approval prior to commencement of work on this item:

<u>Date</u>	<u>Rate</u>	<u>Ratio</u>
to	kg/ha	
to	kg/ha	
to	kg/ha	

3.6 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of seed application until final acceptance by the Departmental Representative or Delegate (DR/D):
 - .1 Water seeded area as required to ensure germination and continued growth of grass. Control watering to prevent washouts.
 - .2 Dead or bare patches must be repaired and reseed, to allow establishment of seed prior to acceptance.
 - .3 Cut grass to 40 mm whenever it reaches height of 60 mm, remove clippings.
 - .4 Fertilize seeded areas after first cutting at the rate determined by the soil test. Spread half the required amount of fertilizer in one direction and remainder at right angles and water in well. Postpone fertilizing until following spring if application falls within four-week periods prior to the expected end of local growing seasons.
 - .5 Maintain seeded areas weed free.

3.7 ACCEPTANCE

- .1 Seeded areas will be accepted by Departmental Representative or Delegate (DR/D) provided that:
 - .1 Areas are uniformly established and turf is free of rutted, eroded, bare or dead spots and free of weeds.
 - .2 Areas have been cut at least twice.
 - .3 Areas have been fertilized.
- .2 Areas seeded in fall will be accepted in following spring, one month after the start of the growing season provided acceptance conditions are fulfilled.

3.8 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until the end of the warranty period:
 - .1 Water seeded area to maintain optimum soil moisture level for continued growth of grass. Control watering to prevent washouts.
 - .2 Dead or bare patches must be repaired and reseed to the satisfaction of the Departmental Representative or Delegate (DR/D).
 - .3 Cut the grass to 40 mm whenever it reaches the height of 60 mm. Remove clippings, which will smother grass. Fertilize seeded areas in accordance with the fertilizing program. Spread half of the required amount of fertilizer in one direction and remainder at right angles and water in well.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Install trees, shrubs and ground covers work in accordance with the Canadian Standards for Nursery Stock - Eighth Edition, except where specified otherwise. Perform all work and supply all materials as specified herein, including but not necessarily limited to the following:
 - .1 Supply and installation of trees, shrubs and ground covers;
 - .2 Maintenance of plant materials.

1.2 RELATED SECTIONS

- .1 Section 32 94 12 – Planting Bed Preparation

1.3 REFERENCES

- .1 Canadian Nursery Landscape Association (CNLA)
 - .1 ‘Canadian Standards for Nursery Stock – Eighth Edition’.

1.4 SCHEDULING

- .1 Obtain approval from Departmental Representative or Delegate (DR/D) of schedule seven days in advance of shipment of plant material.
- .2 Schedule to include:
 - .1 Date for selection of plant material at source by Departmental Representative or Delegate (DR/D).
 - .2 Quantity and type of plant material.
 - .3 Shipping dates.
 - .4 Arrival dates on site.
 - .5 Planting Dates.

1.5 DELIVERY, STORAGE AND PROTECTION

- .1 Tie branches of trees and shrubs securely and protect plant materials against abrasion, exposure and extreme temperature change during transit. Avoid binding of plant stock with rope or wire, which would damage bark, break branches or destroy natural shape of plant. Give full support to root ball of trees during lifting.
- .2 Shade plant foliage with tarpaulin or in a closed facility and protect bare roots by means of peat moss, sawdust or other acceptable material to prevent loss of moisture during storage or transport. Ensure proper ventilation so no excessive heat will build up.
- .3 Remove broken and damaged roots or limbs with sharp pruning shears. Make clean cut.
- .4 Keep roots moist and protected from sun and wind. Heel-in trees and shrubs, which cannot be planted immediately, in shaded areas and water well.

1.6 WARRANTY

- .1 Provide a signed, written guarantee, stating that the plant material as itemized on plant list is guaranteed against defects for a period of one year from the date of substantial completion.
- .2 Departmental Representative or Delegate (DR/D) will conduct an end-of-warranty inspection.
- .3 Departmental Representative or Delegate (DR/D) reserves the right to extend the Contractor's warranty responsibilities for an additional year if at the end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

1.7 REPLACEMENTS

- .1 During warranty period, remove from site any plant material that has died or failed to grow satisfactorily as determined by consultant and replace with same plant material.
- .2 Extend warranty on replacement plant material for a period equal to the original warranty period.
- .3 Continue such replacement and warranty until plant material is acceptable.

1.8 SUBSTITUTIONS

- .1 Substitutions to plant material as indicated on drawings shall not be allowed without written approval by consultant.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Plant Material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system. Root pruned regularly, but not later than one growing season.
- .2 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.
 - .1 Trees larger than 200 mm in caliper; half root pruned during each of two successive growing seasons, the latter at least one growing season prior to arrival on site. Bare Root Stock: nursery grown, in dormant stage, not balled and burlapped or container grown.
- .3 Collected Stock: maximum 40 mm caliper well developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.
- .4 Water: potable and free of minerals, which may be detrimental or inhibit plant growth.
- .5 Stakes: T-bar steel stakes 40 x 40 x 5 x 2440 mm. Two coats black rust inhibitive paint.
- .6 Wire Tightener: Type 1 - steel, Type 2 - turn-buckle, steel, 9.5 mm diameter with 270 mm open length.
- .7 Guying Wire: 9 gauge galvanized wire
- .8 Tree Rings: fabricated from 2 mm galvanized wires encased in two ply reinforced 12 mm diameter rubber garden hose or equivalent.
- .9 Root Ball Burlap: 150 g Hessian burlap.
- .10 Tree Wrapping Material: new, clean, plain burlap strips minimum 2.5 kg per square metre mass and 150 mm wide.

2.2 MULCH

- .1 Provide sample for approval of Wood chips varying in size from 50 to 75 mm and 5 to 20 mm thick, free of bark, small branches and leaves.

2.3 PLANT MATERIAL

- .1 Quality and Source: comply with metric Guide of CNLA referring to size, development, and rootball of plant material. Measure plants when branches are in their natural position. Use trees and shrubs of No.1 Grade.
- .2 Additional Plant Material Qualifications:
 - .1 Plant material obtained from areas with milder climatic conditions from those of site are acceptable only when moved to site prior to the breaking of the buds in their original location, and are heeled-in, in a protected area until conditions are suitable for planting.
 - .2 Use trees and shrubs with strong fibrous root systems free of disease, insects, defects, or injuries and structurally sound. Use trees with straight trunks, well and characteristically branched for species. Plants must be root pruned regularly, but not later than one growing seasons prior to arrival on site.
 - .3 Container-grown stock: acceptable if container is large enough for root development. Trees and shrubs must have grown in container for minimum of one growing season, but not longer than two. Root system must be able to hold soil when removed from container. Plants that have become root bound are not acceptable. Container stock must have been fertilized with a slow releasing fertilizer.
 - .4 Balled and burlapped: coniferous and broad-leafed evergreens over 500 mm tall must be dug with soil ball. Deciduous trees in excess of 3.0 m height must have been dug with large firm ball. Root balls must include 75% of fibrous and feeder root system. Secure root balls with burlap, heavy twine and rope. Protect root balls against sudden changes in temperature and exposure to heavy rainfall.
 - .5 Tree spade dug material: dig plant material with mechanized digging equipment or hydraulic spade or clamshell type. Root balls to satisfy CNLA standards. Lift root ball from the hole, place in wire basket designed for purpose and lined with burlap. Replace root ball and tie basket to ball with heavy rope. Take care not to injure trunk of tree with wire basket or rope.
 - .6 Planting in clay soils: in planting locations with clay soils, use only plant material grown in clay. Excavate planting hole three times diameter of root ball at surface with taper to root ball diameter at bottom of planting hole. Place minimum 300 mm planting soil under root ball, and base of tree 150 mm above surrounding grade.

2.4 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative or Delegate (DR/D) of plant material at source prior to planting.
- .2 Imported plant material must be accompanied with necessary permits and import licenses and conform to federal and provincial regulations.
 - .1 Acceptable certification includes: **Grower's Certification** as to when the trees will be shipped directly from the grower's facility to the site.

- .3 The contractor shall notify Departmental Representative or Delegate (DR/D) a minimum of 48 hours prior to delivery.

PART 3 EXECUTION

3.1 PREPARATION OF PLANTING BEDS

- .1 Stake out or set out location of shrubs and groundcovers as per planting plan. Obtain approval from Departmental Representative or Delegate (DR/D) prior to excavating planting holes. Refer to section 32 94 12.

3.2 PLANTING TIME

- .1 When permission has been obtained, trees, shrubs and ground covers growing in containers may be planted throughout growing season.
- .2 Plant only under conditions that are conducive to health and physical conditions of plants.

3.3 PLANTING

- .1 Plant trees and shrubs vertically with roots placed straight out in hole. Adjust plant material to give best appearance in relation to structure, roads and walks.
- .2 Place plant material to depth equal to depth they were originally growing in nursery. Plant directly into existing soil found in planters.
- .3 With balled and burlapped root ball, loosen and remove ties and burlap, without disturbing root ball. With container stock, remove entire container without disturbing rootball. Non-bio-degradable wrapping must be removed. With fibre pots slit side and remove pot.
- .4 Remove entire wire basket taking care not to disturb rootball.
- .5 Tree Spade Excavated Material: Dig tree pit with same mechanical equipment as used to dig plant material. Ensure hole dug is upright. Place in hole a mixture of 40 L of planting soil and fertilizer mixed with water to soupy consistency.
- .6 During planting of bare-rooted stock, first shake excavated planting soil from pit among roots.
- .7 Tamp planting soil around root system in layers of 15 mm eliminating air voids. Frozen or saturated planting soil is unacceptable. When planting soil has been placed, fill hole with water. After water has completely penetrated soil, complete backfilling.
- .8 For shrub material build 150 mm deep saucer around outer edge of hole.
- .9 When planting is completed, give surface of planting saucer dressing of organic 10-6-4 fertilizer at rate of .12 kg/m² for shrub beds and 40 g/mm for trees. Mix fertilizer thoroughly with top layer of planting soil and water in well.
- .10 Plant bulbs in areas as indicted on drawings. Spacing at 150 mm - 200 mm. Maximum depth of 150 mm minimum to 200 mm maximum.

3.4 WRAPPING

- .1 Wrap deciduous trees, whose calliper is 50 mm to 150 mm, spirally up to height of second branches. Treat trunk with paste of long residual insecticide, lindane or equivalent before

applying wrapping. Secure burlap with binder twice wound in opposite direction to burlap at 100 mm intervals. Place wrapping neatly and snugly with 40 mm overlap.

3.5 PRUNING

- .1 Prune trees and shrubs after planting, to compensate for loss of roots suffered during transplanting. Employ clean, sharp tools; make cuts flush with main branch, smooth and sloping to prevent accumulation of water. Remove projecting stumps on trunk or main branches.
- .2 Remove dead, injured branches and branches that rub causing damage to bark.
- .3 Trim out crown of trees and shrubs without changing natural shape. Be careful not to damage lead branches or remove small twigs along main branches. Treat cuts in excess of 20 mm diameter, and/or damaged parts, with application of wound dressing.

3.6 MAINTENANCE

- .1 From time of acceptance by Departmental Representative or Delegate (DR/D) to end of warranty period, perform the following maintenance operations. Such maintenance shall include all measures necessary to establish and maintain vigorous growth, including but not necessarily limited to:
 - .1 Water trees and shrubs twice weekly for first (4) four weeks and then once weekly thereafter to obtain optimum growing conditions. Ensure adequate moisture in root zone at freeze-up.
 - .2 Keep soil, within confines of planting saucer around trees and planting beds, shallowly cultivated, free from weeds.
 - .3 Spray plants to combat pests and diseases. Do not use DDT or sprays prohibited by Agriculture Canada. Any herbicide/pesticide use is to be approved by Parks Canada and is discouraged.
 - .4 Keep tree stakes, wrapping, guy-wires, and rodent protection in proper repair.
 - .5 Provide adequate protection against winter damage including damage caused by rodents. Fertilize in spring and fall with appropriate fertilizers.
 - .6 Maintain plant material from date of acceptance up to end of warranty period.
 - .7 Remove trunk wrapping tree stakes and guy wires at end of warranty period.
 - .8 Contractor will not be held responsible for damage due to salt, snow removal, or vandalism.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

- .1 The Contractor shall provide maintenance and warranty of all plant material. The maintenance work of this section shall include watering, weeding, fertilizing, pruning and other incidental maintenance deemed necessary to ensure healthy plant material for a period of two years upon completion of planting. The warranty shall cover any defects in materials and workmanship. Any damage to existing turf areas, vegetation, hard surfaces, structures or services caused as a result of the Contractor's work methods and practices for plant material maintenance shall be reinstated or repaired to the satisfaction of the Consultant. The cost of such reinstatement or repair shall be solely at the Contractor's expense.

1.2 RELATED SECTIONS

- .1 Section 32 91 19.13 – Topsoil Placement and Grading
- .2 Section 32 93 10 – Trees, Shrubs and Groundcover Planting

1.3 REFERENCES

- .1 All methods of maintenance shall be in accordance with accepted horticultural / arboricultural practices and standards.

PART 2 MATERIALS

2.1 WATER

- .1 Water shall be free from any contaminants that could adversely affect plant growth.

2.2 FERTILIZER

- .1 Fertilizer shall be a complete commercial type. Formulation and application rate to be determined by soil tests. For estimating purposes, use 10-52-10 applied at a rate of:
 - 1. **0.9 kg** for each **25 mm** of tree caliper (water soluble). Deliver to site in fully labeled bags.

2.3 TOPSOIL

- .1 Any additional topsoil required shall originate from the same source as the initial approved product.

2.4 RODENT GUARDS

- .1 Rodent guards shall originate from the same source as the initial approved product.

2.5 MULCH

- .1 Mulch shall originate from the same source as the initial approved product.

2.6 CONIFEROUS TREE WRAP

- .1 Wrapping material for winter protection of coniferous trees shall be new burlap, at least 270 g/m² in weight supplied in 1.0 m wide or 1.5 m wide rolls.

PART 3 EQUIPMENT

3.1 PUMPS AND HOSES

- .1 Hoses used for watering plant material shall be capable of reaching the limits of the contract area. Pumps shall be under pressure. The outlet end of the hose(s) shall be 25 mm in diameter with a suitable adjustable nozzle(s) and a quick shut-off valve.

3.2 TANKS

- .1 Tanks used for storage or application of water shall be clean and free of any contaminants that may be hazardous to the growth and development of plant material or to the environment in general.

3.3 PRUNING TOOLS

- .1 All pruning equipment shall be designed specifically for tree work and shall be clean, sharp and in proper, safe, working order. Pruning equipment shall be capable of producing clean, flush cuts without tearing or fraying the bark.

PART 4 CONSTRUCTION

4.1 DURATION

- .1 All plant material shall be warranted for a period of two years from the date of SUBSTANTIAL COMPLETION of landscape works. The Contractor shall provide maintenance immediately after each portion of planting is completed and continue throughout the period of warranty to the satisfaction of the Consultant.”

4.2 OPERATIONAL CONSTRAINTS

- .1 The Contractor shall be responsible to obtain any permits or certificates for water usage. No maintenance equipment, materials or other miscellaneous items may be stored on site unless approved by the Consultant. All debris, waste and other extraneous material resulting from the maintenance operation shall be removed from the site daily upon completion of maintenance, unless otherwise directed or approved by the Consultant. The Contractor shall be fully acquainted with all relevant Provincial and Municipal By-laws relating to the work of this contract, and will be required to comply with such by-laws without extra compensation.

4.3 WATERING

- .1 During the first and second year of the warranty period, between May 15 and September 15 of each year, watering of all plants shall be carried out no less than twelve (12) times, in accordance with the pre-approved watering schedule provided by the Contractor.

- .2 The Contractor shall uniformly soak reforestation and shrub areas to a depth of 300 mm using a soft spray nozzle to avoid "packing" of soil and damage to vegetation. Each nursery stock tree (greater than 40 mm caliper or 1.20 m height) shall be watered in accordance with Table 1 and using one of the following watering methods.
 - .1 Water Injection Method: Each tree shall be watered by two injection applications directly into the soil. Both injections shall be located at the outer edge of the planting pit area and shall penetrate the ground to a depth of 450mm at the commencement of the watering operation. The second injection shall be located 180 degrees from the initial injection.
 - .2 Soak Method: The planting saucer of each tree shall be filled with water and the water allowed to percolate into the soil before being re-filled as many times as necessary to meet the volume requirements of Table 1.

TABLE 1: Water application rates for each tree:

Tree Caliper		Tree Height		Litres per Watering
40	- 70 mm	1.20	- 1.8 m	170
71	- 100 mm	1.81	- 2.50 m	230
101	- 125 mm	2.51	- 3.00 m	270
126	- 150 mm	3.01	- 3.50 m	360
151	- 200 mm	3.51	- 4.00 m	460

- .3 All coniferous trees shall be watered in late fall, just prior to freeze-up.
- .4 Water shall be applied so that the washing of the soil or dislodging of mulching or tree guards does not occur.
- .5 Damage shall be immediately repaired to the satisfaction of the Consultant at no additional cost.

4.4 FERTILIZING

- .1 Apply fertilizer at the same time or as part of a watering application. Apply fertilizer as recommended by soil analysis report, subject to adjustment by the Consultant.

4.5 MULCHING

- .1 In the autumn and spring of the warranty period the Contractor shall re-staple or replace plastic blankets or woodchip mulch to meet the specifications.

4.6 WEEDING

- .1 All weeds and grasses within saucers, beds and mulched areas around plant material shall be removed by hand. Weed whackers or whipper-snippers shall not be used to remove weeds in the vicinity of plant material. The application of herbicides shall not be permitted unless otherwise approved by the Consultant. Removed weeds and grasses shall be disposed of the Contract site. At a minimum, weeding shall occur at one month intervals, with the first operation occurring at the beginning of July and the final operation occurring in early October. All areas shall be weeded immediately prior to the final warranty inspection.

4.7 RODENT GUARDS

- .1 In the autumn and spring of each warranty year, the Contractor shall re-position or replace rodent guards to meet the specifications.

4.8 STAKES

- .1 In the autumn of the first warranty year, the Contractor shall ensure that all stakes are secure and functioning properly. Remove all stakes one year from the date of final acceptance of plant material, unless otherwise directed by the Consultant.

4.9 CONIFEROUS TREE WRAPPING

- .1 In the autumn of each warranty year, the Contractor shall wrap all coniferous trees greater than 600 mm in height. The entire needle area shall be completely covered with burlap wrap. Edges of the wrap shall be overlapped a minimum of 100 mm with the exposed edge folded back under and fastened with metal fasteners. After each tree is wrapped, the burlap will be securely fastened with nylon twine or wire to ensure that the wrapping does not unravel. All wrapped trees shall be unwrapped by the Contractor during the following spring, prior to bud break. All materials used to wrap and unwrap the trees shall be removed from the contract site.

4.10 REMOVAL OF SALT SPRAY

- .1 When natural spring precipitation (Apr 1 - 30) of each warranty year is less than 80 mm, the above ground parts of all plant material, within 10 m of the roadway edge upwind of prevailing winds and within 100 m of the roadway edge downwind of prevailing winds, shall be thoroughly sprayed with water to remove salt spray deposits prior to May 15. A soft spray nozzle shall be used. Precipitation data shall be as per Environment Canada from the Macdonald-Cartier Airport weather station.

4.11 INFESTATION

- .1 Monitor plant material throughout the warranty period for any sign of disease or insect problems. Ensure immediate treatment to control and repair damage. Cultural or non-toxic methods of control shall be given first priority. Do not use D.D.T. or other chemicals prohibited by Agriculture Canada. All chemicals must be approved by the Consultant prior to use. It is the Contractor's responsibility to inform the Consultant before applying any corrective actions.

PART 5 QUALITY ASSURANCE**5.1 QUALIFICATIONS OF WORKERS**

- .1 Contractor shall provide proof of a foreman with a minimum of five years' experience, competent and skilled in the work of this section to direct all of the work to be performed, and to be present at all times during the performance of the work. Acceptable forms of proof:
 - .1 ISA Certification as an arborist
 - .2 Diploma in horticulture from a recognized College
 - .3 Ontario Tradesman Certificate

- .4 An acceptable combination of education, training and experience (as determined by the Consultant)

5.2 INTERIM REPLACEMENT PLANT MATERIAL

- .1 Throughout the maintenance and warranty period, units of plant material that are found to be unacceptable will be replaced by the Contractor at the earliest opportunity. At the discretion of the Consultant, plant material that is identified as dead or in a poor or diseased condition shall be immediately removed from the site. All replacement plant material shall be as per the size indicated on the drawings. These sizes are the minimum allowable.

5.3 FINAL WARRANTY INSPECTION

- .1 A one-time inspection of all plant material shall be carried out by the Consultant upon completion of the maintenance and warranty period. Plant material shall be acceptable when it meets the quality requirements set out in the specifications for plant material. All planting pits, beds, and other areas worked by the Contractor shall be free of weeds and in good order, including the removal of all stakes. Plant material shall be unacceptable when it does not meet this quality standard. Units of plant material that are found to be unacceptable will be replaced by the Contractor at the earliest opportunity. The Consultant reserves the right to extend the Contractor's maintenance and warranty responsibilities for an additional one-year for replacement plant material. In the event that this inspection is satisfactory to the Consultant, and that there are no outstanding commitments to the contracted works, the Contractor will be given final approval of the maintenance and warranty requirements.

PART 6 SCOPE OF MAINTENANCE

6.1 PLANT MATERIAL MAINTENANCE

- .1 Where maintenance and replacement of plant material is required during the warranty period, all such costs will be the responsibility of the contractor. No additional costs will be borne by the Owner.
- .2 Maintenance of plant material will be reviewed at the following times:
 - .1 **31 October** (end of first fall maintenance period)
 - .2 **31 October** (end of second fall maintenance period)
 - .3 **01 June** (end of second spring maintenance period and of warranty)
- .3 Where, in the opinion of the Consultant, the Contractor has failed to complete obligations as detailed in this Specification; and further, fails to rectify said deficiency within two days of written notification from the Consultant, the Owner reserves the right to complete the work and deduct incurred expenses from monies owing to the Contractor.

END OF SECTION

UTILITIES
DIVISION 33

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Modular precast concrete manhole sections with tongue-and-groove joints covers, anchorage, and accessories.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 – Quality Control.
- .3 Section 01 74 00 – Cleaning and Waste Processing.
- .4 Section 31 23 16 – Excavating.
- .5 Section 31 23 17 – Rock Removal
- .6 Section 31 23 18 – Trenching.
- .7 Section 32 11 23 – Aggregate Base Courses.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A48/A48M-03(2012) - Standard Specification for Gray Iron Castings.
 - .2 ASTM A123/A123M-2012, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM C478M-13, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
 - .4 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m³)).
- .2 Ontario Provincial Standard Drawings (OPSD)
 - .1 OPSD 701.010 (November 2014, Rev. 5) – Precast Concrete Maintenance Hole, 1200 mm Diameter.
 - .2 OPSD 704.010 (November 2014, Rev. 3) – Precast Concrete Adjustment Units For Maintenance Holes, Catch Basins, And Valve Chambers.
 - .3 OPSD 704.011 (November 2008, Rev. 1) – High Density Polyethylene Adjustment Units For Maintenance Holes, Catch Basins, And Valve Chambers.
 - .4 OPSD 401.010 (November 2013 Rev. 3) – Cast Iron, Square Frame With Circular Closed Or Open Cover For Maintenance Holes.
- .3 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 407 (November 2015) - Construction Specification For Maintenance Hole, Catch Basin, Ditch Inlet And Valve Chamber Installation.
- .4 CSA Group
 - .1 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

- .2 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.4 PRICE AND PAYMENT PROCEDURES

- .1 Manhole: By the unit. Includes excavating, concrete base pad, concrete manhole sections, cover frame and cover, to indicated depth, forming and sealing pipe inlets and outlets.

1.5 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 maintenance holes and catch basin structures and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.6 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 - Quality Control.
- .2 Certifications:
 - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Precast maintenance hole units to ASTM C478 and OPSD 701.010.
- .2 Joints: made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.
- .3 Mortar:
 - .1 Masonry Cement: to CAN/CSA-A3002.
- .4 Ladder rungs to CSA G30.18, No.25M billet steel deformed bars, hot dipped galvanized to ASTM A123/A123M.
 - .1 Rungs to be safety pattern (drop step type).

- .5 Adjusting rings to ASTM C478 and OPSD 704.010 or 704.011.
- .6 Frames, gratings, covers to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames.
 - .1 Frame with grating or cover to constitute one unit.
 - .2 Assemble and mark unit components before shipment.
 - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
 - .3 Castings coated with two applications of asphalt varnish.
 - .4 Maintenance hole frame and cover to OPSD 401.010, Type 'A'.
- .7 Granular bedding: Granular base material in accordance with Section 32 11 23 – Aggregate Base Courses.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for maintenance holes and catch basin structures installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 EXCAVATION AND BACKFILL

- .1 Excavate in accordance with Section 31 23 16 - Excavating and as indicated.
- .2 Backfill in accordance with Section 31 23 18 - Trenching and as indicated.

3.3 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade, in accordance with OPSS 407. Maximum relative difference between specified invert elevations not to exceed 10 mm
- .2 Complete units as pipe laying progresses.
 - .1 Maximum of three units behind point of pipe laying will be allowed.
- .3 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% maximum density to ASTM D698.
- .4 Precast units:
 - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.
 - .2 Make each successive joint watertight with Departmental Representative's approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.

- .3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
- .4 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
- .5 Compact granular backfill to 95% maximum density to ASTM D698.
- .6 Place unshrinkable backfill in accordance with Section 31 23 18 - Trenching.
- .7 Installing units in existing systems:
 - .1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
 - .2 Make joints watertight between new unit and existing pipe.
 - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.
- .8 Place frame and cover on top section to elevation as indicated.
 - .1 If adjustment required use concrete ring.
- .9 Clean units of debris and foreign materials.
 - .1 Remove fins and sharp projections.
 - .2 Prevent debris from entering system.
- .10 Install safety platforms in maintenance holes having depth of 5 m or greater, as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Leakage Test:
 - .1 Install watertight plugs or seals on inlets and outlets of each new sanitary sewer maintenance hole and fill maintenance hole with water.
 - .2 Leakage not to exceed 0.3% per hour of volume of maintenance hole.
 - .3 If permissible leakage is exceeded, correct defects.
 - .4 Repeat until approved by Departmental Representative.
 - .5 Departmental Representative will issue Test Certificate for each maintenance hole passing test.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.
 - .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 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 General**1.1 GENERAL**

- .1 The contractor shall provide all materials, equipment and labor necessary to install, test and place into service replacements of the two main pumps as shown in the plans and described in this specification. The pumps shall including internal piping modification, accessories and auxiliary equipment required.

1.2 REQUIREMENTS

- .1 Furnish and install 2 progressive cavity wastewater pump(s). Each pump shall be connected for operation on a 600 volt, 3 phase, 60 hertz, three-wire service. The power cable shall be sized according to CEC and CSA standards.

Part 2 Products**2.1 PUMPS**

- .1 General
 - .1 The Moyno 2000 Pump is a progressing cavity pump. A single helical rotor rolling eccentrically in the double helix of the stator creates the pumping action. The rotor in conjunction with the stator forms a series of sealed cavities 180 degrees apart. As the rotor turns, the cavities progress from the suction to the discharge. As one cavity diminishes, the opposing cavity increases at exactly the same rate. Thus the sum of the two discharges is a constant volume. The result is a pulsation-free positive displacement flow utilizing no valves.
- .2 Pump Model
 - .1 Pumps shall be replaced with Moyno 2F036G1 CDQ 3SAA. Model to be verified with manufacturer prior to ordering.
- .3 Miscellaneous
 - .1 Modification to internal piping will be require to accommodate the modified pump body dimensions. Supply all required fittings and accessories accordingly.

Part 3 Execution**3.1 INSTALLATION**

- .1 Install pumps as per Manufacturers recommendation.

3.2 TESTING

- .1 Standard Pump Factory Test
 - .1 Each completed and assembled pump/motor unit shall undergo the following factory tests at the manufacturer's plant prior to shipment:
 - .1 Minimum 3-point hydraulic performance test

- .2 No-Leak seal integrity test
 - .3 Electrical integrity test
- .2 Field Start-up
- .1 After installation, a pump station start-up shall be performed by the installing contractor under the supervision of the manufacturer's authorized representative. One (1) day of field service shall be provided by an authorized, factory trained representative of the pump manufacturer. Services shall include, but not be limited to, inspection of the completed pump station installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, supervision of all field-testing and activation of the Pump Manufacturer's Warranty. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load amperage rating of the motor. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

3.3 WARRANTY

- .1 Station Warranty
 - .1 The Pump Manufacturer shall Warrant to the Owner the pump components against defects in material and workmanship for a period of one (1) year from date of start-up or 18 months from date of shipment, whichever is sooner. This warranty shall cover the cost of labor and materials, excluding removal and reinstallation costs, required to correct any warrantable defect, FOB, Manufacturer's authorized warranty service location.
- .2 Pump & Control Warranty
 - .1 Manufacturer's standard warranty covers the pump and control system.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Adjustments of existing manholes and catch basins.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 – Quality Control.
- .3 Section 01 74 00 – Cleaning and Waste Processing.
- .4 Section 33 05 13 – Manholes and Catch Basins.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Adjustment of Manholes and Catch Basins: Measured by the numbers adjusted.

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A123/A123M-2012, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM C478M-13, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
- .2 Ontario Provincial Standard Drawings (OPSD)
 - .1 OPSD 701.010 (November 2014, Rev. 5) – Precast Concrete Maintenance Hole, 1200 mm Diameter.
 - .2 OPSD 704.010 (November 2014, Rev. 3) – Precast Concrete Adjustment Units For Maintenance Holes, Catch Basins, And Valve Chambers.
 - .3 OPSD 704.011 (November 2008, Rev. 1) – High Density Polyethylene Adjustment Units For Maintenance Holes, Catch Basins, And Valve Chambers.
- .3 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 408 (November 2015) - Construction Specification For Adjusting Or Rebuilding Maintenance Holes, Catch Basins, Ditch Inlets, And Valve Chambers.
- .4 CSA Group
 - .1 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .2 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.5 SUBMITTALS

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

1.6 QUALITY ASSURANCE

- .1 Perform Work to OPSS 408.
- .2 Submit in accordance with Section 01 45 00 - Quality Control.
- .3 Certifications:
 - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Precast maintenance hole units to ASTM C478 and OPSD 701.010
- .2 Mortar:
 - .1 Masonry Cement: to CAN/CSA-A3002.
- .3 Ladder rungs to CSA G30.18, No.25M billet steel deformed bars, hot dipped galvanized to ASTM A123/A123M.
- .4 Adjusting rings to ASTM C478 and OPSD 704.010 or 704.011.

PART 3 EXECUTION**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Inform Departmental Representative of any unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANHOLES AND CATCH BASINS

- .1 Remove existing grating, frames, and store for re-use at location designated by Departmental Representative.
- .2 Sectional units:
 - .1 Raise or lower straight walled sectional units by adding or removing precast sections as required.
 - .2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.
 - .3 When amount of raise is less than 600 mm use standard maintenance hole brick, modoloc or grade rings.
- .3 Install additional ladder rungs in manholes as required.

3.3 FIELD QUALITY CONTROL

- .1 Conduct a field inspection in accordance with Section 01 45 00 – Quality Control.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.
 - .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 00 – Cleaning and Waste Processing.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Sanitary sewerage drainage piping, fittings, accessories, and bedding.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 00 – Cleaning and Waste Processing.
- .3 Section 31 23 16 – Excavating.
- .4 Section 31 23 17 – Rock Removal.
- .5 Section 31 23 18 – Trenching (Excavating & Backfilling).
- .6 Section 32 11 23 – Aggregate Base Courses.
- .7 Section 33 34 01 – Abandonment.

1.3 MEASUREMENT AND PAYMENT

- .1 Measure excavation under Section 31 23 16 - Excavating.
- .2 Measure backfill under Section 31 23 18 – Trenching.
- .3 Measure flowable fill under Section 33 34 01 – Abandonment.
- .4 Measure supply and installation of sanitary sewer including testing and including excavation and backfilling and granular bedding and surround horizontally from manhole face to manhole face in metres of each size pipe and depth class installed.
- .5 Measure granular bedding and surround in cubic metres compacted in place.

1.4 REFERENCES

- .1 ASTM International
 - .1 ASTM C12-09, Standard Practice for Installing Vitrified Clay Pipe Lines.
 - .2 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft⁴-lbf/ft³ (600 kN-m/m³)).
 - .3 ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .2 CSA International
 - .1 CSA A3000-08, Cementitious Materials Compendium.
 - .2 CSA B1800-[11], Thermoplastic Non-pressure Pipe Compendium.
 - .1 CSA B182.11-11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .3 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 409 (November 2013) Construction Specification for Closed-Circuit Television (CCTV) Inspection of Pipelines.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction. Provide temporary measures to keep the sanitary system functional during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
- .3 Notify Department Representative and building 24 hours minimum in advance of any interruption in service.

1.6 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 pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate on drawings proposed method for installing carrier pipe for under crossings.
- .4 Samples:
 - .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.
- .5 Certificates:
 - .1 Certification to be marked on pipe.
- .6 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.

1.7 SUBMITTALS FOR REVIEW

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 PLASTIC PIPE

- .1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034.
 - .1 Standard Dimensional Ratio (SDR): 35.
 - .2 Locked-in gasket and integral bell system.
 - .3 Nominal lengths: 4 m.

2.2 CEMENT MORTAR

- .1 Portland cement: to CSA A3000, normal type 10.
- .2 Mix mortar 1 part by volume of cement to two parts of clean, sharp sand mixed dry.
 - .1 Add only sufficient water after mixing to give optimum consistency for placement.
 - .2 Do not use additives.

2.3 BEDDING MATERIALS

- .1 Granular material to Section 32 11 23 - Aggregate Base Courses.

2.4 BACKFILL MATERIAL

- .1 Backfill material to Section 31 23 18 - Trenching.

2.5 FLOWABLE FILL REQUIREMENTS

- .1 Flowable fill in accordance with Section 33 34 01 – Abandonment.

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 sewer pipe installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.
- .3 Clean and dry pipes and fittings before installation.
- .4 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

3.3 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 18 - Trenching.
- .2 Protect trench from contents of sewer or sewer connection.
- .3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .1 Do not use blocks when bedding pipe.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.5 INSTALLATION

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .2 Handle pipe using methods approved by pipe manufacturer.
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
 - .1 Maximum allowable variation from indicated pipe invert elevations as measured at the maintenance holes not to exceed 10mm.
 - .2 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

- .5 Joint deflection permitted within limits recommended by pipe manufacturer.
- .6 Water to flow through pipe during construction, only as permitted by Departmental Representative.
- .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Install plastic pipe and fittings in accordance with CSA B182.11.
- .9 Pipe jointing:
 - .1 Install gaskets in accordance with manufacturer's written recommendations.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage.
 - .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
 - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.
- .11 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.
- .12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .13 Make watertight connections to manholes.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .14 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

3.6 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
 - .1 Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

- .1 Do not dump material within 1 m of pipe.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to underside of backfill to at least 95% maximum density to ASTM D698.
- .6 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.7 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698.

3.8 ABANDONMENT OF SANITARY SEWERS AND MAINTENANCE HOLES

- .1 Abandonment in accordance with Section 33 34 01 – Abandonment.

3.9 FIELD TESTING

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
- .5 Repair visible leaks regardless of test results.
- .6 Television and photographic inspections:
 - .1 Carry out Closed Circuit Television (CCTV) inspection of all new sanitary sewers, in accordance with OPSS 409. Three copies of the CCTV tapes and reports shall be submitted to the Departmental Representative.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.
 - .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 00 – Cleaning and Waste Processing.

END OF SECTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

Sanitary sewerage drainage forcemains, fittings, accessories, and bedding.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 00 – Cleaning and Waste Processing.
- .3 Section 31 23 17 – Rock Removal.
- .4 Section 31 23 18 – Trenching (Excavating & Backfilling).
- .5 Section 32 11 23 – Aggregate Base Courses.
- .6 Section 33 34 01 – Abandonment.

1.3 MEASUREMENT AND PAYMENT

- .1 Measure trenching and backfilling under Section 31 23 18 – Trenching.
- .2 Measure flowable fill under Section 33 34 01 – Abandonment.
- .3 Measure, supply, and installation of sewage force main including excavating and backfilling and granular bedding and surround in metres of each type and size of pipe installed.
- .4 Measurement will be made of actual length in place, through valves and fittings, after work has been completed.
- .5 Measure granular bedding and surround material in cubic metres compacted in place.
- .6 Measure concrete thrust blocks in units in place.

1.4 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C111/A21.11-06, Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .2 ANSI/AWWA C600-10, Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
- .2 ASTM International
 - .1 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft³) (600kN-m/m³)).
 - .2 ASTM D2241-09, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction. Provide temporary measures to keep the sanitary system functional during construction. Maintain the forcemain at all times during construction.

- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
- .3 Notify Department Representative and building 24 hours minimum in advance of any interruption in service.

1.6 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 pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Submit shop drawings showing proposed method of installation for sewage force main in undercrossing.
- .4 Samples:
 - .1 Submit 4 weeks minimum before beginning Work, with proposed source of bedding materials and provide access for sampling.
- .5 Certification to be marked on pipe.
- .6 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- .7 Manufacturer's Instructions: submit to Departmental Representative one copy of manufacturer's installation instructions.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Polyvinyl chloride (PVC) pipe: to ASTM D2241.
 - .1 SDR 26.
 - .2 Pressure Class: 1 MPa.

- .3 Gasket bell end.
- .4 Pipe joints: bell and spigot with rubber gaskets solvent welded joints or mechanical joints to ANSI/AWWA C111/A21.11, with transition gaskets to pipe manufacturer's specifications.
- .5 Rubber gaskets: to ANSI/AWWA C111/A21.11. Gaskets for mechanical joints to be duck-tipped transition gaskets for PVC.

2.2 PIPE BEDDING AND SURROUND MATERIALS

- .1 Granular material to Section 32 11 23 - Aggregate Base Courses

2.3 BACKFILL MATERIAL

- .1 Backfill in accordance with Section 31 23 18 – Trenching.

2.4 FLOWABLE FILL REQUIREMENTS

- .1 Flowable fill in accordance with Section 33 34 01 – Abandonment.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe 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.
- .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Pipes and fittings to be clean and dry.
- .3 Prior to installation, obtain Departmental Representative's approval of pipes and fittings.

3.3 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 18 – Trenching.
- .2 Trench alignment and depth require approval from Departmental Representative prior to placing bedding material or pipe.

3.4 GRANULAR BEDDING

- .1 Place granular bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.
- .6 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.5 INSTALLATION

- .1 Lay pipes in accordance with manufacturer's recommendations.
- .2 Join pipes in accordance with manufacturer's recommendations.
- .3 Avoid damage to machined ends of pipes in handling and moving pipe.
- .4 Maintain grade and alignment of pipes.
- .5 Align pipes carefully before jointing.
- .6 Joint deflection permitted within limits in accordance with pipe manufacturer's written recommendations.
- .7 Support pipe firmly over entire length, except for clearance necessary at couplings.
 - .1 Do not use blocks to support pipe.
- .8 Keep pipe and pipe joints free from foreign material.
- .9 Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Remove disturbed gaskets clean, lubricate and replace before jointing is attempted.
- .10 Support pipes using hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .11 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.
- .12 Apply restraint to pipe to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by Departmental Representative.
- .13 When stoppage of Work occurs, block pipe as directed by Departmental Representative to prevent creep during downtime.

3.6 THRUST BLOCKS

- .1 Restrain bends, tees and fittings using concrete thrust blocks as indicated.
- .2 Keep pipe couplings free of concrete.
- .3 Bearing area of thrust blocks to be as indicated.

3.7 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 1 m of pipe.
- .4 Compact each layer from pipe invert to underside of backfill to at least 95% maximum density to ASTM D698.
- .5 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.8 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Compact backfill to at least 95% maximum density to ASTM D698.

3.9 ABANDONMENT OF FORCEMAINS

- .1 Abandonment in accordance with Section 33 34 01 – Abandonment.

3.10 FIELD TESTING OF FORCE MAIN

- .1 Testing of force main to be carried out in presence of Departmental Representative.
- .2 Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.
- .3 Expel air from force main, by slowly filling main with water.
 - .1 Drill and tap high points and install suitable cocks to vent air and to be shut when pressure is applied.
 - .2 Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.
- .4 Apply hydrostatic test pressure of 1035 kPa based on elevation of lowest point in line and corrected to elevation of test gauge for hydrostatic test and 862 kPa for leakage test.
- .5 Apply pressure for 1 hour for pressure test and 2 hours for leakage test.
- .6 Examine exposed pipe, joints and fittings while system is under pressure.
- .7 Remove defective joints, pipe and fittings and replace with new sound material.

- .8 Define leakage as amount of water supplied from meter in order to maintain test pressure for 2 hours.
- .9 Do not exceed allowable leakage as defined in OPSS 412.
- .10 Locate and repair defects if leakage is greater than amount specified.
- .11 Repeat test until leakage is within specified allowance for full length of force main.
- .12 Complete backfill.
- .13 Repeat test after completing backfill. Locate and repair defects and backfill. Repeat tests, repairs and backfills as needed until leakage is less than amount specified.
- .14 Testing must be completed prior to asphalt paving. No road cut patches will be permitted.

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.
 - .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 00 – Cleaning and Waste Processing.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

Flowable fill requirements, abandonment of sanitary sewers and maintenance holes, abandonment of forcemains.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 00 – Cleaning and Waste Processing.
- .3 Section 31 23 18 – Trenching (Excavating & Backfilling).

1.3 MEASUREMENT AND PAYMENT

- .1 When specified separately in the schedule of prices, measurement for payment shall be cubic meters (m³) of all fill materials described as placed in the field.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction. Provide temporary measures to keep the sanitary system functional during construction. Maintain the forcemain at all times during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
- .3 Notify Department Representative and building 24 hours minimum in advance of any interruption in service.
- .4 Ensure that all pipes are empty of raw sewage prior to removal and abandonment.
- .5 A sewage spill plan must be provided to parks Canada and approved prior to any sewage lines being removed.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:
 - .1 Submit 4 weeks minimum before beginning Work, with proposed source of materials and provide access for sampling.
- .3 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- .4 Manufacturer's Instructions: submit to Departmental Representative one copy of manufacturer's installation instructions.

1.6 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 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 FLOWABLE FILL REQUIREMENTS

- .1 Unconfined compressive strength: minimum 0.5 mPa and maximum 1 mPa at 56 days as determined based on an average of three tests for same placement. Present at least three acceptable strength tests for proposed mix design in mix design report.
- .2 Placement characteristics: self-leveling.
- .3 Shrinkage characteristics: non-shrink.

PART 3 EXECUTION

3.1 ABANDONMENT OF SANITARY SEWERS AND MAINTENANCE HOLES

- .1 All existing sewers to be abandoned may be excavated and removed with the approval of the Contract Administer. The trench left by the removal of pipe shall be backfilled with materials in accordance with Section 31 23 18 – Trenching.
- .2 All sewers to be abandoned and left in place as part of the construction shall have their openings for services plugged. The entire volume of the pipe and any attach service leads shall be completely filled with flowable fill from the invert to the obvert over their entire length.
- .3 All existing maintenance holes and catch basins to be abandoned are to be removed to a minimum of 2.4 metres below the final surface elevations. The remainder of the maintenance hole from the bottom to the top of the subgrade level shall be filled with flowable fill or other material in accordance with Section 31 23 18 – Trenching.

3.2 ABANDONMENT OF FORCEMAINS

- .1 Do not begin cut, plug, and abandonment operations until replacement force main has been constructed and tested, and all service connections have been installed.
- .2 Install plug, clamp, and concrete reaction block and make cut at required location.
- .3 Main to be abandoned shall not be valved off and shall not be cut or plugged.
- .4 Plug or cap ends or openings in abandoned force main in manner approved by Departmental Representative.
- .5 Remove surface identifications and appurtenances such as valve boxes.
- .6 Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that will not distort or imperil portion of work, new or existing.

- .7 Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 150 meters in length.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.
 - .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 00 – Cleaning and Waste Processing.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Corrugated Steel Pipe Culverts:

1.2 RELATED SECTIONS

- .1 Section 31 23 16 – Excavating.
- .2 Section 31 23 18 – Trenching (Excavating & Backfilling)

1.3 REFERENCES

- .1 CAN/CSA-G401-07 (R2013) - Corrugated Steel Pipe Products.
- .2 CSPI (Corrugated Steel Pipe Institute).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate the Work of this section and directly related sections, with installation of surrounding opening.

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submittal procedures.
- .2 Product Data: Provide data on pipe product and connecting accessories.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal procedures.
- .2 Test Reports: Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.
- .3 Installation Data: Manufacturer's special installation requirements.
- .4 Sustainable Design:
 - .1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 10: Closeout Submittals

1.8 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Perform Work to CAN/CSA-G401.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Armtec Inc.; Product: Corrugated Steel Pipe – Aluminized Steel Type 2.
- .2 Other acceptable manufacturers offering functionally and aesthetically equivalent products.

2.2 CORRUGATED STEEL PIPE

- .1 Corrugated Steel Pipe: CAN/CSA-G401.
 - .1 Culvert Couplers: Standard annular corrugated coupler.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 02 41 13 Site work Demolition & Removals: Verify existing conditions before starting work.
- .2 Verify dimensions, tolerances, and method of attachment with other work.

3.2 TRENCHING AND BACKFILL

- .1 Perform trenching and backfill work.
- .2 Obtain Departmental Representative or Delegate (DR/D) approval for trench line and depth, prior to placing bedding material or pipe.
- .3 Do not backfill until pipe grade and alignment checked and accepted by Departmental Representative or Delegate (DR/D).

3.3 BEDDING

- .1 Place minimum thickness of 200 mm of granular material on bottom of excavation. Compact to minimum of 95% Standard Proctor optimum density.
- .2 Shape bedding to fit lower segment of pipe exterior so that a width of at least 50% of pipe diameter is in close contact with bedding.
- .3 Set camber as indicated or directed, free from sags or high points.

3.4 LAYING CORRUGATED STEEL PIPE CULVERTS

- .1 Commence pipe placing at downstream end.
- .2 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .3 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .4 Place pipe surround material in maximum 150 mm lifts. Compact to minimum density of 95% Standard Proctor density.
- .5 Compact fill material adjacent to haunch of pipe using a hand tamper or a small diameter mechanical tamper.
- .6 Do not allow water to flow through pipe during construction.

3.5 JOINTS FOR CORRUGATED CULVERTS

- .1 Corrugated steel pipe:
 - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .2 Tap couplers firmly as they are tightened, take up slack to ensure snug fit.
 - .3 Insert and tighten bolts.

END OF SECTION

APPENDIX 'A'
BEST MANAGEMENT PRACTICES



Parks Canada
Parcs Canada

Parks Canada National Best Management Practices

Roadway, Highway, Parkway and Related Infrastructure

Canada



Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure

Approved by

Original signed by Mike Wong

Mike Wong, Executive Director Natural Resource Conservation Branch

Original signed by Calvin Mercer

Calvin Mercer, Associate Vice-President Asset Management and Project Delivery

July 23, 2015

Date



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Introduction

The Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure will allow an identified suite of project activities to be undertaken in such a manner that there will not be resulting significant adverse environmental effects.

The Best Management Practice (BMP) pathway is applied when there is a suite of routine, repetitive projects (e.g. paving) or activities (e.g. de-watering), with well understood and predictable effects. This fulfils Park's Canada's obligations under the *Canadian Environmental Assessment Act 2012* as a manager of federal land, see the [Guide to the Parks Canada EIA Process](#). The BMP maximizes efficiency through creation of a pre-approved impact assessment for the defined suite of projects, to which standard mitigation and environmental management measures can be applied.

The impact assessment officer (IAO) will review a proposed project and advise the functional manager of the project if and how this BMP should be applied. The IAO's advice will be based on whether the project falls within the scope of the BMP, and whether application of the mitigation measures in the BMP will adequately address potential adverse effects of the project.

Project Managers are responsible to ensure all mitigation measures applicable to the project are added to the terms and conditions of any permits or contracts issued for the project.

The Impact Assessment Officers must ensure the project, EIA pathway applied and determination are recorded in the Parks Canada National Impact Environmental Assessment [Tracking System](#).

Scope of Application

This BMP outlines the impact assessment of repetitive and routine projects on roadways, highways and parkways. If a project involves some or all of below activities, and the initial assessment of site and project indicate "the project is unlikely to result in significant adverse environmental effects" the BMP can be applied. Projects that this BMP would likely be applied to include:

- The proposed maintenance or repair of an **existing** sidewalk, or parking lot.
- The proposed maintenance or repair of an **existing** road, including pull-off areas, that would be carried out on the existing right of way¹.

Activities included in the scope of this BMP are:

1. Project Design
2. General Activities
 - Worksite Conditions/Staging/Laydown
 - Equipment operations
 - Fuel storage and refueling

¹ Highway Footprint or Right of Way (ROW): The permanent physical intrusion of a highway or freeway, including the road surface, shoulders, side slopes, drainage ditches and/or storm drainage ponds (Transport Canada, 2008).



- Site Clean Up/Waste Disposal
3. Asphalt Production and Handling
 - Asphalt Plant Operation
 - Gravel Crushing and Washing
 - Oiling of Truck Boxes
 - Clean Up and Disposal of Waste Products
 4. Concrete Handling
 - Operation, maintenance and inspection of Onsite Temporary Concrete Washout Facility
 - Removal of Temporary Concrete Washout Facilities
 - Onsite concrete management
 5. Paving, Resurfacing and Grading
 - Grading
 - Paving and Resurfacing
 - Pavement Marking and Barrier and Guardrail Reinstatement
 6. Barriers and Guardrails
 - Repair, replacement and upgrades of barriers and guardrails
 7. Vegetation Removal
 - Vegetation Removal
 - Grubbing
 - Brushing
 - Disposal of Vegetation Debris
 - Integrated Pest Management
 8. Excavation, Soil Stripping and Overburden Removal
 - Excavation
 - Soil Stripping
 - Topsoil Salvage
 - Excavated Material Storage
 - Excess Material and Waste (overburden removal)
 9. Slope Stabilization, Drilling and Blasting
 - Slope stabilization-scaling, hydraulic hammers
 - Drilling and blasting for Slope Stabilization and Geotechnical Investigations
 10. Soil and Vegetation Restoration
 - Topsoil Replacement
 - Soil Amendments
 - Seedbed Preparation
 - Species Selection
 - Seed Lot Selection
 - Seed Mixture Composition
 - Seeding
 - Alternatives to Seeding
 - Reclamation Standards
 - Reclamation Plot Evaluation
 - Time Limits



10. Drainage Structures
 - Drainage structures
 - Culverts
11. Bridge Maintenance
 - Bridge Cleaning
 - Bridge Repairs Using Treated Wood Products
 - Bridge and Structure Painting
12. Water Withdrawal and Dewatering
 - Water Withdrawal
 - Pump Screens
 - Dewatering

Exceptions

This BMP is not suitable for the following project activities as they would require supplemental assessment and/or mitigations:

- Work that may impact aquatic or terrestrial wildlife habitat connectivity, such as fences or culverts;
- Elongation of culverts; realigning water courses; dredging; or work below the high water mark of a fish bearing water body;
- Bridge projects needing work to occur below the High-Water Mark¹, with permanent alteration to the water course, such as replacement of piers/abutments or permanent installation of structures on the bed of a water body;
- Greater than 10% increase in land use footprint (e.g. gravel pit expansion); and,
- Work which might adversely impact any potential or established Aboriginal and Treaty rights or traditional use².

If the project has the potential to have an adverse effect on the critical habitat of a species at risk (with endangered, threatened, or extirpated status) this BMP does NOT apply. The project will require a separate environmental impact analysis.

If the project has the potential for residual adverse effects on a listed species at risk (including effects to individuals and residence of the individuals) this BMP does NOT apply, the project will require a separate environmental impact analysis.

Note: If there is any uncertainty regarding potential adverse effects to species at risk, consult a member of the [National Office Species Conservation team](#).

¹ High-water Mark is the usual or average level to which a body of water rises at its highest point and remains for a sufficient time so as to leave a mark on the land. (Fisheries and Oceans, 2015). Upper Controlled Water Elevation (UCWE) is used as definition of High-water Mark in managed waterways.

² Parks Canada must engage in additional and separate consultations with Aboriginal groups if there is a possibility of a project adversely affecting established or potential Aboriginal or Treaty rights. This is required to fulfill federal government responsibilities in upholding the honour of the crown. If there is uncertainty regarding the need for Aboriginal consultation with respect to a project, refer the matter to Parks Canada Legal Services for advice. Guidance on consultation may be sought from the [Aboriginal Affairs Secretariat](#) and from the guidance document "[A Handbook for Parks Canada Employees on Consultation with Aboriginal Peoples](#)".



Approved geographic area of application

This BMP is intended for use in all Parks Canada administered protected heritage places with roadways, highways and parkways.

Components of the environment that may be affected

Potential effects from projects of this type are well understood and predictable. They include:

Water Resources:

- Adverse modifications to surface drainage patterns
- Reduced water quality due to increased erosion, sedimentation, transportation of debris and contamination (i.e. from leaks and accidental spills, etc.)

Soil/Land Resources:

- Change in slopes, landforms, and landscape
- Soil compaction and rutting
- Slope instability, due to increased soil exposure and improper excavation and storage
- Soil contamination

Air quality:

- Decreased ambient air quality (i.e. from dust, equipment emissions, etc.)
- Increased ambient noise levels
- Temporary increased levels of CO₂ and other pollutants
- Temporary increased localized temperatures from paving and equipment operation.

Flora and Fauna:

- Damage to and/or removal of vegetation in immediate or adjacent areas
- Introduction of non-native species populations, or expansion of existing populations
- Wildlife sensory disturbance causing displacement/preferred habitat avoidance
- Wildlife habituation/attraction to artificial food sources
- Impeded/altered wildlife movement
- Damage to nests/disruption of nesting animals
- Mortality from project activities

Cultural Resources:



- Adverse effects on the heritage value or character-defining elements of a cultural resource
- Impacts to archaeological resources (known or potential)

Mitigation Measures

To use the document efficiently, keep the activity mitigation lists that apply to the project expanded and collapse the other activities by clicking on the section titles, print this as a pdf or paper document and include with the EIA determination record. This will reduce the overall size and scope of the mitigations to present to contractors and project managers.

Choose all that apply to project. Each title is hyperlinked to the related section.

Module

1.	Project Design
2.	General Activities
3.	Asphalt Production and Handling
4.	Concrete Handling
5.	Paving, Resurfacing, Grading
6.	Barriers and Guardrails
7.	Vegetation Removal
8.	Excavations, Soil Stripping and Overburden Removal
9.	Slope Stabilization, Drilling and Blasting
10.	Soil and Vegetation Restoration
11.	Drainage Structures
12.	Bridge Maintenance
13.	Water Withdrawal and Dewatering



1. Project Design

When upgrades to infrastructure are planned opportunities to decrease the environmental impacts of long term operation should be considered in the engineering design. Some examples are: directing runoff into vegetated areas rather than directly into surface waters to decrease pollution in surface waters, increasing the span length of bridges during replacements to allow for terrestrial wildlife passage underneath and converting smaller culverts to larger culverts or clear span bridges to allow for better fish passage and less restricted flows.

2. General Activities Mitigations Module

Construction activities involve the use of laydown/staging areas, equipment operations, storage and handling of hazardous materials. Potential adverse effects include: destruction of vegetation, erosion and sedimentation, constriction for wildlife movements and introduction/spread of non-native vegetation.

Work Site Conditions/Staging/Laydown

- 2.1. All employees must attend a briefing with an Impact Assessment Officer (IAO) or Surveillance Officer (SO) before beginning work at the site review and explain the mitigations that are conditions of the project approvals.
- 2.2. Minimize vegetation-clearing activities and ground disturbance by staging on existing hardened areas wherever possible.
- 2.3. Avoid or terminate activities on site that attract or disturb wildlife. Vacate the area and stay away from the immediate location if wildlife display aggressive behaviour or persistent intrusion.
- 2.4. Control materials that might attract wildlife (e.g. petroleum products, human food and garbage).
- 2.5. Notify the SO immediately about dens, litters, nests, carcasses (road kills), wildlife activity or encounters on or around the site or crew accommodation. Other wildlife-related encounters are to be reported to SO within 24 hours.
- 2.6. Delineate the work zone; clearly mark the limits to active construction and the access and egress locations.
- 2.7. When work involves the disturbance of soils or the use of erodible materials (e.g. sands, topsoil), prevent the transport of sediment by the installing of appropriate erosion and sediment control.
- 2.8. An Erosion and Sedimentation Management Plan shall be prepared for the components of the work undertaken in proximity to watercourses, wetlands or riparian environments. If sediment ponds are required, they shall be designed to settle all sediment particles 0.02 mm or larger. The ponds shall also be designed to handle 1:5 year storm events, with overflow spill capacity for 1:10 year storm events and emergency spillway capacity for 1:100 year storm events. All components require regular maintenance to ensure effectiveness.

Equipment Operations

- 2.9. Equipment movements and workers' private vehicles shall be restricted to the 'footprint' of the construction area.



- 2.10. Ensure machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species, noxious weeds and soils from off-site.
- 2.11. Operate machinery on land above the high water mark, on ice, or in another manner that minimizes disturbance to the banks and bed of any water body.
- 2.12. Limit machinery crossing (fording) a stream or watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure in compliance with the *Fisheries Act*.
- 2.13. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
- 2.14. Use temporary crossing structures or other practices to cross streams or water bodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds.

Fuel Storage and Refueling/Emergency Plans

- 2.15. A Spill Response Plan will be prepared and detail the containment and storage, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products in accordance with all applicable federal and provincial legislation. The Plan shall include a list of products and materials to be used or brought to the construction site that are considered or defined as hazardous or toxic to the environment. Such products include, but are not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement and sand blasting agents.
- 2.16. Spill kits shall be provided at re-fuelling, lubrication, and repair locations that are capable of dealing with 110% of the largest potential spill and shall be maintained in good working order. Site staff shall be informed of the location of the spill response kit(s) and be trained in its use.
- 2.17. If potentially hazardous materials (e.g. cement-based products, sealants or paints) are used on site ensure raw material, mixed compounds and wash water are not released to any watercourse or soils. Measures such as collection/drip trays and berms lined with occlusive material such as plastic and a layer of sand, and double-lined fuel tanks can prevent spills into the environment.
- 2.18. Hazardous or toxic products shall be stored no closer than 100 metres from streams, wetlands, water bodies or waterways.
- 2.19. Timely and effective action shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. The SO shall be notified immediately of any spill. In the event of a major spill, all other work shall be stopped and all personnel devoted to spill containment and clean-up.
- 2.20. The costs involved in a spill incident (the control, clean up, disposal of contaminants and site remediation to pre-spill conditions), shall be the responsibility of the proponent. The site will be inspected to ensure completion to the expected standard and to the satisfaction of Parks Canada.

Site Clean Up/Waste Disposal

- 2.21. Clean tools and equipment off-site to prevent the release of wash water that may contain deleterious substances.



- 2.22. Where possible, sweep up loose material or debris. Any material thought to pose a risk of contamination to soils, surface water or groundwater should be disposed of appropriately off-site.
- 2.23. Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried or discarded at the construction site or elsewhere in Parks Canada protected heritage places. These wastes shall be contained and removed in a timely and approved manner and disposed at an appropriate waste landfill site located outside the Parks Canada protected heritage place. Construction waste storage containers, shall be emptied when 90% full. Waste containers will have lids, be wildlife proof if there attractants and waste loads shall be covered while being transported.
- 2.24. Sanitary facilities, such as a portable container toilet, shall be provided and maintained in a clean condition.

3. Asphalt Production and Handling Mitigations Module

Asphalt is a common building material for transportation infrastructure. Its production requires the use of gravel, water, and petroleum products, and associated project activities include transportation, storage and handling of these materials. Installation of asphalt plants is common within the larger parks where gravel extraction is undertaken.

Timing of Works

- 3.1. Asphalt works are preferably undertaken during periods of dry weather as this allows easier control of contaminated runoff and sediment.
- 3.2. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

Operation of Asphalt Plants

- 3.3. Asphalt plant operation must comply with all environmental pollution control regulations, including provincial regulations, and the plant operational plan.
- 3.4. Spoil piles and stock piles will be at least 30 meters from the edge of any water body.
- 3.5. There must be enough room between the stockpiles and the asphalt plant for a loader in the event of a spill at the asphalt plant.
- 3.6. A containment berm with an associated liner made of occlusive material (e.g. plastic of a thickness approved by the SO) and covered with absorbent sand or clay shall be installed under the asphalt storage tank to ensure containment of 110% of the tank's capacity.
- 3.7. The proponent shall be responsible for the purchase and safe delivery/storage/handling of asphalt cement and emulsions to the asphalt plant site.
- 3.8. Excess hot mix or reject new asphalt shall be temporarily in stored in the containment area sufficient to prevent runoff of petroleum into soils or surface waters as directed by



the SO, and removed from the Parks Canada protected heritage place, prior to project completion.

- 3.9. Every effort will be made to recycle waste asphalt, either as a base course, or by recycling waste asphalt through the asphalt plant according to engineering specifications. Old cured ground asphalt material shall be removed, recycled, or stored for future recycling at an approved operational gravel pit or asphalt plant site. Stockpiles must be further than 30 metres from any surface waters.
- 3.10. Remaining stockpiles will be removed or incorporated into reclamation plans for the gravel pits or asphalt plant sites.
- 3.11. Asphalt to be removed must be sampled and analyzed to determine possible lead contamination. Contaminated asphalt will be transported to an approved waste disposal facility. A receipt of delivery is to be provided to the SO.
- 3.12. Proponent should protect containment/catchment areas and drip trays at the asphalt plant from rainfall since, if contaminated, all of the collected water will require disposal of at an approved disposal facility at the expense of the Proponent.
- 3.13. Dyking and ponding will be required to control the rate and quality of runoff from the plant site.
- 3.14. Ensure that the water in the settling ponds remains clean of petroleum products. Any contaminated water will require disposal at an approved disposal facility at the expense of the Proponent.

Gravel Crushing and Washing

- 3.15. Where possible within engineering constraints, asphalt materials should be recycled to reduce the need for new gravel.
- 3.16. Gravel will be obtained from an approved operational borrow pit only. For gravel obtained from a borrow pit within a protected heritage place or borrow pit, gravel extraction within the footprint of the disturbed area of the approved operational borrow pit is permitted.
- 3.17. Gravel will not be crushed within 30 meters of any water body.
- 3.18. If water for cleaning is extracted from a watercourse, refer to [water withdrawal section](#) of this BMP.
- 3.19. If gravel requires washing, the water used will not be returned directly to any watercourse.
- 3.20. Water free from chemical contaminants will be discharged into ground where further erosion and runoff into surface water is prevented. Discharging into well vegetated ground surface, at a rate which prevents erosion can often provide increased absorption and reduction of sediment load.
- 3.21. Contaminated water must be treated to meet CCME guidelines or transported outside of the Parks Canada protected heritage place for disposal at an approved facility.
- 3.22. For waste removed from the park a detailed receipt of delivery to an approved facility will be provided to the SO.

Oiling of Truck Boxes

Trucks for hauling asphalt mixture shall have tight, clean, smooth metal beds that have been sprayed with a minimum amount of thin fuel oil to prevent the mixture from adhering and causing waste asphalt.



- 3.23. Truck boxes may be oiled only when absolutely necessary.
- 3.24. Oiling will take place in a bermed area, consisting of a plastic underlay with 15 centimetres overlay of clean gravel. Oil contaminated gravel will be hand collected (so as to prevent tearing of the plastic) from the bermed area daily, and put through the asphalt plant.
- 3.25. Vehicle covers shall be securely fastened.

Air Quality Mitigations

- 3.26. Asphalt plants should be 500 meters from buildings with human habitation.
- 3.27. Emissions from the asphalt plant and paving project equipment will comply with End Product Specifications (EPS) emission control standards and other provincial emissions regulations. Stack test results provided to the ESO by the operator or surveillance contractor may be required when the asphalt plant is at full capacity to ensure the plant is operating within the required standards. If the plant is not operating within the appropriate levels, production will cease until the requirements are met.
- 3.28. Sludge removed from the clarifier that is free of chemical contamination will be contained to prevent fine dust particles from becoming airborne during windy periods.
- 3.29. Unannounced stack tests will be conducted throughout the project. If the plant does not meet requirements, operation will cease until the requirements can be met.

Disposal and Clean Up of Other Waste Products

- 3.30. To ensure regular clean-up of waste asphalt and petroleum spills, a defined clean up schedule will be established during the preconstruction meeting.
- 3.31. Leaks will be collected in drip-trays, the collected material will either be removed from the park, or recycled back through the Asphalt Plant. For any material removed outside the park to an approved facility, a detailed receipt will be provided to the ESO.
- 3.32. Used oil, filters, grease cartridges, oil cans and other waste products of plant servicing will be collected and disposed of at the nearest industrial waste facility.

4. Concrete Handling Mitigations Module

Concrete is a common construction material used in transportation infrastructure. Its use ensures longevity of the infrastructure and safety for public use. One litre of concrete wash water or leachate in 1000L of water will kill fish. Cement-based products including grouts and concrete are lethal to fish and many other aquatic organisms. Raw product or leachate entering a watercourse will alter water chemistry, making it more basic or alkaline.

Onsite Temporary Concrete Washout Facility

- 4.1. Temporary concrete washout facilities shall be located a minimum of 30m from storm drain inlets, open drainage facilities, and watercourses.
- 4.2. Temporary concrete washout facilities shall be temporary pit or bermed areas constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.



- 4.3. Straw bales, wood stakes, and sandbag materials can be used to construct temporary containment walls or “barriers”.
- 4.4. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.
- 4.5. The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.
- 4.6. Perform washout of concrete mixer trucks in designated areas only.
- 4.7. Wash concrete from mixer truck chutes into approved concrete washout facility or collect in an impermeable bag for disposal.
- 4.8. Pump excess concrete in concrete pump bin back into concrete mixer truck.
- 4.9. Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed offsite.
- 4.10. Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of per federal and provincial regulations.

Maintenance and Inspection of Temporary Concrete Washout Facilities

- 4.11. Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 100 mm (4 inches) for above grade facilities and 300 mm (12 inches) for below grade facilities.
- 4.12. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.
- 4.13. Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- 4.14. Temporary concrete washout facilities shall be inspected for damage (i.e. tears in PVC liner, missing sand bags, etc.).
- 4.15. Onsite concrete waste storage and disposal procedures should be monitored at least weekly or as directed by the ESO.

Removal of Temporary Concrete Washout Facilities

- 4.16. Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and restored.

Onsite Concrete Management

- 4.17. Rolling concrete mixers with surplus concrete in amounts less than one cubic metre of wet concrete may waste this concrete in the grade right-of-way as directed by the Parks Canada Representative in areas that drain well away from watercourses. Surplus amounts in excess of one cubic metre are to be returned to the batching yard.
- 4.18. Water contaminated in the placing of cement and curing of concrete shall be contained and removed from the site to an approved disposal facility.



- 4.19. The concrete batching plant must be operated pursuant to applicable dust, air emission, and water quality control regulations.
- 4.20. Waste, solidified concrete from rolling concrete mixers in amounts less than 1 cubic meter and waste solidified concrete from construction pour shall be buried in the grade within 48 hours of the pour, subject to approval and direction from the Departmental Representative

5. Paving, Resurfacing, Grading Mitigations Module

Highway surface management activities are undertaken to ensure public safety on Parks Canada Agency highways by maintaining clean, level, and unbroken road surface conditions through activities such as pavement cleaning, patching, application of surface treatments, and pavement crack sealing. Grading is used to address drainage issues, vegetation encroachment, potholes and rough surfaces.

Timing of Works

- 5.1. Works are preferably undertaken during periods of dry weather (e.g., summer) as this allows easier control of contaminated runoff and sediment.
- 5.2. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

Grading

- 5.3. During grade construction conducted close to any watercourse, water body or wetland ensure materials are not pushed, fall or are eroded into the water or wetlands.
- 5.4. No grade building shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.
- 5.5. Materials shall be placed at storage sites or on the grade without spillage outside the work limits. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.
- 5.6. Retain a 30 metre vegetated buffer around water bodies or install runoff management structures.
- 5.7. If possible grade roads early in the spring before vegetation develops seed heads or late in season after vegetation has set seed and is dormant to minimize non-native vegetation propagation.
- 5.8. Ensure gravel or road bed material is free of weeds and comes from an approved operational gravel source free of other contaminants.

Paving and Resurfacing

- 5.9. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface waters.



5.10. Minimize application of seal coats in wet conditions. Attempt to apply only to dry surfaces and not prior to (within 24 hrs.) or during rainfall. If unforeseen rain arrives ensure runoff from recently seal coated surfaces are prevented from entering surface waters.

5.11. For asphalt handling and management see the [Asphalt Mitigation Module](#) of the BMP.

Pavement Marking and Barrier and Guardrail Reinstatement

5.12. Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface water. Pavement marking shall be undertaken pursuant to standard methods applied in National Parks for control of paint products, both in transport and handling. The Contractor shall present a description of methods to be employed for transporting and controlling paint and hazardous products, application of paint, cleaning of equipment, containment and disposal of waste paint and cleaning products, etc. the satisfaction of the Parks Canada Representative.

5.13. Where concrete barriers or guard rails are temporarily removed, for highway improvements, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

6. Barriers and Guardrails Mitigations Module

Repair, installation and upgrade of barriers and guardrails involves laydown/staging areas, equipment operations, minor excavation (e.g., for barrier post holes) and use of concrete. Potential adverse effects include destruction of vegetation and erosion and sedimentation.

Timing of Works

- 6.1. Where excavation is required, schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 6.2. If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

Repairs, Replacement and Upgrades

- 6.3. An Erosion and Sedimentation Management Plan shall be prepared for the components of the work undertaken within 100m of watercourses, wetlands or riparian environments. If sediment ponds are required, they shall be designed to settle all sediment particles 0.02 mm or larger.
- 6.4. Where use of concrete is required for guardrail post holes, Concrete Handling Mitigations apply.
- 6.5. If vegetation removal is required for barrier or guardrail works, Vegetation Removal Mitigations apply.



- 6.6. Where concrete barriers or guardrails are temporarily removed, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

7. Vegetation Removal Mitigations

Module

Roadside vegetation management activities include mowing, brushing, and landscape maintenance activities undertaken to maintain clear sight lines for highway users, control noxious weeds, facilitate effective drainage, and reduce possible fire hazards. Mature timber may need to be removed for improving road alignments, improving sight lines or replacing or repairing associated infrastructure. Grubbing (stump and root removal) may be required to prepare the ground surface for other activities.

Timing Windows

- 7.1. Vegetation clearing can negatively impact nesting birds and/or bats in spring and summer. Avoid all vegetation removal during this time. If vegetation removal is scheduled to occur within these times a qualified professional biologist/ecologist should further clarify the species presence and timing particular to the work site and any occupied bird nests, eggs, or nests of species protected under the Migratory Bird Convention Act (MBCA). See [appendix on regulatory guidance for further detail on the MBCA and SARA](#).
- 7.2. If a nest is found during the pre-work surveys, the vegetated area will be left intact with a suitable sized buffer of shrubs/trees around it until the young have fledged and left the nest. Size of buffer species dependent, to be determined in consultation with professional biologist or park ecologist.
- 7.3. Grass mowing and trimming should not occur during peak spring or fall reptile/amphibian migrations and hatching. Consult a local biologist/ecologist for site and species specific timing windows.

Vegetation Removal Mitigations

- 7.4. Vegetation removal should be limited to the minimum Clear Zone Distance¹ dependent on type and size of road and maximum height needed to meet the road safety objectives.
- 7.5. Minimize full removal and retain vegetation when possible to reduce erosion.
- 7.6. Prior to the commencement of any vegetation removal, the worksite must be surveyed for species at risk. If species at risk are found, work must be stopped until site-specific mitigations to address potential adverse effects are developed.
- 7.7. Survey vegetation for non-native species, clear vegetation areas with non-native vegetation in spring and early summer to avoid further spread and development of the non-native seed bank.

¹ A clear zone is an unobstructed, traversable roadside area designed to enable a driver to stop safely or regain control of a vehicle that has accidentally left the roadway. The selection and design of appropriate clear zone dimensions is project-specific and should be the responsibility of professionals trained in roadside design.



- 7.8. Clearing activities shall be avoided during nesting seasons for birds, reptiles and amphibian species in the project area.
- 7.9. If wildlife is observed during work, if possible, give animals the opportunity to escape the work area to the surrounding forest or elsewhere to seek new shelter.
- 7.10. Avoid ground vegetation removal during dry, windy periods to prevent erosion of topsoil and reduction of air quality with dirt/dust.
- 7.11. Retain 30 metre vegetated buffer around water bodies, where disturbance is necessary and unavoidable restoration is required.
- 7.12. Debris will not be deposited in water bodies.
- 7.13. Ensure tree limbs/stumps are flush cut as close to the ground or stem as possible.
- 7.14. Logs and other salvage materials are to be conveyed to and placed at a storage site without spread of debris or damage to other standing trees or landscape resources outside the marked clearing or storage limits. They shall not be skidded through wetlands, waterways or water bodies.
- 7.15. During the grubbing component, stumps, roots, imbedded logs and other non-soil debris shall be pulled and shaken free of loose soil and rocks before transport to a designated pit.
- 7.16. Where possible preserve identified wildlife trees by limbing or topping if they are not assessed as hazard trees.

Disposal of Vegetation Debris

- 7.17. All vegetation debris must be removed as soon as possible from the right-of-way, either by transporting off-site for disposal or piling and burning on-site.
- 7.18. All vegetation containing non-native species will be piled and burnt or bagged and removed off site to disposal facility.
- 7.19. Piles will be made where trees are felled, piles will be 1.2-1.8 (4 to 6 feet) in diameter and no more than 1.2 m (4 feet) high (approximately 1 to 3 trees per pile) or as instructed by local fire and vegetation specialists.
- 7.20. Piles are to be located so that they do not scorch surrounding live trees and measures must be in place to ensure that fires do not spread (i.e., conduct burning on snow or on mineral soil).
- 7.21. Piles will be left until fall for burning to allow for curing of green fuels.
- 7.22. Provincial regulations for air quality must be met.
- 7.23. Where fire fuel loading is not a concern vegetation debris of limited amounts will be dragged in the forest to mimic natural tree fall.
- 7.24. If removal or burning are not feasible a chipper may be used for less than 50 boles per hectare. Chip depth is to be a maximum of 5 cm (2 inches), spread over area no greater of 5m x 5m per hectare so as to not cover underlying vegetation, prevent new native seedlings from sprouting, and cause soil/seed bank sterilization. Spreading of chips may extend beyond these parameters with permission from Parks Canada.
- 7.25. To facilitate chipping of woody debris, all trees/shrubs/vines can be left temporarily along the road shoulders and laid facing the same direction.
- 7.26. In some cases, logs from newly cut trees may be set aside for use elsewhere as directed by local park site managers and the ESO.



- 7.27. Store removed vegetation on already disturbed areas to minimize disturbance area.
- 7.28. In appropriate areas re-establish native vegetation where it has been completely removed/damaged.

Integrated Pest Management

- 7.29. A Field Unit Integrated Pest Management Plan (IPMP) must be completed and approved prior to the use of herbicides to ensure the most effective and least harmful substances are properly used.

8. Excavations, Soil Stripping and Overburden Removal Mitigations Module

Construction projects often involve excavations. To successfully complete reclamation of disturbed areas, and protect areas from erosion proper soil handling and backfilling procedures must be followed. Post excavation and stripping soil and vegetation restoration mitigations should be applied. See section of this BMP for [Soil and Vegetation Restoration](#).

Timing of Works

- 8.1. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 8.2. If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

Excavation

- 8.3. Materials shall be placed at storage sites or on the grade without spillage outside the working limits. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation.
- 8.4. All sediment control measures must be in place before starting work in the vicinity of rivers, water bodies, watercourses, and wetlands.
- 8.5. Special precautions may have to be taken during excavation in the vicinity of intermittent or active drainage channels.
- 8.6. Excavation plans must be compared to local archaeological resource inventories, if available. If no archaeological information is available for the work area, an Archaeological Overview Assessment (AOA) may be required to determine the archaeological potential of the work area. Based on the results from the AOA, an Archaeological Impact Assessment might be required. It would be time and cost efficient to refer the plan to Parks Canada's Terrestrial Archaeology section before conducting any excavation to determine the appropriate course of action.
- 8.7. If cultural resources (eg. archaeological resources) are discovered, immediately cease work, and alert SO.
- 8.8. Minimize changes to the ground surface that affects its infiltration and runoff characteristics and maintain/re-establish effective surface drainage on completion of the project
- 8.9. Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation.



- 8.10. All trenches or ditches left unattended overnight must be fenced or covered to prevent wildlife entrapment.

Soil Stripping

- 8.11. Strip topsoil under dry conditions, whenever possible.
- 8.12. No stripping shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest.
- 8.13. In the event of a work program shutdown during inclement weather (e.g. winter conditions unfavourable for construction, heavy rain events, construction delays, etc.) erosion control of bared soils or excavated material stockpiles is required.
- 8.14. Stripping close to any watercourse, water body or wetland shall employ methods to ensure materials are not pushed, do not fall or erode into the water or wetlands.
- 8.15. Work within a 100 metre buffer from the high water mark of waterways or wetlands will require a site specific sediment and erosion control plan.
- 8.16. An erosion control plan is also needed to control dust generated from the construction site.

Topsoil Salvage

- 8.17. Salvage topsoil at all excavation sites for reclamation purposes.
- 8.18. Usually the upper 15 cm of soil, below the sod layer if present, is considered topsoil, where depths exceed 15cm salvage the entire depth of topsoil.
- 8.19. Remove stumps and woody debris from topsoil, wherever possible.

Excavated Material Storage

- 8.20. Allow space for separate storage of topsoil and spoil; where space is available separate stored topsoil from spoil by at least 1 m. Use appropriate material (e.g., geo-textile) to separate soil components where space is limited.
- 8.21. Topsoil may be stored on hardened surfaces, geo-textile material or directly on undisturbed vegetation. If storage occurs on vegetation, material recovery by hand may be required.
- 8.22. Cover all stockpiled material with heavy-duty plastic or filter cloth to prevent erosion during precipitation events.
- 8.23. Topsoil should be stockpiled on the uphill side of the disturbance on sloped terrain.
- 8.24. Construct barricades to prevent losses on steep terrain (>18°, 3:1) and within 100m of watercourses.

Excess Materials and Waste (Overburden Removal)

- 8.25. Remove excess excavated material from site where it cannot be used for the final grading of the area. Site specific arrangements must be made for disposal locations and procedures of overburden.
- 8.26. Surplus excavated material may be used to fill depressions around the project site providing topsoil is stripped before filling, with approval from SO.



9. Slope Stabilization, Drilling and Blasting Mitigations Module

Where standard excavation is not sufficient, scaling, hydraulic hammers, drilling units or trim blasting are used to break up rock or soil for removal. Accumulations of debris in ditches reduce their effectiveness at trapping rock fall and reduce public safety. Ditches will be cleaned using a loader and back hoe. Guardrails and rock fences may be temporarily removed to permit this activity.

Timing of Works

- 9.1. Time any vegetation removal work should adhere to the Migratory Bird windows for the area.
- 9.2. Time work to reduce impact to mammals, amphibians and reptiles using rock faces during sensitive life stages such as birthing and rearing of young. This often occurs during the spring. Confirm timing windows with local wildlife ecologists.
- 9.3. Avoid ditch clearing during wet periods and wait until ditches are dry to reduce impacts to amphibians and reptiles and limit sedimentation.

Slope Stabilization-Scaling, Hydraulic Hammers

The use of hydraulic hammers attached to excavators is considered the ideal solution for rock disintegration. It avoids rock blasting where the parent rock is no longer rippable by the excavator's bucket but still has enough planes of weakness for economical operation and effective use of the hydraulic hammer. Scaling is the manual removal of loose material on rock slopes using pry bars, hydraulic press, brooms, shovels and power equipment operated by personnel using roped access to a rock face.

- 9.4. For vegetation clearing refer to the [vegetation removal mitigation module](#) of this BMP.
- 9.5. For slope-stabilization in soils, please refer to the Excavation section.
- 9.6. Survey the work site for cultural resources such as rock art (ex. pictographs, petroglyphs, etc. prior to the work commencing, establish site specific mitigations for their protection.
- 9.7. Measures shall be taken to control dust as much as possible during the removal and falling of rock materials down slope.
- 9.8. Placement of rip rap and backfill on shorelines shall be undertaken without contacting the watercourse, wetted margins and must not be below the High Water Mark.
- 9.9. If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately- sized, clean rock is used, and rock is installed at a similar slope to maintain a uniform bank.
- 9.10. Direct concentrated surface water (runoff) away from cut and fill slopes.
- 9.11. Immediately stabilize banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through vegetation restoration with native species suitable for the site-refer to [soil and vegetation restoration section of BMP](#).



Drilling and Blasting for Slope Stabilization and Geotechnical Investigations

Trim blasting is used for controlled blasts in which explosive charges are placed in predetermined pattern of holes drilled into the rock face and then detonated. Potentially unstable masses of rock can sometimes be stabilized using rock bolts and long steel rods drilled into the rock to bind it together. Drilling is a common method of investigation to obtain geotechnical reports required for engineering design.

Drilling

- 9.12. Debris from drilling will be contained (screened or settle out) so it will not cover the surrounding area or enter any water course. All debris will be removed, [see section on overburden removal](#) for further mitigations.
- 9.13. The cuttings from all drilling will be contained so they can be removed entirely from the site. If contaminated, the cuttings are to be disposed at an approved waste disposal facility.
- 9.14. Control of spoil and sediment loaded water is required on the drill site. Dyking will be required to retain the deposit on non-vegetated surfaces. If contaminated, the spoil pile must be disposed at an approved waste disposal facility.
- 9.15. During aquifer tests, the water must be piped so it does not erode any soil or any part of the ground. If the water from the tests is piped to a creek, stream, or river, the pipe is to be situated so that there is no erosion of the stream bank or bed. If any sand or similar material is discharged during the aquifer test, care must be taken that the sand does not cover any vegetation.
- 9.16. All test wells will be filled in after the testing is completed. The proponent will be responsible for rectifying any future problems associated with any of the wells or test wells.

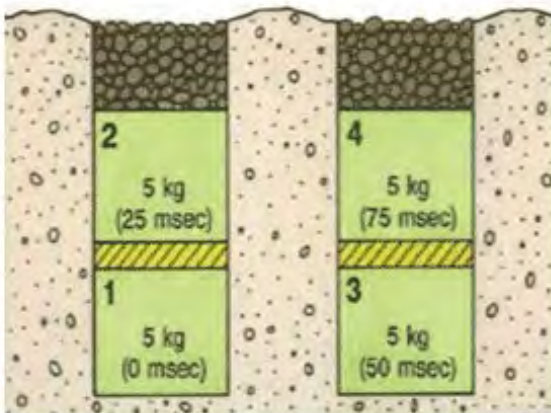
Blasting

- 9.17. The Parks Canada Representative will identify a magazine location for explosives should a factory site or "ready-to-use" explosives storage site be required
- 9.18. The blasting supervisor will ensure no damage to infrastructure, people, surrounding vegetation or wildlife by mitigating risk of fly rock.
- 9.19. Avoid using explosives in or near water. Use of explosives in or near water produces shock waves that can damage a fish swim bladder and rupture internal organs. Blasting vibrations may also kill or damage fish eggs or larvae.
- 9.20. If explosives are required as part of a project (e.g., removal of structures such as piers, pilings, footings; removal of obstructions such as beaver dams; or preparation of a river or lake bottom for installation of a structure such as a bridge or culvert), the potential for impacts to fish and fish habitat will be minimized by implementing the following measures:
 - Time in water work requiring the use of explosives to prevent disruption of vulnerable fish life stages, including eggs and larvae, by adhering to appropriate fisheries [timing windows](#).
 - Isolate the work site to exclude fish from within the blast area by using bubble/air curtains (i.e., a column of bubbled water extending from the



- substrate to the water surface as generated by forcing large volumes of air through a perforated pipe/hose), cofferdams or aquadams.
- Remove any fish trapped within the isolated area and release unharmed beyond the blast area prior to initiating blasting.
 - Minimize blast charge weights used and subdivide each charge into a series of smaller charges in blast holes (i.e. Decking) with a minimum 25 millisecond (1/1000 seconds) delay between charge detonations (see Figure 1).
 - Back-fill blast holes (stemmed) with sand or gravel to grade or to streambed/water interface to confine the blast.
 - Place blasting mats over top of holes to minimize scattering of blast debris around the area.
 - Do not use ammonium nitrate based explosives in or near water due to the production of toxic by-products. Remove all blasting debris and other associated equipment/products from the blast area.

Figure 1: Sample Blasting Arrangement



Per Fig. 1: 20 kg total weight of charge; 25 msecs delay between charges and blast holes and decking of charges within holes. (Fisheries and Oceans Canada, 2015)

10. Soil and Vegetation Restoration Mitigations Module

Almost all projects activities included in this BMP will require some ecological restoration- *the process of assisting the recovery of an ecosystem that has been degraded, damaged, or*



destroyed. The restoration plan can be a simple application of the following mitigations and can be at the site or both at the site and in concert with another site designated to offset the permanent impact of a project. For disturbance areas greater than a hectare a restoration plan is required. The restoration works can be often be considered projects in and of themselves. Soil and vegetation restoration must apply the principles of effective, efficient and engaging solutions.

Timing Windows

- 10.1. Develop restoration plan as part of the project scoping and specifications prior to project approvals.
- 10.2. Vegetation restoration is most effective if seeded in the fall, this allows for full scarification of the seed over the winter and adequate moisture available. Spring and early summer will also work, consider using seed that requires shorter scarification times for these applications. Transplants will do best in the spring and summer and will require adequate watering.

Topsoil Replacement

- 10.3. Implement restoration plan for the disturbed area immediately following completion of construction.
- 10.4. Replace topsoil to all areas immediately following fine grading.
- 10.5. Do not compact topsoil.
- 10.6. Where insufficient topsoil is available imported soil may be used as a last resort. Imported topsoil must be certified completely free of non-native seeds and compost developed from sewage treatment plants. Methods of improving vegetation succession using locally sourced, weed and contaminant free materials are preferred.
- 10.7. Slopes to be seeded should be no steeper than 2 horizontal to 1 vertical (2:1) and covered with a minimum of 5 cm (2 inch) of topsoil. Finish grading should always follow top soil placement.
- 10.8. Where remaining soils are unstable due to steepness or soil characteristics, immediate installation of sod or erosion control blanket is required.
- 10.9. Methods of bioengineering such as terracing, willow staking, live pole drain systems should be assessed as solutions where soils are steeper or remain unstable.

Soil Amendments

Fertilizer Application

- 10.10. Avoid use of fertilizer to limit non-native vegetation growth and allow for local species to use available nutrients.
- 10.11. If needed use locally sourced mycorrhizae compost teas to improve vegetative success.

Topsoil substitute

- 10.12. Apply an organic cellulose only amendment as a soil substitute if reclamation standards are not being met within the defined time frame.
- 10.13. Determine the type of organic amendment based on the site-specific requirements (e.g., peat moss, compost).



Seedbed Preparation

- 10.14. The seedbed will be scarified by hand or, with the approval of the SO, by machine on large areas (i.e., roadbeds) where it is accessible and appropriate.
- 10.15. The seedbed will be scarified if seeding takes place more than 7 days after final grading or if there has been a rainfall between final grading and the seeding date.
- 10.16. The cleats of a tracked vehicle or a harrow device will be used, where possible, to prepare an adequate seedbed with seedling safe-sites (microsites) substantially free of soil crusts.
- 10.17. Align cleat marks at right angles on slopes to trap seed and sediment and reduce erosion.

Species Selection

- 10.18. When selecting species and varieties:
 - Use species of local native plant communities.
 - Species viability in proposed environment and climatic conditions.
 - Capability to effectively control erosion, where required.
 - Adaptation to the variable site conditions of undulating topography.
 - Consider palatability of some species to herbivores and avoid growing attractants in areas of increased risk to wildlife and visitors.
 - Variable life expectancy to produce variable, delayed die-out of seeded species and replacement with indigenous native plants.

Seed Lot Selection

- 10.19. Select seed lots based on indigenous species variety and quality (guaranteed weed seed free content and highest purity and germination), consult with vegetation restoration specialist or fire/vegetation ecologist.
- 10.20. Reject any seed lots containing any seed of undesirable crop or weed species.

Seed Mixture Composition

- 10.21. The proportion of each species should be calculated to provide an adequate quantity of pure live seed (PLS) per unit area of each key component.
- 10.22. Aim for density of about 140 seedlings/m² at the end of the first growing season to provide adequate ground cover and allow native species to re-colonize the site over time.
- 10.23. Consider that parameters such as seed lot purity, seed germination, seedling establishment, seed size and seeding method affect the final stand composition.

Seeding

- 10.24. Use approved native seed mixes developed for site-specific conditions for various elevations.
- 10.25. Seed and stabilize (e.g. mulch/tackifier) bare areas as soon as possible after disturbance, preferably as soon as a significant area is graded and finished and before the next rain event. If there is a risk of seedling mortality as a result of fall frost stabilize until appropriate growing conditions exist.



- 10.26. Use sod in high traffic areas or places that need extra erosion control. Source sod grown from native species (often called fescue sod) and ensure adequate anchoring and watering is in place.
- 10.27. Use temporary seeding when outside the seeding dates for permanent vegetation
- 10.28. Apply a seed mixture which is appropriate for the climate, soil, and drainage conditions of the site.
- 10.29. Apply seed at a rate appropriate to the seed mixture, seeding method and existing vegetation conditions.
- 10.30. Conduct broadcast seeding under calm wind conditions. Hydro-seeding is acceptable where access is available.
- 10.31. Do not exceed 30 kg/ha for the broadcast method, ensure seed is integrated with the soil by light rake or harrow. Broadcast method seeding rate is 25 kg/ha (2.5g/m²) (e.g., 1x25 kg bag will cover 10,000m² or 1 hectare).
- 10.32. For hydro-seeding do not exceed 75 kg/ha with light mulch rates (500 kg/ha- of mulch with hydro-seeding) and 150 kg/ha with heavy mulch rates (1500 kg/ha of mulch with hydro-seeding).
- 10.33. Do not increase the seeding rate to compensate for poor seedbed conditions.
- 10.34. Monitor temporary erosion control measures to prevent seed loss.
- 10.35. Some seeding procedures may have to be completed or repeated in subsequent years.

Alternatives to Seeding

- 10.36. Use topsoil seed bank in small areas when there is no risk of erosion or competition from invasive species (i.e., natural regeneration).
- 10.37. Use native transplants in areas where conventional seeding applications are not applicable or where slope stability is an issue.
- 10.38. Use conventional forestry planting methods for container grown transplants, see website for guidance.

Reclamation Standards

- 10.39. Minimum standard for plant density is 25 plants/m², with 90% frequency.
- 10.40. Minimum standard for plant cover is 80% ground cover, with 90% frequency.
- 10.41. Minimum standard for plant community composition standard is 50% cover and 90% frequency of native species.
- 10.42. Exclude species designated as weeds in the work sites from the plant density standard consult local vegetation ecologist for current site specific non-native vegetation management program.
- 10.43. Rock, plant litter and non-vascular species are included in the cover standard.
- 10.44. Remaining plant cover of seeded native species is acceptable.

Reclamation Plot Evaluation

- 10.45. Select any site within reclamation area measuring 10 x 10 m, providing 100 plots of 1 square meter.
- 10.46. Measure the plant density, cover and composition in each of the 100 square meter plots.
- 10.47. The reclamation standard will have been met if 90 of the 100 plots match or exceed the criteria.



- 10.48. No fertilizer will be applied one year before the reclamation standard is evaluated.

Time Limits

- 10.49. Inspect site annually during the growing season.
- 10.50. Minimum reclamation standard, as above, to be met within one season post planting.
- 10.51. Apply amendments annually, depending on reclamation progress.
- 10.52. Re-seed site if the plant density standard is not expected to be achievable within 5 years.
- A new restoration plan will be prepared and implemented when reclamation standards have not been met after 5 years.

11. Drainage Structures Mitigations Module

Drainage structures on roadway, highway and parkways are structures such as culverts, ditches and drains. Drainage structure management activities are undertaken to ensure that surfaces are safe and efficiently drained, water is efficiently channeled to ditches and watercourses, and erosion of highways and adjacent properties is prevented. These mitigations include the cleaning and maintenance of drainage structures and related hardware, as well as the repair or replacement of existing and installation of new drainage structures.

Timing of Works

- 11.1. Time work in water to respect [timing windows](#) to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed. Contact your local aquatics specialists and DFO offices for further information on [timing windows](#) in your region.
- 11.2. Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
- 11.3. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 11.4. If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

Drainage Structures

- 11.5. Isolate your work area from any flowing water that may be present. Ensure any flows are temporarily diverted around the portion of the ditch or watercourse where you are working.
- 11.6. Select appropriate equipment and work access routes to reduce damage to riparian vegetation and watercourse banks when using earth-moving equipment.
- 11.7. For smaller scale debris and sediment removal activities, remove materials by hand.
- 11.8. To assist with bank stability and invasive plant prevention, leave topsoil and root systems intact on channel banks surrounding your work area.



- 11.9. Ensure any works to repair damaged structures retain the pre-repair channel conditions (e.g., streambed profile, substrate, channel cross section) and do not constrict the stream width.
- 11.10. Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved.

Culverts

If a proposed culvert crosses a stream where fish are present, the crossing should be designed or upgraded to provide fish passage and avoid interference with fish habitat. To mitigate the impact of culverts on fish movement technical assessment of the water flows and fish species is required to establish a culvert design that will allow for passage of fish. Often there are regional or provincial best practices available online and qualified professionals can assist with designs. Some best management practices for installation or replacement of culverts follows.

Culvert Design and Alternatives

Utilize alternative crossing structures (e.g. clear span bridges, lock blocks and concrete decks) as a replacement for culverts, where possible.

- 11.11. Ideally, crossings should have natural streambed material through them to allow continuous substrate that matches the streambed below and above the crossing. Open bottom crossings are ideal for maintaining natural substrate.
- 11.12. Utilize a single large culvert design over a multiple culverts design (i.e. several smaller culverts) to reduce debris blockage and increased fish and wildlife passage, where hydrologically feasible
- 11.13. Design culvert bottoms to be placed at least 30cm below the stream bed elevation to ensure culverts remain passable by fish and wildlife by preventing culverts from becoming perched.
- 11.14. A minimum water depth of 200 mm should be provided throughout the culvert length. To maintain this water depth at low flow periods an entrance/downstream pool can be constructed. In some cases, an upstream pool may also be necessary.
- 11.15. The culvert slope should follow the existing streambed slope where possible.
- 11.16. The culvert, inlet(s) and outlet(s) should be adequately protected with rip-rap to prevent erosion and scour around the culvert during high runoff events. The following measures should be incorporated when using replacement rock to stabilize the culvert:
 - Place appropriately-sized, clean rocks into the eroding bank area by hand or machinery operating outside the water course.
 - Do not obtain rocks from below the ordinary high water mark of any water body.
 - Where possible, install rock at a slope similar to the stream bank to maintain a uniform stream profile and natural stream alignment. Otherwise, install the rock at the closest slope required to ensure it is stable.
 - Ensure rock does not interfere with fish passage or constrict the channel width.
- 11.17. Trash racks should not be used near the culvert inlet. Accumulated debris may lead to severely restricted fish passage and potential injuries to fish. Where trash racks cannot be avoided in culvert installations, they must only be installed above the water surface indicated by bank full flow. A minimum of 9 inches clear spacing should be provided between trash rack vertical members. If trash racks are used, a



long term maintenance plan must be provided along with the design, to allow for timely clearing of debris.

- 11.18. Natural or artificial supplemental lighting should be considered in new or replacement culverts that are over 150 feet in length.
- 11.19. Ensure designs locate culvert structures in areas that minimize impacts to riparian vegetation and associated wildlife.

Culvert Installation

- 11.20. It may be necessary to exclude fish from the immediate construction site while a culvert is being installed. If this practice is necessary, fish shall be salvaged by a qualified aquatics professional from within the exclusion area.
- 11.21. If dewatering is required refer to the [dewatering mitigation module](#) of this BMP for appropriate mitigations.
- 11.22. Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved.
- 11.23. Remove any old structures to a suitable upland disposal facility away from the riparian area and floodplain to avoid waste material from re-entering the watercourse

Wildlife Considerations for Culverts

At times, culverts are placed along portions of highways that bisect wetlands or specific habitats that support an abundance of wildlife. Consider building natural rock ledges through culverts to allow for small and medium-sized animals to walk on during periods of high flow.

12. Bridge Maintenance Mitigations Module

Bridge structure management activities include the cleaning and painting of bridge structures as well as the repair, rehabilitation, and replacement of bridge elements including decks, railings, abutments, and bearings. Works may include asphalt, concrete works, chipping, painting, grouting, timber truss, abutment and piling maintenance. These activities help ensure bridge structures remain structurally sound and safe for public use.

Timing of Works

- 12.1. Time work in water to respect [timing windows](#) to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed. Contact your local aquatics ecologists, provincial jurisdictions and DFO offices for further information on [timing windows](#) in your region.
- 12.2. Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
- 12.3. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 12.4. Cover or otherwise contain stockpiled materials during heavy rain events or extended absences.
- 12.5. If the work schedule requires working in the rain, the area of work must be isolated with appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.



Bridge Cleaning

- 12.6. Schedule bridge-cleaning activities to coincide with the watercourse's spring freshet when possible. At freshet or during periods of high flow a large watercourse will often have its highest background levels of sediment. At this time, the introduction of a small amount of sediment to a watercourse (from bridge cleaning) will have a lower risk of potential impact when considered against those high natural background levels.
- 12.7. If works are planned outside the freshet or if your region does not experience a freshet, discuss the protocol and timing of these works with your local aquatics ecologist and/or DFO Officer.
- 12.8. Dry sweep and collect loose material off bridge surfaces before washing the bridge. Adequately seal drains and any open joints on the bridge deck before sweeping or washing to prevent material or sediment-laden wash water from entering any watercourse
- 12.9. If dry sweeping and preventing direct runoff to waterway is not a feasible way to clean the surface, discussion and planning with local aquatic ecologists will be required.
- 12.10. Use water alone. If your cleaning activities require degreasers or any other chemical, approval for use must be obtained from local aquatics specialists and/or DFO.
- 12.11. Contain any wash water or runoff to the bridge deck. Direct wash water towards the bridge approaches and away from the watercourse, then to a vegetated area or contained settling area (e.g., dry ditch channel unconnected to a watercourse) where it can infiltrate.
- 12.12. If superstructure cleaning is undertaken above or on the bridge deck level, prevent potentially harmful materials from entering into road drains. Block deck drains with suitable barriers (e.g., polyethylene or drain blocks) to prevent direct discharge to a watercourse, or re-route runoff through temporary piping onto adjacent settling pond or structure, using a hydro vacuum would be another option.
- 12.13. If water for cleaning is extracted from a watercourse, refer to [water withdrawal section](#) of this BMP.

Repairs Using Treated Wood Products

- 12.14. Untreated wood products are recommended, if treated wood is to be used, ensure it has been treated with a wood preservative appropriate for the project. Refer to the [Parks Canada Guide for the Use, Handling and Disposal of Pressure Treated Wood 2009](#) and any further updates from [Parks Canada Real Property – Environmental Management](#).
- 12.15. If treated timber must be cut to size, ensure cutting takes place away from the bridge and watercourse. Sawdust from treated wood is harmful to aquatic organisms and must be prevented from entering any watercourse.
- 12.16. Wood preservatives should be applied in a contained area and not be applied over or within 200m of water.



Bridge and Structure Painting

- 12.17. Ensure paint flakes, abrasive grits and abrasive/paint flake mixtures do not enter the watercourse as they may leach toxic heavy metals into receiving waters and/or be ingested by fish.
- 12.18. Install ground covers and/or vertical drapes such as sheets of plastic or air-permeable cloth (e.g., burlap or canvas) prior to removal activities to capture falling debris. Floating barges may be deployed in watercourses to capture falling debris, such as paint flakes and dust.
- 12.19. Waste materials collected during removal and application of protective coating operations (e.g., blasting abrasives, paint particles, rust and grease) should be collected and retained for disposal at appropriate locations. Waste materials must not be deposited into watercourses or riparian areas.
- 12.20. Use hydro blasting or manual techniques, where possible, when removing road dirt, soluble salts and loose paint to minimize impacts to the watercourse.
- 12.21. Use water without cleaning agent additives if grease film removal is necessary.
- 12.22. Avoid use of toxic liquid paints, primers, solvents, degreasers and rust inhibitors.
- 12.23. Minimize spill potential by storing, mixing and transferring paints and solvents on land.

13. Water Withdrawal and Dewatering Mitigations Module

Construction often requires the use of water, many common methods of excavation and site isolation require dewatering. Temporary, short term water withdrawal provides an efficient uncontaminated water source for local project sites. Dewatering can allow sites to be effectively dry during construction, reducing the impact of sediment laden water entering fish bearing waters.

Timing Windows

- 13.1. As a general guide to prevent taking more water than aquatic system can support, limit total take of water to less than 5 successive days and less than 10 days in any period of 30 days.
- 13.2. Avoid water withdrawal during breeding seasons of amphibians and reptiles to avoid destruction of egg masses, consult local aquatics ecologist for site specific guidance.

Water Withdrawal

- 13.3. Water should not be withdrawn from a wetland or stream less than 5 metres wide at the surface or a lake less than one hectare in area.
- 13.4. Water withdrawal should follow the 10/90 rule which allows for up to 10% of the stream flow to be withdrawn, as long as the stream flow does not fall below the 90% exceedence flow (eg.1 in 10 chance in a given year).
- 13.5. No permanent or semi-permanent works for water withdrawal should be placed in the stream channel.
- 13.6. Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish, amphibians and/or reptiles. Entrainment occurs when a fish or amphibian is drawn into a water intake and cannot escape. Impingement occurs when an



entrapped fish, reptile or amphibian is held in contact with the intake screen and is unable to free itself.

Pump Screens

- 13.7. In freshwater, fish-bearing waters design and installation of intake end-of-pipe fish screens:
- Locate screen in areas and depths of water with low concentrations of fish throughout the year away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
 - Orient the screen face in the same direction as the flow of water.
 - Ensure openings in the guides and seals are less than the opening criteria to make “fish tight”.
 - Screens should be located a minimum of 300 mm (12 in.) above the bottom of the watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.
 - Provide structural support to the screen panels to prevent sagging and collapse of the screen. Large cylindrical and box type screens should have a manifold installed to ensure even water velocity distribution across the screen surface. The end of the structure should be made of solid materials and the end of the manifold capped.
 - Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where debris loading (woody material, leaves, algae mats, etc.) is a concern. A 150 mm (6 in.) spacing between bars is typical.
 - Provision should be made for the removal, inspection, and cleaning of screens.
 - Ensure regular maintenance and repair of cleaning apparatus, seals, and screens to prevent debris fouling and impingement of fish.
 - Pumps must be shut down when fish screens are removed for inspection and cleaning.

Dewatering

- 13.8. A site specific dewatering plan is required be provided before commencing a pump-out sump to dewater excavation sites with specific details on how and where the water will be discharge.
- 13.9. Site specific mitigations may be required depending on the conditions of the discharge area, freezing conditions operation, overflow avoidance, decanting and settlement pond reclamation.
- 13.10. Water containing suspended materials shall not be pumped into watercourses, drainage systems or on to land, except with the permission of the SO.
- 13.11. Soil and vegetation erosion protection is required for water pumped on to land.



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Appendix 1 Regulatory Guidance

Jurisdictions

While all projects on lands managed by Parks Canada must adhere to Federal law and regulation, it is considered best practice to refer to local community, regional, provincial regulation and best practices where federal guidance is silent and/or attempt to meet those targets if it can reduce the overall impact of the project.

Some of the project activities reviewed have potential environmental impacts that are addressed by various provincial, federal and territorial acts and regulations. All activities must meet current environmental law and regulations in their design and construction. The following is a brief description of some of the key federal acts and regulations. Further review, understanding and application of other federal, provincial and territorial environmental laws are part of a rigorous approach to project planning and execution.

Canada National Parks Act and Regulations - Parks Canada

All work inside National Parks and Protected Areas must be performed in accordance with the laws and regulations set out in the *Canada National Parks Act and Regulations*. This includes the requirement for most activities described to only be done under a permit such as: business licence for contractor, disturbance of natural objects, travel in restricted areas, special events or use of disposal sites.

Fisheries Act - Fisheries and Oceans Canada

If a project is to be conducted near water, it is the proponent's responsibility to ensure they avoid causing [serious harm to fish](#) in compliance with the [Fisheries Act](#). The [advice in on the Fisheries and Oceans website](#) will help a proponent avoid causing harm and comply with the Act.

If the water body in the project area has fish or is connected to waters at any time that have fish the project must meet the [self assessment criteria on the Fisheries and Oceans website](#), if not a project review can be made by Fisheries and Oceans Canada to assess whether the project requires authorization or authorization can be requested directly. Given the level of detail required for a review and/or authorization request the EIA officer may need to consider a more involved EIA pathway in those circumstances.

Migratory Bird Convention Act - Environment Canada

The purpose of this Act is to implement the Convention by protecting and conserving migratory birds - as populations and individual birds - and their nests. Section 6 - prohibits the disturbance, destruction, or taking of a nest, egg, or nest shelter of a migratory bird.

In Canada, the general nesting period may start as early as mid-March and may extend until end of August. This is a general nesting period that covers most federally protected migratory bird species. This period varies regionally across Canada mainly due to differences in species



assemblages, climate, elevation and habitat type. Generally, the nesting period is delayed in more northerly latitudes, corresponding to vegetation development and food availability. (Environment Canada, 2014). To help with determining regionally relevant periods where nesting is likely to occur, Environment Canada is publishing estimated regional nesting periods within large geographical areas across Canada referred as "nesting zones". These periods are estimated for each zone and consider the time of first egg-laying until the young have naturally left the vicinity of the nest. Field Units may wish to refine this section and add their known local nesting periods.

Species at Risk Act

If a species listed under the *Species at Risk Act* (SARA) is found within the project area, any potential adverse effects from the proposed project to the individuals of the species, their residences and/or their critical habitat must be understood. Species at risk considerations require specific expertise, due to additional legal requirements under the SARA and CEAA 2012. If the projects or activities to be addressed by the BMP could affect a listed species or its critical habitat, the EIA officer may need to consider a more involved EIA pathway in those circumstances.

APPENDIX 'B'

**PAVEMENT DESIGN AND SEWER
INVESTIGATION REPORTS**



December 7, 2016

PAVEMENT DESIGN REPORT

Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation Pukaskwa National Park Heron Bay, Ontario

Submitted to:

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PARSONS
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Markham, Ontario
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REPORT

Report Number: 1545167

Distribution:

2 Copies - PARSONS Corp.
2 Copies - Parks Canada
1 Copy - Golder Associates Ltd.





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Pavement Design Analysis



1.0 INTRODUCTION

This report presents the results of a pavement investigation carried out for the proposed improvements at the Pukaskwa National Park, near Heron Bay, Ontario. The pavement engineering components of the project include the reconstruction or rehabilitation of approximately 3.1 km of paved access roads and 2 km of gravel roads. In addition, there are two parking areas which require rehabilitation and one parking area proposed for expansion. The location of the site is shown on the Borehole Location Plans attached as Figures 1 to 3.

The purpose of the pavement investigation was to evaluate the existing pavement structure and the existing subsurface soil and shallow groundwater conditions at the site by advancing 30 shallow boreholes, and provide pavement design recommendations for the reconstruction or rehabilitation of the access roads and existing parking areas, as well as the expansion of one parking area.

The project scope also includes replacement and rehabilitation of the sewer infrastructure which is addressed in a separate report.

Golder Associated Ltd. (Golder) submitted the scope of work and cost estimate for this investigation to Parsons Corporation (Parsons) in a proposal dated November 17, 2015 (P1545167). Authorization to proceed with this investigation was provided by Mr. Jan Wiczorek of Parsons, in an email dated December 22, 2015, and in the signed agreement dated February 1, 2016.

The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within eighteen (18) months of the date of the report, Golder should be given an opportunity to confirm that the recommendations are still valid. In addition, this report should be read in conjunction with the attached "Important Information and Limitations of This Report" included in Appendix A. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

2.0 SITE DESCRIPTION

The following tables summarize the pavement design components in the study area:

EXISTING ROADS				
Section	Road	Starting Station	Ending Station	Approximate Length (km)
Primary Access Road	Pukaskwa Entrance Road	18+000	20+000	2.0
	Administration Building Access Road	6+000	6+621	0.6
Circulation Roads	Pukaskwa Entrance Road	17+664	18+000	0.3
	Visitor's Centre Access Road	5+000	5+244	0.2
	Total Circulation Roads			1.1



PAVEMENT INVESTIGATION AND DESIGN REPORT ROAD RECONSTRUCTION PUKASKWA NATIONAL PARK

EXISTING ROADS

Section	Road	Starting Station	Ending Station	Approximate Length (km)
Area Roads	North Campground Loop	1+000	1+669	0.7
	South Campground Loop - South	3+000	3+298	0.3
	South Campground Loop - East	4+000	4+297	0.3
	South Campground Loop - West	2+000	2+325	0.3
	Lagoon Access Road	10+000	10+437	0.4
	Total Area Roads			

The two existing parking lots that require rehabilitation are as follows:

EXISTING PARKING LOTS

Location	Approximate Area (sq.m)
Visitor Reception Centre	910
Administration Centre	1720
Total	2630

We understand that the parking lot adjacent to the Registration Kiosk at the entrance to the campground will be expanded to include seven additional parking spaces. The Beach Trail parking lot will include 4 spaces.

3.0 DESIGN CRITERIA

The following design standards are from the Design Criteria dated February 26, 2016.

PRIMARY ACCESS ROAD, Pukaskwa Entrance Road

	Present Conditions	Design Standards	Proposed Standards
Functional Highway Classification	RU60	RU60	RU60
Min Stopping Sight Distance	n/a	85	85
Equivalent Minimum "K" Factor	Crest: 5	Crest: 15	Crest: 15
	Sag: 7	Sag: 18	Sag: 18
Grades Maximum (%)	8.9	12	8.9
Radius Minimum	160	130	160
Pavement Width (m)	6.0-7.0 (2 lanes)	6.0	6.5
Shoulder Width	1.0	1.0	1.0
Shoulder Rounding	n/a	0.5	0.5
Posted Speed	50	40	40
Design Vehicle	P, PT, B12, SU	P, PT, B12, SU	P, PT, B12, SU



PAVEMENT INVESTIGATION AND DESIGN REPORT ROAD RECONSTRUCTION PUKASKWA NATIONAL PARK

CIRCULATION ROADS, Pukaskwa Entrance Road, Administration Building Access Road, Visitor's Centre Access Road			
	Present Conditions	Design Standards	Proposed Standards
Functional Highway Classification	RU30	RU30	RU30
Min Stopping Sight Distance	n/a	45	45
Equivalent Minimum "K" Factor	Crest: 3	Crest: 4	Crest: 4
	Sag: 3	Sag: 8	Sag: 8
Grades Maximum (%)	3.3	12	3.3
Radius Minimum	24	55	55
Pavement Width (m)	6.5-7.0 (2 lanes)	5.5	6.5
Shoulder Width	none	1.0	1.0
Shoulder Rounding	n/a	0.5	0.5
Posted Speed	30	30	30
Design Vehicle	P, PT, B12, SU	P, PT, B12, SU	P, PT, B12, SU

AREA ROADS, North Campground Loop, South Campground Loop, Lagoon Access Road			
	Present Conditions	Design Standards	Proposed Standards
Functional Highway Classification	RU20	RU20	RU20
Min Stopping Sight Distance	n/a	20	20
Equivalent Minimum "K" Factor	Crest: 1.5	Crest: 1	Crest: 1.5
	Sag: 2	Sag: 3	Sag: 3
Grades Maximum (%)	6.9	12	6.9
Radius Minimum	20	14	14
Pavement Width (m)	2.5 -3.75 (1 lane)	3.6	3.75
Shoulder Width	none	0.0 – 0.3	0.0
Shoulder Rounding	-	-	0.5
Posted Speed	15	15	15
Design Vehicle	P, PT, SU	P, PT, SU	P, PT, SU

4.0 SOIL CONDITIONS

The Ontario Geologic Society's 1979 Northern Ontario Engineering Geology Terrain Study 60 for the Heron Bay Area (NTS 42D/NE) indicates that Pukaskwa Road and the various campground access roads lie within two different surficial geologic areas within the District of Thunder Bay.

According to the study, the northern portion of the site consisting of Pukaskwa Road near Pic River is within a glaciolacustrine plain, primarily consisting of sandy material, and some silty material. The glaciolacustrine plain has low relief and is characterized as dissected and gullied with mixed drainage conditions (both wet and dry).

The southern portion of the site, consisting of Pukaskwa Road approximately 800 to 900 m south of Pic River and the campground access roads, is within a surficial geologic area characterized with rock knobs consisting of either exposed bedrock or bedrock overlain by a thin veneer of glacial till. The area has higher relief and is characterized as jagged, rugged and cliffed.



5.0 GEOLOGY

Based on the Ontario Geologic Society's digital data set for the Bedrock Geology of Ontario (MRD 126 – Revision 1), the bedrock at the site generally consists of felsic to intermediate metavolcanic rocks including tuffs and breccias with minor metasedimentary and intrusive rock.

6.0 FIELD INVESTIGATION

6.1 Geotechnical Drilling Investigation

The fieldwork for the investigation was carried out the week of January 19, 2016, during which time 30 boreholes (BH1 through BH30) were advanced to practical refusal or to a maximum depth of 2.2 m below ground surface (bgs) at the locations shown on the Borehole Location Plans attached as Figures 1 to 3.

Prior to commencing the investigation a private locator was retained and the borehole locations were cleared of underground infrastructure.

All the boreholes were drilled using a truck-mounted drill rig supplied and operated by KC Drilling Ltd. The fieldwork was carried out under the supervision of members of our engineering staff who directed the drilling operations, logged the boreholes, and obtained samples for further examination and testing. The shallow groundwater conditions were monitored in the open boreholes during drilling. All of the boreholes in the paved areas were backfilled and sealed with cold-mix asphalt at the surface, whereas the boreholes in the unpaved areas were backfilled with auger cuttings upon completion of drilling.

The borehole locations were marked out in the field based on stationing provided by a survey sub-consultant retained by PARSONS. Geodetic elevations of the borehole locations were provided by the survey sub-consultant. The locations of the boreholes as shown on the Borehole Location Plan should be considered as approximate.

All of the granular and soil samples obtained during this investigation were brought to our Whitby laboratory for further visual examination, and natural water content and classification testing on selected samples.

7.0 SUBSURFACE CONDITIONS

The existing pavement structures, subgrade soil and shallow groundwater conditions encountered in the boreholes, as well as the results of the field and the geotechnical laboratory testing, are shown in detail on the Record of Pavement Borehole sheets (Table 1) and on Figures 4 through 7 following the text of this report. The Method of Soil Classification and Symbols and Terms Used on the Records of Pavement Boreholes sheets are provided to assist in the interpretation of the logs.

It should be noted that the boundaries between the strata on the borehole logs have been inferred from drilling observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes. The following is a summarized account of the subsurface conditions encountered in the boreholes drilled at the site, followed by more detailed descriptions of the existing pavement structures, major subgrade soil strata and shallow groundwater conditions.

Underlying the pavement structure, the subsurface soil conditions generally consists of sand or silty sand with occasional cobbles, boulders and bedrock. A layer of clayey silt was encountered in Borehole 9.



7.1 Pavement Structure and Subgrade Conditions

The pavement structure encountered at the borehole locations drilled along existing roads is summarized as follows:

LOCATION		THICKNESS OF PAVEMENT LAYERS AND SUBGRADE TYPE			
		Average (Min-Max)			
Road Classification	Borehole Numbers	Asphalt (mm)	Base (mm)	Subbase (mm)	Subgrade Type
Primary Access Road	6 – 13	65 (50-175)	280 (150-450)	790* (0-1880)	<ul style="list-style-type: none"> • Sand, Silty • Sand, • Boulders and Bedrock • Localized Clayey Silt
Circulation Roads	5, 15, 16 17, 26	55 (50-75)	200 (110-280)	1350 (370-2020)	<ul style="list-style-type: none"> • Sand • Boulders
Area Roads	1, 2, 18 – 23, 25	-	150 (50-340)	-	<ul style="list-style-type: none"> • Sand
Existing Parking Lot Visitor Reception Centre	27 - 30	50 (50-55)	250 (160-300)	-	<ul style="list-style-type: none"> • Sand
Existing Parking Lot – Administration Center	3, 4	70 (60-75)	180 (160-200)	-	<ul style="list-style-type: none"> • Sand
Proposed Parking Expansion - Campground Entrance Registration Kiosk	14		200	-	<ul style="list-style-type: none"> • Bedrock

*An existing subbase thickness of 300 mm has been assumed for design.

The base material generally consists of a brown silty crushed gravelly sand and the subbase material consists of brown fine to coarse sand, trace to some silt, trace cobbles. The results of the gradation testing carried out on two granular base samples indicate that the material generally does not meet the OPSS 1010 specification for Granular A (too fine on multiple sieves and too silty). The gradations of the granular base samples tested are provided on Figure 4.

Two of the four granular subbase samples tested did not meet the OPSS 1010 specification for Granular B, Type I due to excessive fines. The results of the gradation testing carried out on the granular subbase samples are provided on Figure 5. In many of the boreholes, the subbase material and subgrade material were similar and the layer boundary between the two layers could not be delineated.

The subgrade and subbase materials encountered generally have low frost susceptibility. A localized deposit of highly frost susceptible clayey silt was encountered in Borehole 9 at a depth of 1.9 m; however, based on the pavement condition, it does not appear to be impacting pavement performance. The results of the particle size distribution tests carried out on selected subgrade soil samples are provided on Figures 6 and 7.



7.2 Groundwater Conditions

The groundwater conditions observed during our January 2016 investigations were as follows:

Observed Groundwater Conditions		
Area	Borehole Number	Water Level (m)
Pukaskwa Road	7	1.2
	9	0.85
North Campground gravel road (North Loop)	19	1.3
	20	1.5
South Campground gravel roads (South Loop)	21	1.2
	22	0.56
	23	1.5
	24	1.4
	25	1.3
Visitors Centre Parking Area	28	1.7

It should be noted that the groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

Rock was encountered in a number of boreholes. Details regarding depth to rock and potential impact on trenching for storm sewer/forecmain will be presented in the Supplemental Geotechnical Report.

8.0 DISCUSSION

This section of the report provides engineering information for the geotechnical and pavement design aspects of the project, based on our interpretation of the borehole data and on our understanding of the project requirements. The information in this portion of the report is provided for the guidance of the design engineers and technicians. Where comments are made on construction, they are provided only in order to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

9.0 PAVEMENT DESIGN CONSIDERATIONS

The AASHTO 93 method has been used for the design of the pavement structure.

Traffic within the Park's road network is limited to visitors and park staff and there is no through traffic. The park's entrance is located at the end of Highway 627. The vehicle types that utilize the road network include passenger cars, recreational vehicles and trailers, buses and single unit trucks (maintenance vehicles). Large commercial trucks are not anticipated within the park.

The number of visitors for the 2015 to 2017 period and the number of recreational vehicles, buses and light trucks are as follows:



Visitor and Traffic Information			
Vehicle Type	Year	Number of Trips/Year	Average Truck Factor
Passenger Cars	2015	4950	0
	2016	5050	0
	2017	5150	0
Recreational Vehicles	-	2205	1.1
Buses	-	15	1.1
Light Trucks	-	3650 (10 trips/day)	0.8 (FHWA Class 6)

For pavement design purposes, it is assumed that two visitors arrive in each vehicle. The traffic volume growth rate is approximately 2%.

Based on the above traffic information, the site conditions and material properties outlined in Section 7.0 of the report, the following design parameters are selected.

Design Consideration	Parameter Selected
Pukaskwa Primary Access Road 18 Year ESALs	140,000
Initial Serviceability	4.2
Terminal Serviceability	2.0
Reliability Level (%)	85
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus (MPa)	40
Structural Coefficient of New Asphalt	0.42
Structural Coefficient of New Granular Base	0.14
Structural Coefficient of Existing Granular Base	0.11
Drainage Coefficient of Existing Granular Base	0.9
Structural Coefficient of New Granular Subbase	0.09
Structural Coefficient of Existing Granular Subbase	0.07
Drainage Coefficient of Existing Granular Subbase	0.9
Required Structural Number	67

The AASHTO design sheets are attached in Appendix B.

10.0 PAVEMENT DESIGN CONSIDERATIONS

Parsons has provided a list of four Options (Options A to D) considering varying levels of serviceability levels and design lives. The four options from a pavement engineering perspective are as follows:

- Option A – Full Depth Reconstruction (18 Year Design Life)
- Option B and C – Major Rehabilitation (15 Year Design Life)



- Option D – Minor Rehabilitation/Preservation/Holding Strategy (3-5 Year Design Life)

Based on the design analysis using AASHTO 93, the following pavement designs are recommended for the various project components. The selection of a reconstruction or rehabilitation strategy will be dependent on the location of the sewer/forcemain replacement locations. If the excavations for sewer/forcemain do not extend into the existing roadway, then a rehabilitation strategy should be selected.

Option A – Primary Access Roads, Circulation Roads and Existing/Proposed Parking Lots – Reconstruction/Expansion

- Excavate to a depth of 360 mm and place:
- 60 mm Superpave 12.5 or HL-3
- 300 mm Granular A

The backfill material placed in trenches for sewer/forcemain replacement should be compacted to 100% of the backfill material's Standard Proctor Density within 1 m of the bottom of the pavement. Specifications for backfill material will be provided in the supplemental report.

Options B and C - Primary Access Roads and Circulation Roads and Existing Parking Lots – Rehabilitation

- In-place process to a depth of 150 mm starting 15 m from Highway 627
- Pave with 60 mm of Superpave 12.5 or HL-3

Alternately, the asphalt can be removed full depth, the exposed granular materials re-graded and the grade brought to 60 mm below finished pavement grade using new Granular A base material prior to placing 60 mm of new asphalt. This option is recommended by Golder for Primary Access Roads, Circulation Roads and Existing Parking Lots and was selected by Parks Canada as the preferred strategy.

Option A - Area Roads – Reconstruction

Excavate to provide for:

- 300 mm Granular A

Options B, C and D – Area Roads – Rehabilitation

Add 200 mm of Granular A. This option is recommended by Golder for the Area Roads and was selected by Parks Canada as the preferred strategy.

Option D – Primary Access Roads and Circulation Roads and Existing Parking Lots – Minor Rehabilitation/Preservation/Holding Strategy

Micro-surfacing is a lower cost pavement preservation strategy that will extend the pavement service life by three to five years. The micro-surfacing mixture consists of a polymer modified asphalt emulsion, fine-medium graded high quality aggregate, filler, additives and water. A 10 mm lift of the material is applied to the existing asphalt surface. Micro-surfacing work should be completed in accordance with OPSS 336.



10.1 Asphalt Mix Type and Performance Graded Asphalt Cement

The SP12.5 surface course asphalt mix should be designed for Category B or higher. Performance graded PG 52-34 cement should be used on this project.

10.2 Pavement Distress Areas

A number of Pavement Distress Areas with moderate rutting were identified along Pukaskwa Road, from Sta. 18+900 to Sta. 19+000 and from Sta. 19+500 to Sta. 19+550. The following treatments should be completed depending on the Option selected.

- Option A – Full Depth Reconstruction – Raise grade by 200 mm by increasing the Granular A thickness to 500 mm
- Option B and C – Major Rehabilitation – Add 200 mm of Granular A after completion of IPP.
- Option D – Extend micro-surfacing through the distress area limits. Additional rutting is anticipated to form after the first spring-thaw if this option is selected.

10.3 Paved Shoulders or Bike Lanes

Option A – Full Depth Reconstruction

Paved shoulder and bike lanes should be constructed using the same pavement structure recommended for the main lanes in Section 10. Bike lanes are proposed along Pukaskwa Road from Sta. 17+880 to Sta. 20+000, along the Visitor Centre Road from Sta. 0+000 to the existing parking lot, and along the Administrative Centre Road from Sta. 0+000 to Sta. 0+300.

10.4 Compaction Requirements

Adequate compaction of all granular and earth fill materials is essential to ensure an acceptable level of pavement performance. Compaction of all materials should be carried out in conformance with the procedures outlined in OPSS.PROV 501, dated November 2014.

10.5 Conversion Factors

For estimating purposes, the following granular and hot mix asphalt conversion factors may be used to convert from volume (m^3) to mass (tonne):

- Granular A – 2.4 t/m^3
- Granular B, Type I – 2.0 t/m^3
- Superpave 12.5 or HL-3 – 2.46 t/m^3
- Existing Hot Mix Asphalt for Removals – 2.46 t/m^3



10.6 Pavement Transitions

The recommended pavement transition for the tie-in to existing Highway 627 is as follows:

Existing and Future Roadway, Tie-in Station and Proposed Asphalt Thickness	Existing Pavement Thickness (mm)	Recommended Pavement Transition Treatment
Highway 627 – Pukaskwa Road	175 mm HMA	- A transverse step joint 60 mm deep and 5 m long to key in the surface course of new pavement into the existing pavement on Highway 627.

10.7 Frost Penetration Depth

The depth of frost penetration for this project should be taken as 2.2 m. This depth should be used when designing frost tapers in accordance with the OPSD 803 series.

11.0 MONITORING AND TESTING

The geotechnical and pavement aspects of the final design drawings and specifications should be reviewed by this office prior to tendering and construction, to confirm that the intent of this report has been met. During construction, sufficient in-situ materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes and to monitor conformance to the pertinent project specifications. Testing of the asphalt mixes and granular base materials should be carried out in a CCIL certified laboratory.

12.0 CLOSURE

We trust that this report provides sufficient geotechnical and pavement engineering information to facilitate the design of this project. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.



Report Signature Page

GOLDER ASSOCIATES LTD.



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Principal, Pavement and Materials Engineer

KM/JBH/ACB/nh/leb

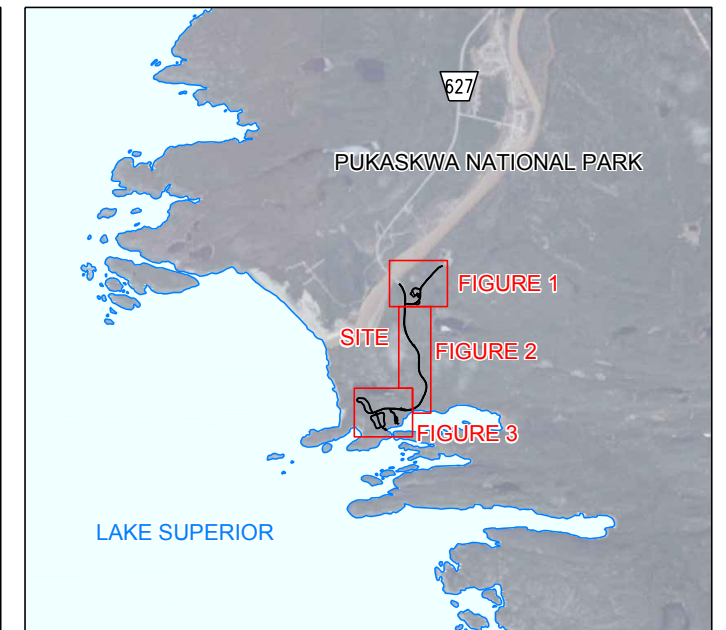
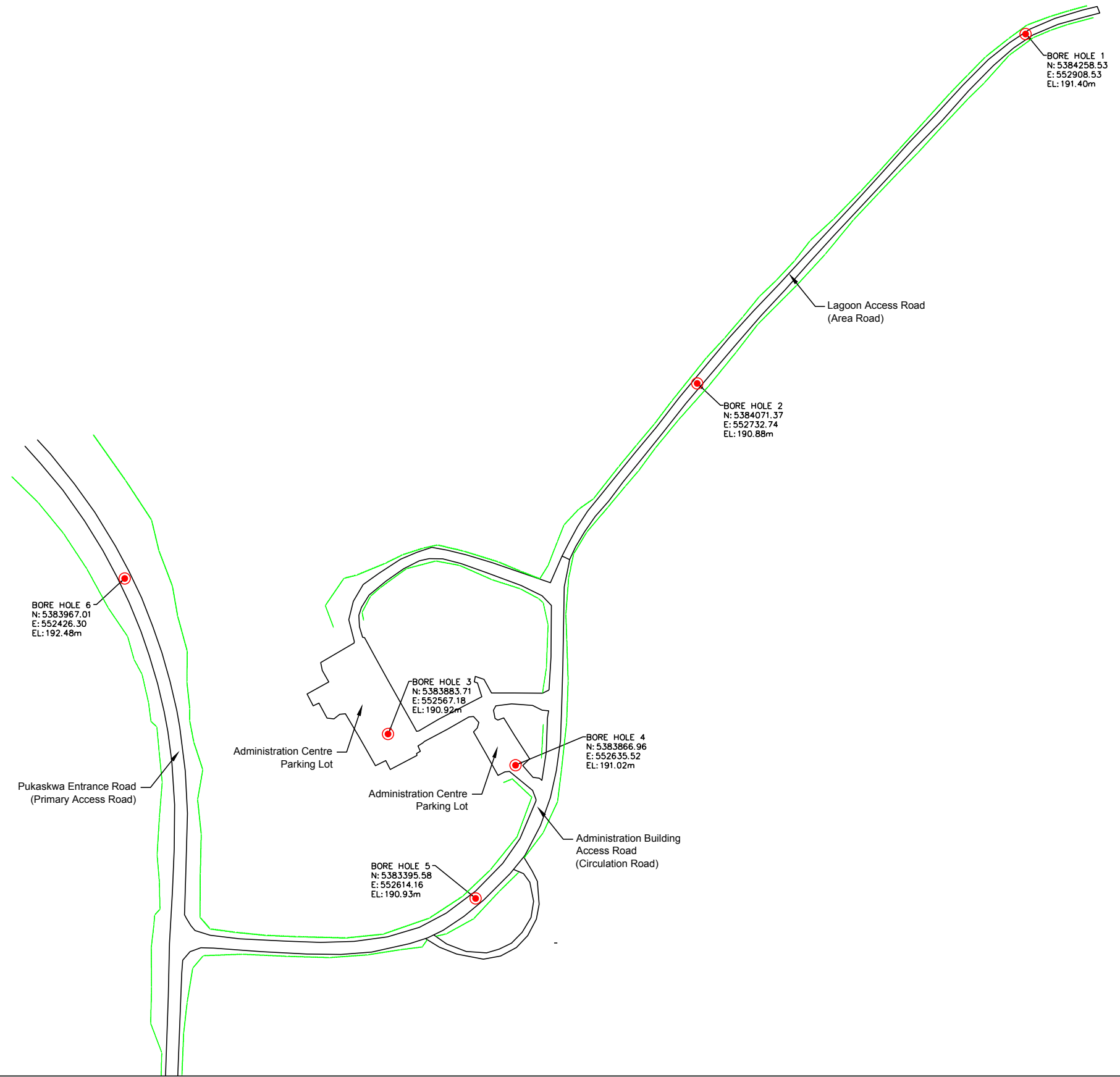
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ATTACHMENTS

**Figures 1 to 7
Record of Borehole Logs**



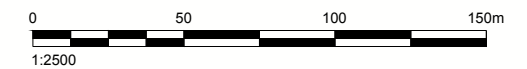
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LEGEND

● BOREHOLE LOCATION

NOTES


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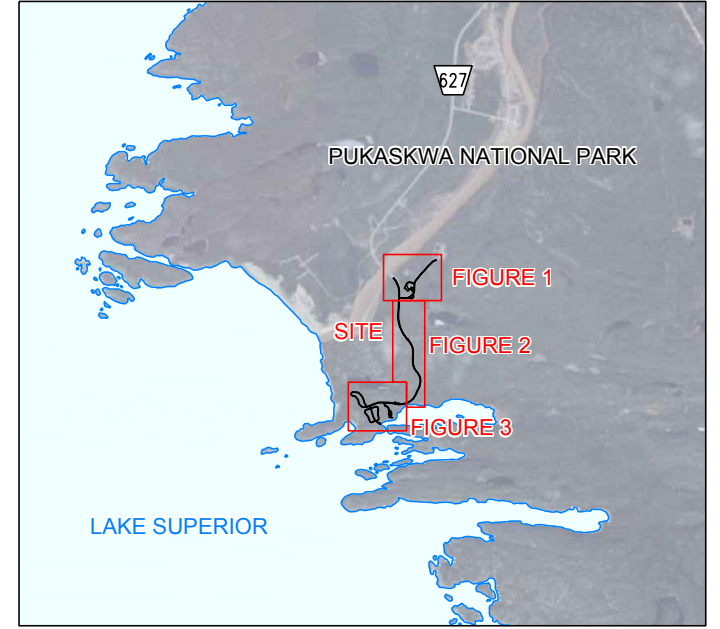
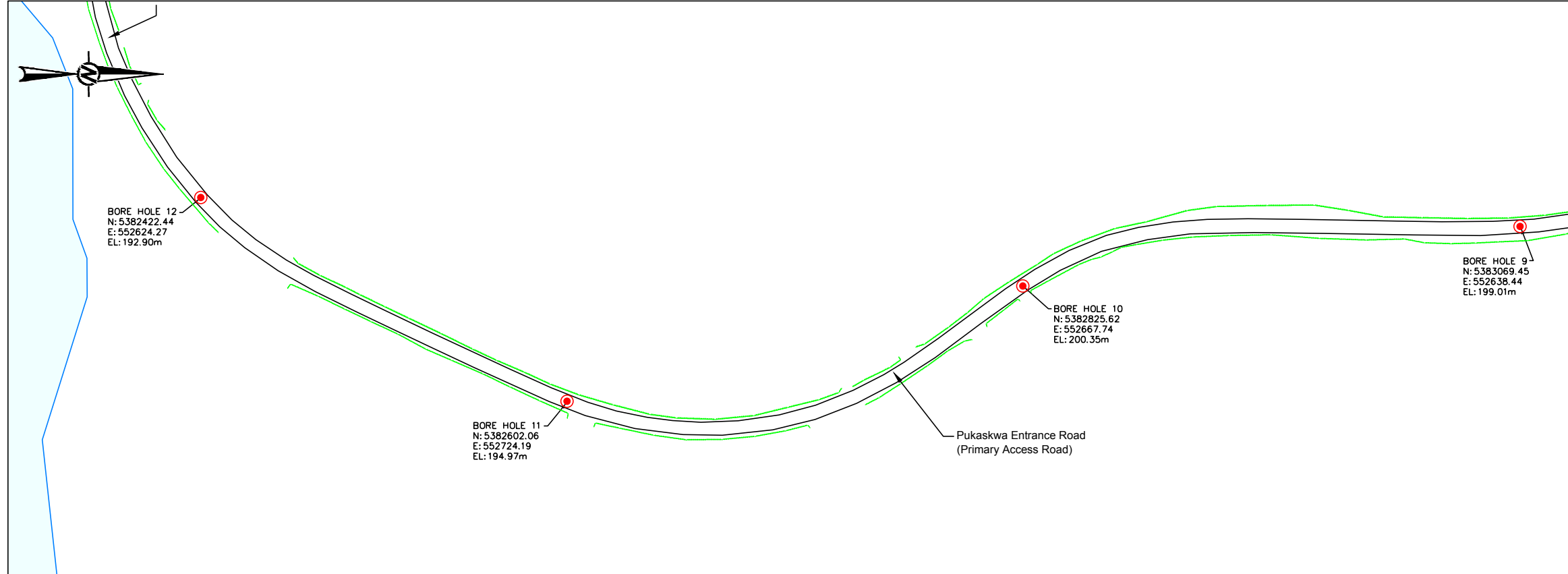


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PARKS CANADA

PROJECT
ROAD RECONSTRUCTION
PUKASKWA NATIONAL PARK
HERON BAY, ONTARIO

TITLE
BOREHOLE LOCATION PLAN

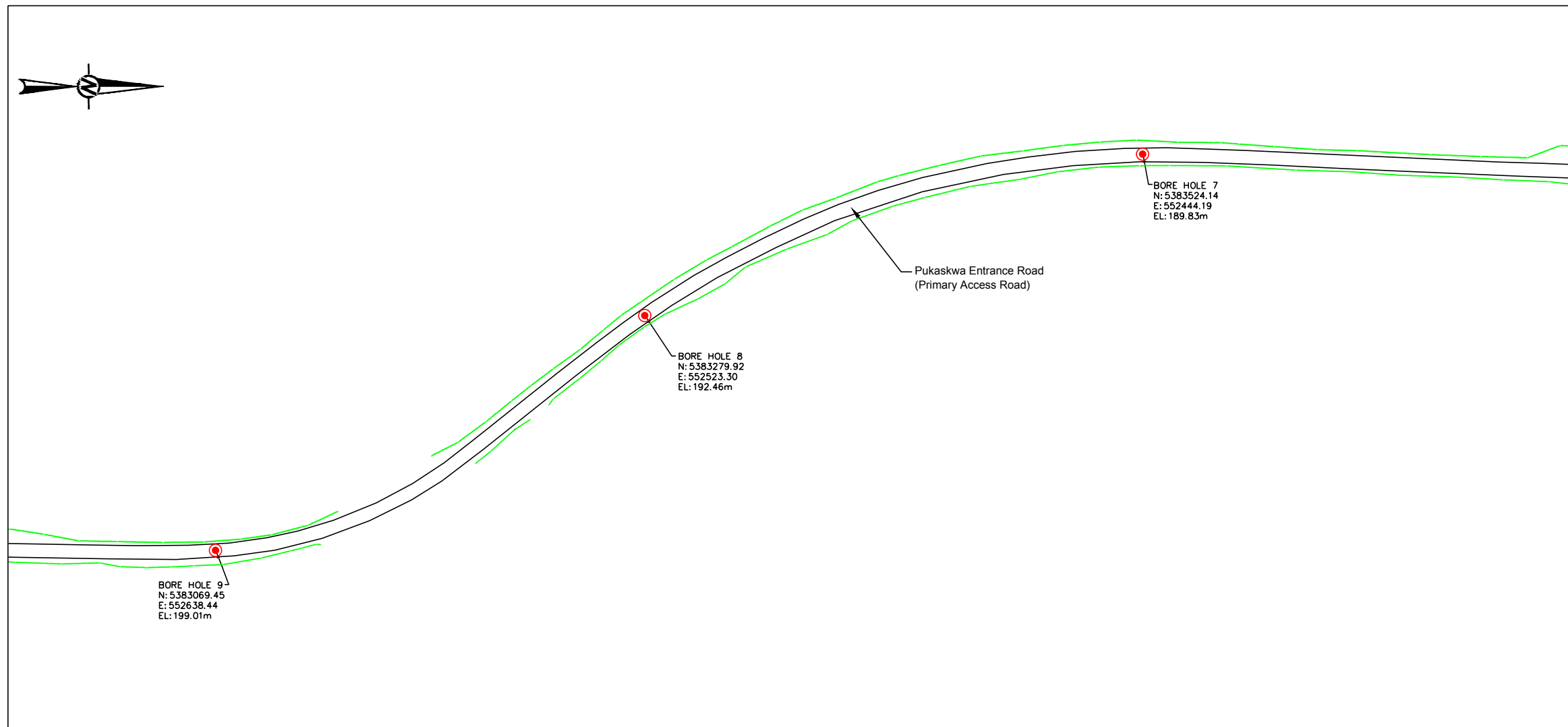
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	DESIGN	
	REVIEW	JBH
	APPROVED	ALB



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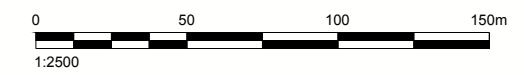
LEGEND

- BOREHOLE LOCATION



NOTES


1. DATUM UTM NAD 83 ZONE 16
2. MAPPING BASED ON CALLON DIETZ INC. ONTARIO LAND SURVEYORS (DRAWING NO. 16-20450 SHEET 1-3)

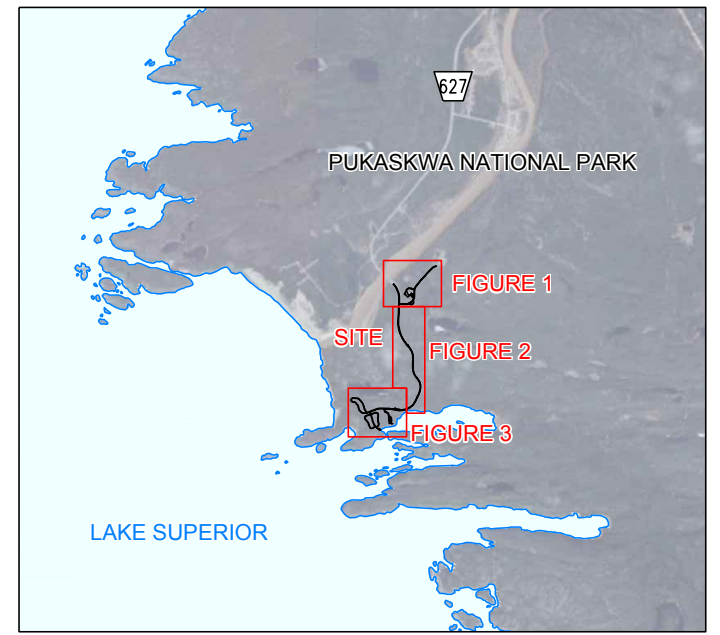
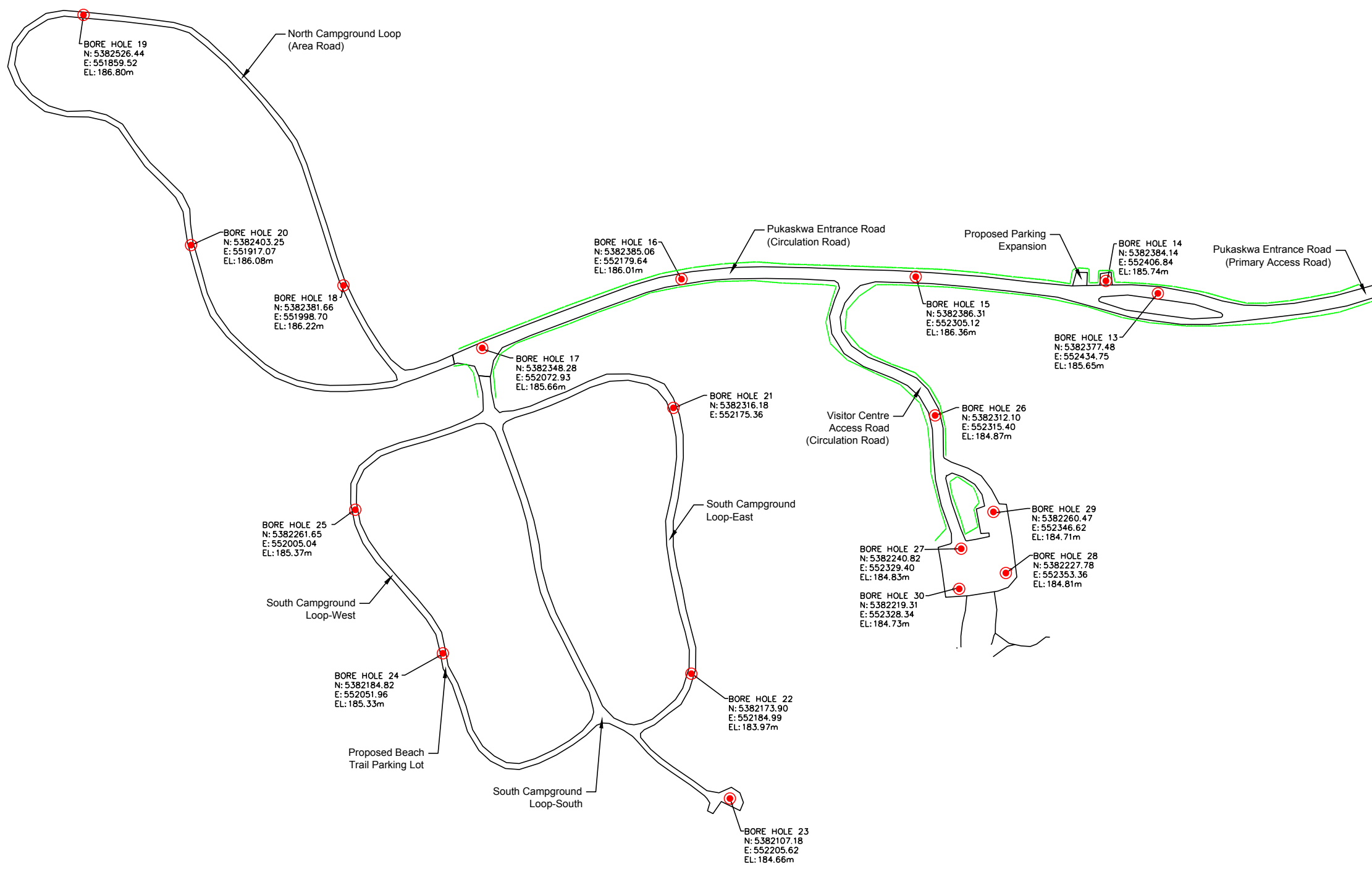


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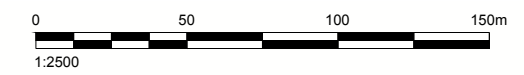
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LEGEND

- BOREHOLE LOCATION

NOTES

- DATUM UTM NAD 83 ZONE 16
- MAPPING BASED ON CALLON DIETZ INC. ONTARIO LAND SURVEYORS (DRAWING NO. 16-20450 SHEET 1-3)



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HERON BAY, ONTARIO**

TITLE
BOREHOLE LOCATION PLAN

CONSULTANT	YYYY-MM-DD	2016-05-09
	PREPARED	STB
	DESIGN	
	REVIEW	JBH
	APPROVED	ALB

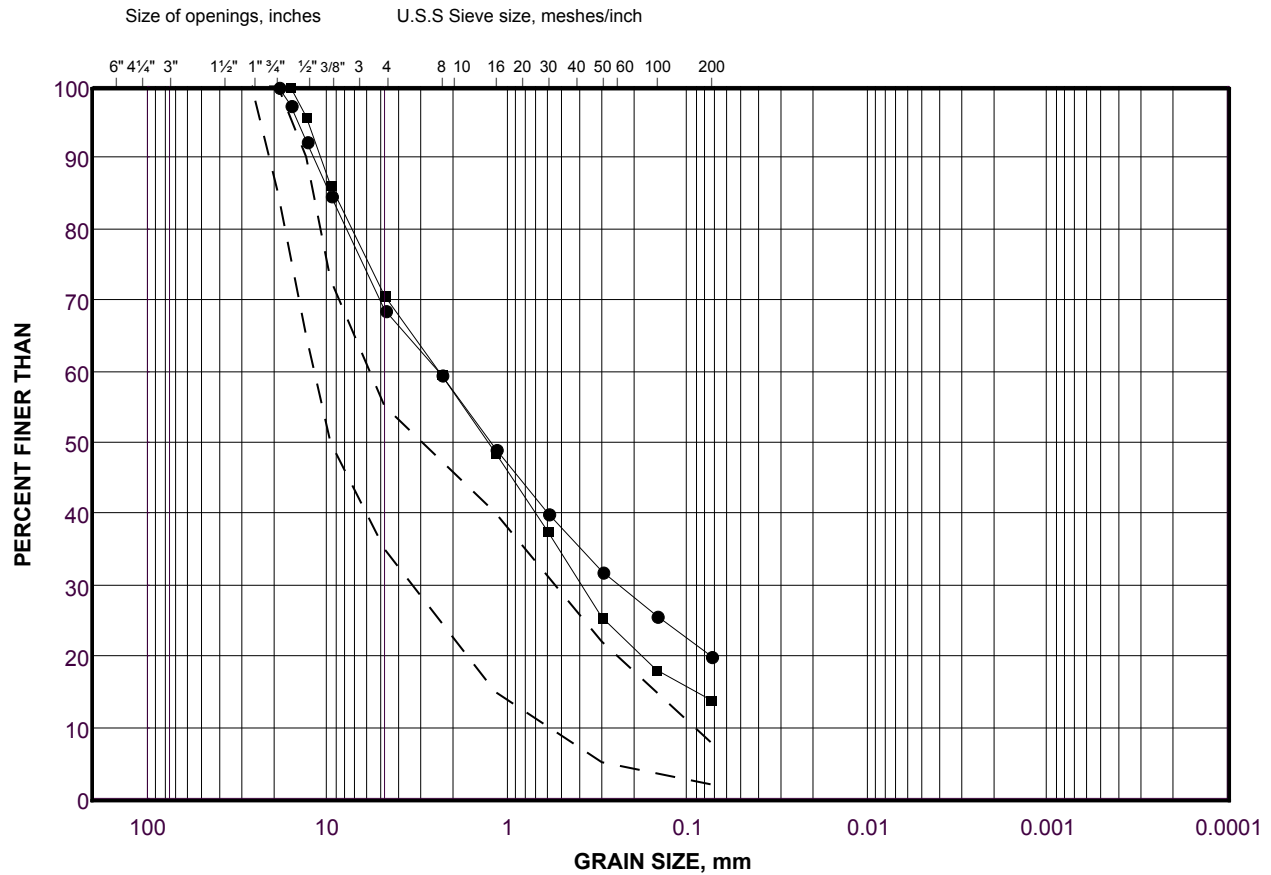
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GRAIN SIZE DISTRIBUTION

Granular A

FIGURE 4



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	12	10	50.0 - 370.0
■	19	2	0.0 - 300.0

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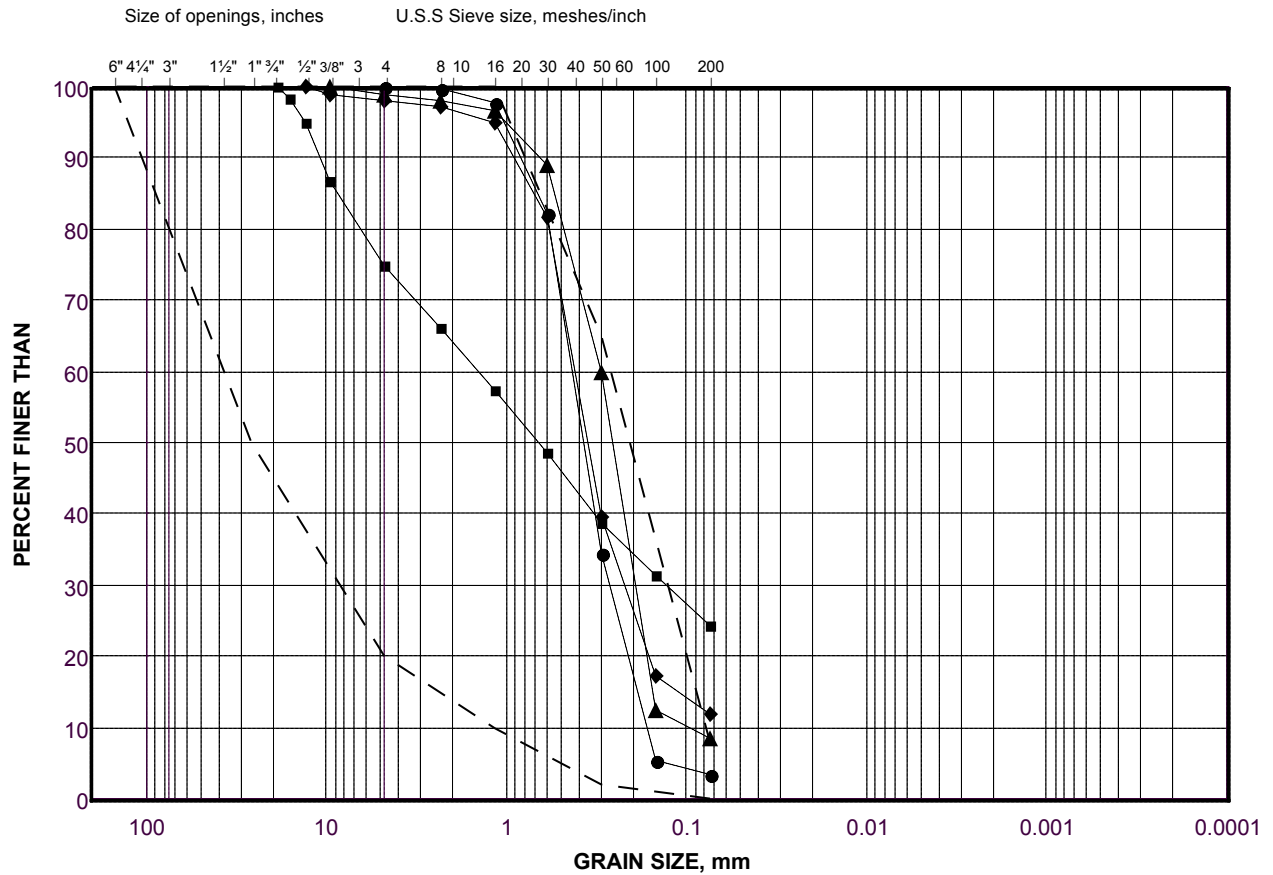
Golder Associates

Date: 23-Feb-16

GRAIN SIZE DISTRIBUTION

Granular B Type 1

FIGURE 5



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	18	1	1.80 - 2.10
■	8	13	300.0 - 600.0
◆	23	4	500.0 - 800.0
▲	27	8	1.50 - 1.80

Project Number: 15-45167

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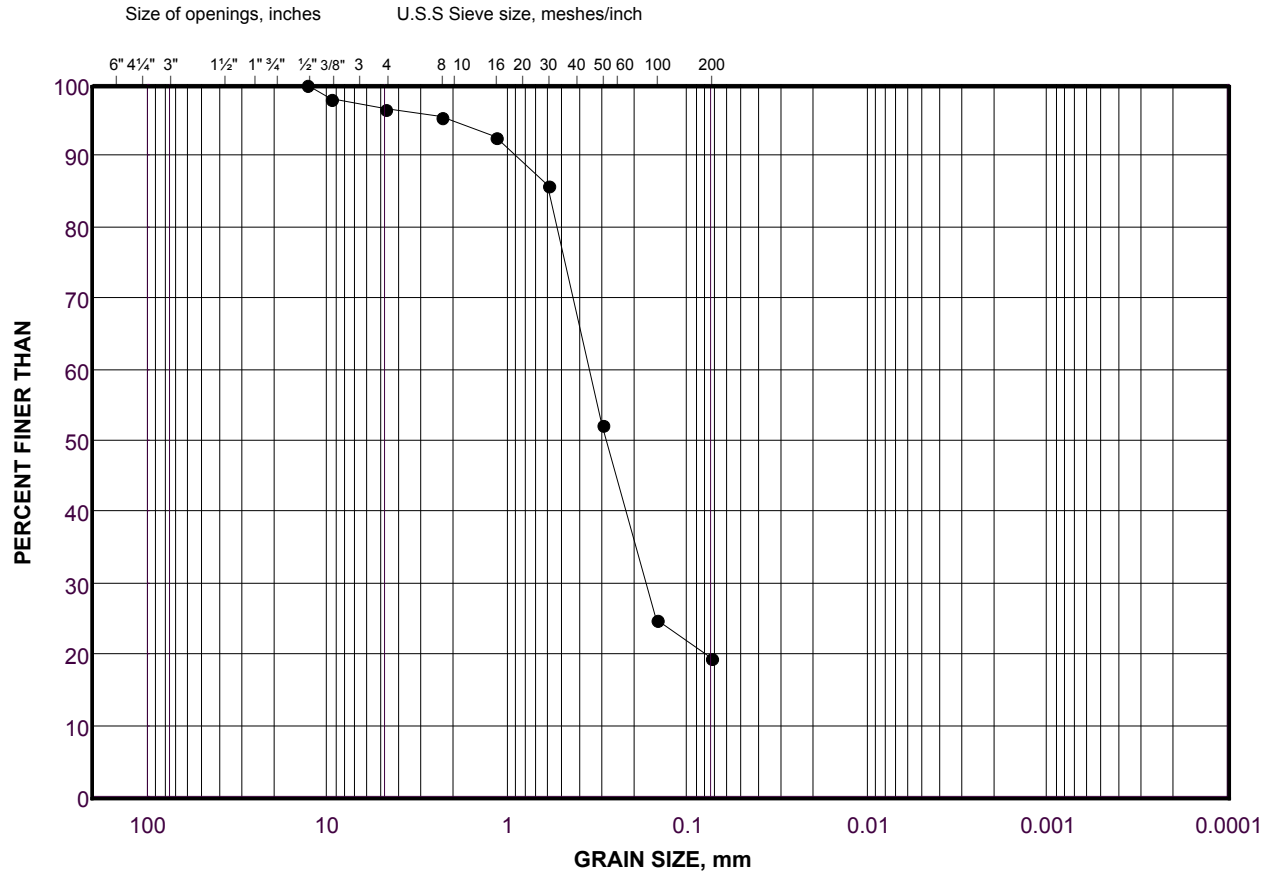
Golder Associates

Date: 23-Feb-16

GRAIN SIZE DISTRIBUTION

Silty Sand

FIGURE 6



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES FINE GRAINED
	GRAVEL SIZE		SAND SIZE			

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	9	12	700.0 - 1.0

Project Number: 15-45167

Checked By: _____

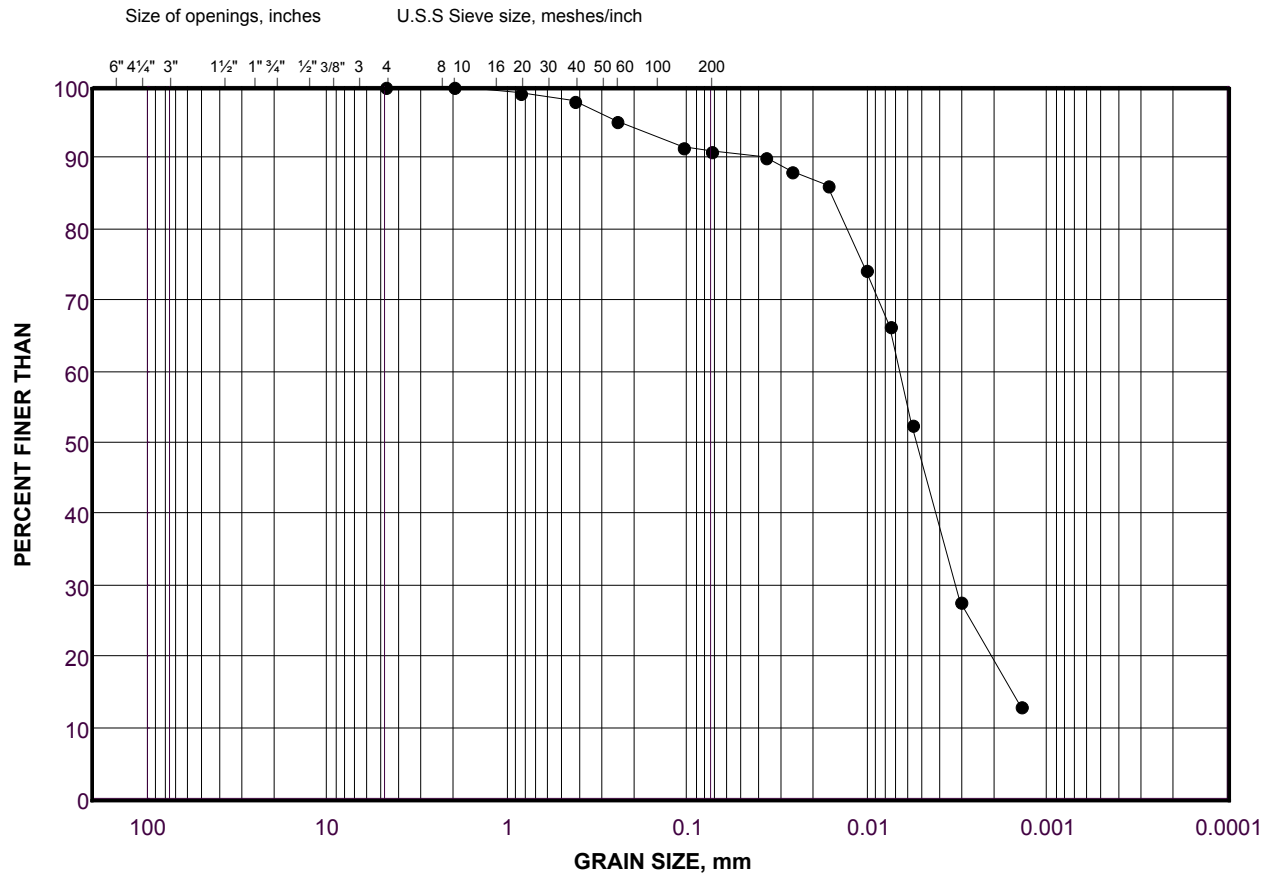
Golder Associates

Date: 23-Feb-16

GRAIN SIZE DISTRIBUTION

Clayey Silt

FIGURE 7



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
	GRAVEL SIZE		SAND SIZE			

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	9	18	1.90 - 2.20

Project Number: 15-45167

Checked By: _____

Golder Associates

Date: 23-Feb-16

**TABLE 1
RECORD OF PAVEMENT BOREHOLES**

Borehole No.	BOREHOLE LOG				LABORATORY TESTING		
	Depth (mm/m)		Sample Depth (mm)	Frost Susceptibility	K Factor (Erodability)	Water Content (%)	Gradation
Location	See borehole plan						
BH1	0 - 50 50 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, moist, compact					
Location	See borehole plan						
BH2	0 - 80 80 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, moist, compact					
Location	See borehole plan						
BH3	0 - 60 60 - 220 220 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, moist, compact					
Location	See borehole plan						
BH4	0 - 75 75 - 270 270 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, moist, compact					
Location	See borehole plan						
BH5	0 - 55 55 - 240 240 - 760 760 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown SAND with gravel, with silt, moist, compact Brown fine to coarse SAND, trace gravel, trace silt, moist, wet @ 1.5 m, compact					
Location	See borehole plan						
BH6	0 - 175 175 - 330 330 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown SAND trace gravel, trace silt, moist, compact					
Location	See borehole plan						
BH7	0 - 50 50 - 320 320 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, free water @ 1.2 m, saturated, compact					
Location	See borehole plan						
BH8	0 - 50 50 - 280 280 - 1.1 - 1.1	Asphalt Brown Crushed GRAVELLY SAND Brown gravelly SILTY SAND, trace cobbles, moist, compact NFP Boulders	300 - 600	LSFH	0.05	5	Figure 5, Unacceptable Granular B Type I, too silty
Location	See borehole plan						
BH9	0 - 50 50 - 300 300 - 690 690 - 1.9 1.9 - 2.2	Asphalt Brown Crushed GRAVELLY SAND Brown SAND, trace gravel, trace silt, trace cobbles, moist, compact Brown SILTY SAND, trace gravel, wet, free water @ 850 mm, saturated, compact Grey CLAYEY SILT, some sand, wet, firm	700 - 1.0 1.9 - 2.2	LSFH HSFH	0.1 0.35	13 23	Figure 6 Figure 7
Location	See borehole plan						
BH10	0 - 50 50 - 350 350 - 1.7 - 1.7	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, compact NFP Boulders					

**TABLE 1
RECORD OF PAVEMENT BOREHOLES**

Borehole No.	BOREHOLE LOG				LABORATORY TESTING		
	Depth (mm/m)		Sample Depth (mm)	Frost Susceptibility	K Factor (Erodability)	Water Content (%)	Gradation
Location	See borehole plan						
BH11	0 - 50 50 - 500 - 500	Asphalt Brown crushed GRAVELLY SAND NFP Shattered Rock over Bedrock					
Location	See borehole plan						
BH12	0 - 50 50 - 370 - 370	Asphalt Brown crushed silty GRAVELLY SAND NFP Bedrock	50 - 370	LSFH	0.04	4.5	Figure 4, Unacceptable Granular A, too fine on multiple sieves & too silty
Location	See borehole plan						
BH13	0 - 60 0 - 60 60 - 400 - 400	Asphalt Asphalt Brown GRAVELLY SAND NFP Bedrock					
Location	See borehole plan						
BH14	0 - 200 - 200	Brown crushed GRAVELLY SAND NFP Bedrock					
Location	See borehole plan						
BH15	0 - 50 50 - 230 230 - 600 - 600	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND with gravel, trace silt, trace cobbles, moist, compact NFP Probable Bedrock					
Location	See borehole plan						
BH16	0 - 50 50 - 310 310 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, moist, compact					
Location	See borehole plan						
BH17	0 - 70 70 - 180 180 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, wet @ 1.7 m, compact					
Location	See borehole plan						
BH18	0 - 170 170 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace silt, moist, wet @ 1.8 m, compact	1.8 - 2.1	LSFH	0.05	18	Figure 5, Acceptable Granular B Type I
BH19	0 - 340 340 - 2.2	Brown crushed silty GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, free water @ 1.3 m, saturated, compact	0 - 300	LSFH	0.05	9	Figure 4, Unacceptable Granular A, too fine on multiple sieves & too silty
Location	See borehole plan						
BH20	0 - 50 50 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, free water @ 1.5 m, saturated, compact					

**TABLE 1
RECORD OF PAVEMENT BOREHOLES**

Borehole No.	BOREHOLE LOG				LABORATORY TESTING		
	Depth (mm/m)		Sample Depth (mm)	Frost Susceptibility	K Factor (Erodability)	Water Content (%)	Gradation
Location	See borehole plan						
BH21	0 - 120 120 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, free water @ 1.2 m, saturated, compact					
Location	See borehole plan						
BH22	0 - 150 150 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, wet, free water @ 560 mm, saturated, compact					
Location	See borehole plan						
BH23	0 - 250 250 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, some silt, moist, free water @ 1.5 m, saturated, compact	500 - 800	LSFH	0.05	10	Figure 5, Unacceptable Granular B Type I, too silty
Location	See borehole plan						
BH24	0 - 160 160 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, moist, free water @ 1.4 m, saturated, compact					
Location	See borehole plan						
BH25	0 - 140 140 - 2.2	Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, free water @ 1.3 m, saturated, compact					
Location	See borehole plan						
BH26	0 - 55 55 - 330 330 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, compact					
Location	See borehole plan						
BH27	0 - 50 50 - 350 350 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, some silt, trace cobbles, moist, wet @ 1.5 m, compact	1.5 - 1.8	LSFH	0.05	17	Figure 5, Acceptable Granular B Type I
Location	See borehole plan						
BH28	0 - 50 50 - 210 210 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, free water @ 1.7 m, saturated, compact					
Location	See borehole plan						
BH29	0 - 55 55 - 310 310 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, moist, wet @ 1.8 m, compact					
Location	See borehole plan						
BH30	0 - 50 50 - 330 330 - 2.2	Asphalt Brown crushed GRAVELLY SAND Brown fine to coarse SAND, trace gravel, trace silt, trace cobbles, moist, wet @ 1.6 m, compact					



APPENDIX A

Important Information and Limitations of This Report



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

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Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



APPENDIX B

Pavement Design Analysis

Table B1
PAVEMENT DESIGN AND ANALYSIS - FLEXIBLE STRUCTURAL DESIGN MODULE

PUKASKWA ROAD RECONSTRUCTION PROJECT
Option A - 18 YEAR DESIGN FOR RECONSTRUCTION OF PUKASKWA ACCESS ROAD

Flexible Structural Design

80-kN ESALs Over Initial Performance Period	140,000
Initial Serviceability	4.0
Terminal Serviceability	2.0
Reliability Level (%)	85
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	40,000 kPa
Stage Construction	1.0
Calculated Design Structural Number	67

Specified Layer Design

<u>Layer</u>	<u>Material Description</u>	Struct Coef. <u>(Ai)</u>	Drain Coef. <u>(Mi)</u>	Required		Calculated <u>SN (mm)</u>
				Thickness <u>(Di) (mm)</u>	Thickness <u>(mm)</u>	
1	New Hot Mix Asphalt	0.42	1.00	60	60	25
2	New Granular A Base	0.14	1.00	300	300	42
Total	-	-	-	360	360	67

Layered Thickness Design

<u>Layer</u>	<u>Material Description</u>	Struct Coef. <u>(Ai)</u>	Drain Coef. <u>(Mi)</u>	Actual		Elastic Modulus <u>(kPa)</u>	Calculated Thickness <u>(mm)</u>	Calculated <u>SN (mm)</u>
				Spec Thickness <u>(Di) (mm)</u>	Min Thickness <u>(Di) (mm)</u>			
1	New Hot Mix Asphalt	0.42	1.00	-	-	2,750,000	84	35
2	New Granular A Base	0.14	1.00	-	-	210,000	231	32
Total	-	-	-	-	-	-	314	67

Table B2
PAVEMENT DESIGN AND ANALYSIS - FLEXIBLE STRUCTURAL DESIGN MODULE

PUKASKWA ROAD RECONSTRUCTION PROJECT
Option B and C - 18 YEAR DESIGN FOR REHABILITATION OF PUKASKWA ACCESS ROAD

Flexible Structural Design

80-kN ESALs Over Initial Performance Period	140,000
Initial Serviceability	4.0
Terminal Serviceability	2.0
Reliability Level (%)	85
Overall Standard Deviation	0.49
Roadbed Soil Resilient Modulus	40,000 kPa
Stage Construction	1.0
Calculated Design Structural Number	67

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Required		Calculated SN (mm)
				Thickness (Di) (mm)	Thickness (mm)	
1	New Hot Mix Asphalt	0.42	1.00	60	60	25
2	Pulverized Base	0.13	1.00	150	150	20
3	Existing Granular Base	0.11	0.90	195	195	19
4	Existing Granular Subbase	0.07	0.90	300	300	19
Total	-	-	-	705	705	83

Layered Thickness Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Actual		Elastic Modulus (kPa)	Calculated Thickness (mm)	Calculated SN (mm)
				Spec Thickness (Di) (mm)	Min Thickness (Di) (mm)			
1	New Hot Mix Asphalt	0.42	1.00	-	-	2,750,000	84	35
2	Pulverized Base	0.13	1.00	-	-	210,000	0	0
3	Existing Granular Base	0.11	0.90	-	-	210,000	117	12
4	Existing Granular Subbase	0.07	0.90	-	-	105,000	328	21
Total	-	-	-	-	-	-	529	68

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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December 7, 2016

GEOTECHNICAL DESIGN REPORT

Geotechnical Investigation and Design for Proposed Replacement and Rehabilitation of the Sewer Infrastructure at Pukaskwa National Park, Heron Bay, Ontario

Submitted to:
PARSONS
Attention: Mr. Jan Wiczorek, P.Eng.
625 Cochrane Drive, Suite 500
Markham, ON L3R 9R9

REPORT

Report Number: 1545167

Distribution:

2 Copy - PARSONS
2 Copy - Parks Canada
1 Copy - Golder Associates Ltd.





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1.0 INTRODUCTION

This report presents the results of geotechnical explorations, testing and engineering carried out for the proposed sewer infrastructure replacement and rehabilitation at the Pukaskwa National Park, near Heron Bay, Ontario (Park). The geotechnical engineering components of the project include the removal and replacement and/or new installation of approximately 3.5 km of sanitary force mains and gravity sewers. In addition, one existing pump station is proposed for replacement. The location of the site is shown on the Borehole Location Plans attached as Figures 1 to 3.

The purpose of the work was to evaluate the existing subsurface soil and shallow ground water condition at the site by advancing 21 boreholes to depths ranging from 5 m to 8 m and provide geotechnical design recommendations for the removal and replacement and/or installation of the sanitary force mains, gravity sewers and a sanitary pump station (SPS).

The project scope also includes reconstruction and rehabilitation of the Park's access roads which has been addressed in a separate report, "Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation of Pukaskwa National Park" submitted on December 7, 2016.

Golder Associates Ltd. (Golder) submitted the scope of work and cost estimate for this work to Parsons in a proposal dated November 17, 2015 (P1545167). Authorization to proceed was provided by Mr. Jan Wieczorek of Parsons, in an email dated December 22, 2015, and in the signed agreement dated February 1, 2016.

The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within eighteen (18) months of the date of the report, Golder should be given an opportunity to confirm that the recommendations are still valid. In addition, this report should be read in conjunction with the attached "Important Information and Limitations of This Report" included in Appendix A. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

2.0 SITE DESCRIPTION

Pukaskwa National Park, in located near Heron Bay, Ontario on the north shore of Lake Superior. The footprint of the Park is approximately 1,800 square kilometres and is located approximately 315 km from Thunder Bay, Ontario. The Park contains two car accessible campgrounds, a day-use area and a visitor centre. The Park is serviced by approximately 3 km of paved roads and 2 km of unpaved roads as well as site servicing infrastructure including sanitary sewers, water and electrical lines.

The Ontario Geologic Society's (OGS) 1979 Northern Ontario Engineering Geology Terrain Study 60 for the Heron Bay Area (NTS 42D/NE) indicates that Pukaskwa Road and the various campground access roads lie within two different surficial geologic areas within the District of Thunder Bay. According to the OGS study, the northern portion of the site consisting of Pukaskwa Road near the Pic River is within a glaciolacustrine plain, primarily consisting of sandy and silty sediments. The glaciolacustrine plain has low relief and is characterized as dissected and gullied with mixed drainage conditions (both wet and dry). The southern portion of the site, consisting of Pukaskwa Road approximately 800 to 900 m south of Pic River and the campground access roads, is within a surficial geologic area characterized with rock knobs consisting of either exposed bedrock or bedrock overlain by a thin veneer of glacial till. The area has higher relief and is characterized as jagged, rugged and cliffed. Based



on the OGS digital data set for the Bedrock Geology of Ontario (MRD 126 – Revision 1), the bedrock at the site generally consists of felsic to intermediate metavolcanic rocks including tuffs and breccias with minor metasedimentary and intrusive rock.

3.0 PROJECT UNDERSTANDING

As noted above, the purpose of this report is to provide geotechnical information and design recommendations for the removal and replacement and/or new installation of the sanitary sewer infrastructure at the Park. The initial scope of work for the rehabilitation of the sanitary sewer infrastructure was presented as four options by Parson’s in their “Schematic Design Report”, submitted in draft to Parks Canada on June 27, 2016. Golder understands that Option B was pursued, with some modifications made to the sanitary sewer infrastructure rehabilitation plan in August 2016 at the design review meeting. Based on Golder’s review of Parson’s “Schematic Design Report”, “Schematic Design Drawings” which accompanied the report, and the results of the design review meeting the following table outlines Golder’s understanding of the scope for the rehabilitation of the sanitary sewer infrastructure at the Park.

Type	New Construction or Remove and Replace	Diameter (mm)	Approximate Length (m)	Location
Gravity Sewer	New Construction	200	110	North Campground
Gravity Sewer	Remove and Replace	200	630	Entrance Road (Manhole 15 to Pump Station # 2)
Gravity Sewer	New Construction	200	190	From Pump Station # 2 to RV Dump Station
Forcemain	New Construction	100	1550	Southern Campground and Entrance Road (from Pump Station # 1 to Pump Station # 2)
Forcemain	Remove and Replace	100	420	From Pump Station # 2 to just north of Administration Building Entrance
Forcemain	Remove and Replace	100	550	From just North of Administration Building to Lagoon

The new gravity sewers and forcemain will be buried below the frost depth which is considered 2.2 m below ground surface at the Park. In addition to the rehabilitation of the linear infrastructure, Golder understands that the existing pump station within the southern campground (designated in the “Schematic Design Report” as Pump Station # 1) will be replaced. The founding elevation of the new pump station is assumed to be similar to that of the existing station, which based on the “Schematic Design Drawings” has an invert of about elevation 182.2 m or about 2.7 m below existing ground surface.

4.0 SCOPE OF WORK

To provide the necessary geotechnical information required to complete the rehabilitation of the sanitary sewer infrastructure at the Park, Golder proposed to complete geotechnical drilling and testing along the alignment for the proposed sewer infrastructure improvements and at the SPS location. Following field work, a laboratory testing program was undertaken to further classify the subsurface material encountered. The methods and results of field



and laboratory testing programs along with interpretation of the results and design recommendations are presented in this report.

For details regarding Golder's previous work at the site, please refer to the report titled "Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation of Pukaskwa National Park" submitted in final on December 7, 2016.

4.1 Field Work

Field work was carried out from September 8, 2016 to September 11, 2016. Twenty (20) boreholes were advanced along the alignment of the proposed sewer infrastructure improvements to depths ranging from 0.6 m to 5.2 m. Boreholes BH16-08 to BH16-13 encountered auger refusal at depths ranging from 0.6 to 2.6 m on inferred rock fill or bedrock. One (1) borehole was advanced at the location of the SPS replacement to a depth of 7.3 m and a dynamic cone penetration test (DCPT) was completed from 7.3 to 7.9 m. The location of the boreholes are shown on the Borehole Location Plan, attached to this report as Figures 1 to 3. The location of the boreholes drilled as part of Golder's previous work are also shown on Figures 1 to 3.

Prior to completion of the field work, Golder completed underground utility clearances of the proposed borehole locations through Ontario One Call and a private utility locate sub-contractor. Golder completed a site specific health and safety plan as well as a traffic management plan.

Field work was monitored by members of Golder's technical staff, who located the boreholes, arranged for the clearance of the underground services, observed the drilling, sampling and in situ testing operations, logged the boreholes, and examined the recovered soil samples. The samples were classified in the field, placed in appropriate containers, labelled and transported to Golder's geotechnical laboratory where the samples underwent further visual examination and laboratory testing. Classification testing (water content and grain size distribution) was carried out on selected samples. Record of Borehole sheets for the boreholes advanced as part of this assignment are provided following the text of this report.

All boreholes were drilled using a truck-mounted drill rig supplied and operated by Landcore Drilling under the full time supervision of a member of Golder's engineering staff. The boreholes were advanced using 150 mm outside diameter (O.D.) solid stem augers or 150 mm O.D. hollow stem augers. Standard Penetration Tests (SPTs) were completed at regular intervals of depth in general accordance with American Society for Testing and Materials standard ASTM D1586 and a DCPT was completed in one borehole. Boreholes were terminated once the target depth was reached (5.2 m for those advanced for linear infrastructure and 7.9 m at pump station location) or if auger refusal was encountered.

Groundwater conditions and water levels in the open boreholes were observed during and upon completion of drilling operations. All boreholes were backfilled with cuttings and bentonite in accordance with Ontario Regulation 903 (as amended) and the road surface was reinstated using cold asphalt patch, where holes were advanced through paved surfaces.

Upon completion of drilling the locations of the boreholes were recorded using a hand-held Global Positioning System (GPS) device (accurate to ± 3 m). The borehole coordinates were subsequently plotted on the site topographic plan, provided by Parson's via email on July 22, 2016, to obtain the borehole elevations. The following table outlines the borehole coordinates and elevations and termination depth.



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Borehole	Surface Elevation (masl)	Termination Depth (m)	UTM Zone 16 (NAD 83)	
			Easting (m)	Northing (m)
BH16-01	186.0	5.2	552992	5384380
BH16-02	190.5	5.2	552827	5384172
BH16-03	189.6	5.2	552669	5383987
BH16-04	190.8	5.2	552626	5383805
BH16-05	189.7	5.2	552459	5383764
BH16-06	189.8	5.2	552446	5383522
BH16-07	192.1	5.2	552519	5383286
BH16-08	199.0	2.6	552638	5383073
BH16-09	200.3	1.9	552667	5382828
BH16-10	198.0	1.1	552727	5382727
BH16-11	195.3	0.9	552728	5382608
BH16-12	194.0	0.6	552675	5382490
BH16-13	189.1	1.1	552590	5382398
BH16-14	186.0	4.6	552507	5382370
BH16-15	185.5	5.2	552432	5382364
BH16-16	185.6	5.2	552342	5382384
BH16-17	185.6	5.2	552271	5382383
BH16-18	185.6	5.2	552070	5382346
BH16-19	185.8	5.2	551984	5382327
BH16-20	185.2	5.2	552089	5382289
BH16-21	184.9	7.9*	552101	5382236

*Borehole drilling extended to 7.3 m below ground surface in BH16-21, a DCPT was carried out to 7.9 m below ground surface.

4.2 Laboratory Testing Program

The soil samples obtained were brought to our Barrie Laboratory to undergo further visual inspection and classification testing. The table below outlines the completed Laboratory Testing Program.

Laboratory Test	Number Completed
Moisture Content	104
Particle Size Analysis (Sieve only)	12
Particle Size Analysis (Sieve and Hydrometer)	1
Atterberg Limits	1



5.0 SUBSURFACE CONDITIONS

The, subgrade soil and shallow groundwater conditions encountered in the boreholes, as well as the results of the field and the geotechnical laboratory testing, are shown in detail on the Record of Borehole sheets (BH16-01 to BH16-21) and on Figures B1 through B6 following the text of this report. Method of Soil Classification and Symbols and Terms Used on the Records of Pavement Boreholes sheets are provided to assist in the interpretation of the logs.

It should be noted that the boundaries between the strata on the borehole logs have been inferred from drilling observations and non-continuous samples, represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes.

Underlying the road structure, the subsurface soil conditions generally consist of sand with traces of gravel and silt. Shallow bedrock or rock fill was inferred based on auger refusal in a localized section of the entrance road. An isolated granular deposit of silt and a cohesive deposit of clayey silt to silty clay was encountered in Borehole BH16-08. The subsurface soil conditions encountered during Golder's previous investigation were predominantly sand and silty sand.

Relevant information from Golder's previous investigation has been included in the sections below. For more detailed information refer to Golder's report titled "Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation of Pukaskwa National Park" submitted on December 7, 2016.

5.1 Soil Conditions

5.1.1 Asphalt and Fill

All boreholes were advanced through existing paved or unpaved roads or parking areas. Where boreholes were advanced through paved roads the asphalt thickness ranged from 40 to 70 mm. The underlying fill was characterized as gravelly silty sand. The results of one particle size analysis carried out on a sample of the gravelly silty sand is attached in Appendix B as Figure B4. Eighteen water content tests were conducted on samples of the gravelly silty sand which resulted in water contents ranging from 3 per cent to 15% with an average of 55. Two SPT tests completed on the gravelly silty sand fill resulted in N-values of 21 and 40 blows for 0.3 m of penetration, indicating a compact to dense material. The gravelly silty sand fill was encountered immediately underlying the asphalt and extended to depths ranging from 0.6 m to 1.5 m below ground surface (mbgs). Boreholes BH16-11, BH16-12, and BH16-13 were terminated within the gravelly silty sand fill layer due to auger refusal on inferred bedrock or rock fill.

Where boreholes were advanced through unpaved roads and parking areas fill material ranging from sand to silty sand was encountered at surface. The fill was brown in colour and contained trace to some gravel and occasionally traces of fibrous organics. The results of one particle size analysis completed on a sample of sand fill is attached in Appendix B as Figure B1. Seven water content tests were completed on samples of the silty sand and sand fill which resulted in water contents ranging from 5 to 7% with an average of 6%. Two SPT tests completed on the silty sand and sand fill resulted in N-values of 7 and 25 blows for 0.3 m of penetration, indicating a loose to compact material. The silty sand and sand fill was encountered at surface and extended to depths ranging from 0.7 m to 1.5 mbgs.



A 100 mm thick layer of black organic silt was noted within the sand fill at Borehole BH16-02. One water content test on the organic silt resulted in a water content of 38%.

Further details regarding the pavement structure for paved and unpaved roads is available in Golder’s report titled “Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation of Pukaskwa National Park” submitted in December 7, 2016.

5.1.2 Sand

The predominant subsurface soil type encountered during the investigation was characterized as poorly graded sand with trace to some silt and gravel. Near surface the sand is brown in colour but generally becomes grey with depth. The results of ten particle size analysis conducted on samples of the sand are attached in Appendix B as Figures B2 and B3. Seventy-four (74) water content tests were completed on samples of the sand and which resulted in water contents ranging from 4% to 30% with an average of 18%. Eighty-six (86) SPT tests completed in the sand resulted in N-values of 1 to 27 blows for 0.3 m of penetration with an average of 13 blows for 0.3 m of penetration, indicating a very loose to compact material. The sand was encountered below the fill material in all boreholes and extended to depths ranging from 1.8 m to 7.3 mbgs. Borehole BH16-01 through to BH16-07, BH16-09, BH16-10, and BH16-14 to BH16-21 were terminated within the sand deposit.

5.1.3 Silt

An approximately 0.4 m thick layer of grey silt was encountered in Borehole BH16-08, underlying the sand. One water content test on the silt layer resulted in a natural water content of 13%.

5.1.4 Silty Clay to Clayey Silt

An approximately 0.6 m thick layer of grey silty clay to clayey silt was encountered in Borehole BH16-08 underlying the silt. Borehole BH16-08 was terminated in the stratum at a depth of 2.6 mbgs. One particle size analysis and the Atterberg Limits of a sample of silty clay to clayey silt are attached in Appendix B as Figures B5 and B6, respectively. One water content test conducted on a sample of silty clay to clayey silt resulted in a value of 27%.

5.1.5 Inferred Bedrock and Rock Fill

The presence of bedrock and rock fill has been inferred through observation of drilling progress. Rock coring to confirm the presence of bedrock or rock fill was not completed as part of this investigation. Bedrock was inferred to be encountered in six (6) boreholes advanced as part of the investigation, while rock fill was inferred to be encountered in one (1) borehole advanced as part of the investigation. The following table outlines the boreholes where bedrock or rock fill was inferred to be encountered, the depth it was encountered, and the elevation. Select boreholes from Golder’s previous investigation are also included in this table.

Borehole	Bedrock or Rock Fill	Depth (mbgs)	Elevation (m)
BH16-08	Bedrock	2.6	196.4
BH16-09	Bedrock	1.9	198.4
BH16-10	Bedrock	1.1	196.9
BH16-11	Bedrock	0.9	194.4
BH16-12	Rockfill	0.6	193.4
BH16-13	Bedrock	1.1	188.0



Borehole	Bedrock or Rock Fill	Depth (mbgs)	Elevation (m)
BH16-14	Bedrock	4.6	181.4
BH11*	Bedrock	0.5	194.5
BH12*	Bedrock	0.4	192.5
BH13*	Bedrock	0.4	185.3
BH14*	Bedrock	0.2	185.5
BH15*	Bedrock	0.6	185.8

*Boreholes advanced as part of Golder’s previous investigation. For further details see “Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation of Pukaskwa National Park” submitted on December 7, 2016.

5.2 Groundwater Conditions

Groundwater conditions and water levels in the open boreholes were observed during and upon completion of drilling operations. The following table presents the water levels that were measured in the open boreholes upon completion of drilling. Select boreholes from Golder’s previous investigation are also included in this table.

Borehole	Groundwater Depth (mbgs)	Elevation (m)
BH16-01	1.6	184.4
BH16-02	1.8	188.7
BH16-03	1.1	188.5
BH16-04	1.6	189.2
BH16-05	1.7	188.0
BH16-06	1.4	188.4
BH16-07	3.1	189.0
BH16-08	1.6	197.4
BH16-09	Dry upon completion of drilling	
BH16-10	Dry upon completion of drilling	
BH16-11	Dry upon completion of drilling	
BH16-12	Dry upon completion of drilling	
BH16-13	Dry upon completion of drilling	
BH16-14	2.7	183.3
BH16-15	2.2	183.3
BH16-16	2.0	183.6
BH16-17	2.1	183.5
BH16-18	1.8	183.8
BH16-19	1.7	184.1
BH16-20	1.2	184.0
BH16-21	1.4	183.5
BH7*	1.2	188.6



Borehole	Groundwater Depth (mbgs)	Elevation (m)
BH9*	0.9	198.1
BH19*	1.3	185.5
BH20*	1.5	184.6
BH21*	1.2	-
BH22*	0.6	183.3
BH23*	1.5	183.2
BH24*	1.4	183.9
BH25*	1.3	184.1
BH28*	1.7	183.1

*Boreholes advanced as part of Golder's previous investigation. For further details see "Pavement Investigation and Design for Proposed Reconstruction and Rehabilitation of Pukaskwa National Park" submitted on December 7, 2016.

It should be noted that the groundwater levels presented, represent unstabilized levels and that groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

6.0 DISCUSSION

This section of the report provides engineering information for the geotechnical design aspects of the project, based on our interpretation of the borehole data and on our understanding of the project requirements. The information in this portion of the report is provided for the guidance of the design engineers and technicians. Where comments are made on construction, they are provided only in order to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

It is understood that the project will include excavations for site servicing including:

- removal and replacement or new Installation of approximately 3.5 km of sanitary forcemains and gravity sewers by open cut; and,
- replacement of one Sanitary Pump Station (SPS).

It is understood that forcemains and gravity sewers will be placed below the frost penetration depth, which is considered to be 2.2 m for this site. The diameter of the proposed forcemains will be 100 mm and the diameter of the proposed gravity sewers will be 200 mm.

6.1 Excavations for Forcemains, Gravity Sewers and Pump Stations

Based on the results of this investigation, the founding soils for the services and SPS will primarily consist of compact to loose and locally very loose sand. Although cobbles and boulders were not noted in this investigation, Golder's previous field work noted occasional cobbles and boulders within the native soils. The native soil is



generally considered to be suitable for supporting the pipes, provided the integrity of the base can be maintained during construction. Where very loose soil is expected at the founding depth such as in the vicinity of boreholes BH16-04, BH16-07, BH16-14, and BH16-15 some over-excavation and additional bedding material should be anticipated in the event that the native material at the excavation base is not considered suitable to support the buried services.

Based on the groundwater conditions encountered in the boreholes during drilling and considering the anticipated excavation depths, the services will generally be at or below the local water table at the site. Given the granular and relatively uniform nature of the native soil encountered at the site, the tendency for some boreholes to slough (cave) upon completion of the drilling and the relatively shallow groundwater table observed during drilling, excavations are expected to yield significant volumes of water. The native soils will readily flow upon exposure if not adequately dewatered in advance of excavation. Based on the observed groundwater and soil conditions during the investigation and the excavation depths groundwater control measures will require active dewatering such as closely-spaced (less than 5 m centre to centre) vacuum well points, eductors and/or submersible wells. Unless drawdown and radius of influence analyses completed as part of the final dewatering design demonstrate that dewatering systems installed on one side of the excavation are suitable, for the purposes of this report it is anticipated that dewatering systems would be required on both sides of the trench excavations. It is anticipated that a Permit to Take Water will be required for this construction work. It should be noted that in areas where bedrock is below but within 1 to 1.5 m of the base of the excavations, it may be difficult to achieve adequate dewatering of soils near the excavation base because of limitations associated with drawdown availability and spacing between dewatering point locations.

It is anticipated that the dewatered trench excavations will consist of conventional temporary open cuts with side slopes not steeper than 1 horizontal to 1 vertical. However, depending upon the construction procedures adopted by the contractor, actual groundwater seepage conditions, the success of the contractor's groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing of the slopes may be required.

Care should be taken to direct surface runoff away from the open excavations and all excavations should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. According to the Act, the native sand would be classified as Type 3 soil above the water table and a Type 4 soil below the water table. Excavations in Type 4 soil and excavations should be flattened to 3 horizontal to 1 vertical.

Although relatively deep excavations may not be required for the SPS installation, construction may still be carried out with a vertically sided shored excavation. Temporary excavation support for the SPS or other installations could consist of conventional "close sheeting" (timber frame sheets, braces and posts), pre-fabricated trench boxes and soldier piles and lagging wall systems provided that adjacent services or structures can tolerate some movement and that groundwater is adequately controlled. It should be noted that installation of conventional "close sheeting" and trench boxes typically require that excavation be made prior to or during installation of the supports. In particular, use of trench boxes requires that the excavation be carried to the full depth prior to installing the support system. Such excavation support systems, while designed for protection of the workers if properly installed, do not prevent or mitigate displacements of the surrounding ground, particularly if groundwater is not adequately controlled. For a soldier pile and lagging wall, the lagging boards should be installed as soon as space permits and with a lift height that does not exceed 1.2 m. The space behind any support lagging, timbers, sheets or pre-fabricated trench box systems should be immediately packed with granular material to minimize the potential



for uncontrolled ground losses and uneven loads on the systems. Temporary protection systems should be designed and constructed in accordance with OPSS.PROV 539 (Temporary Protection Systems). Temporary excavation support systems should be designed to Performance Level 2 for any excavation adjacent to existing roadways and utilities/structures. In addition, care must be taken during excavation to ensure that adequate support is provided for any existing structures (utility poles) or underground services located adjacent to the excavations.

It should be noted that trench boxes or any systems that require excavation prior to installation do not support either the ground behind the side walls of the excavations nor any adjacent utilities and structures and thus should not be utilized in areas where buried utilities or surface structures are present or where impacts to the adjacent roadway would then impact traffic flow.

6.1.1 Rock Excavation

In the vicinity of Boreholes BH16-08 to BH16-13 and BH11 to BH15 bedrock may be encountered above the excavation bottom, bedding and invert elevations for the forcemains and gravity sewers. In this instance, rock excavation will be required to install site services below the frost penetration depth.

As noted above, based on the OGS digital data set for the Bedrock Geology of Ontario (MRD 126 – Revision 1), the bedrock at the site generally consists of felsic to intermediate metavolcanic rocks including tuffs and breccias with minor metasedimentary and intrusive rock. During field work undertaken at the site, the rock could not be penetrated with conventional auger drilling techniques. Conventional excavation techniques will likely not be suitable for the excavation of the rock encountered at the site.

Golder understands that excavation of rock using explosives (e.g., blasting) may be prohibited at this site. Therefore mechanical means such as use of hoe rams, splitters or other systems will need to be used to excavate to the founding elevation. The method chosen will depend on the weathering condition and strength of the rock.

Although all boreholes where shallow bedrock was inferred were noted as dry, excavations in rock may still experience groundwater seepage through cracks or fissure in the rock. Groundwater seepage in rock excavations are expected to be handled with standard sumps and pumps. Temporary excavations in rock can be vertical.

6.2 Pipe Bedding, Cover and Trench Backfill

The bedding for the sanitary forcemains and gravity sewers should be compatible with the type and class of pipe, the surrounding subsoil and anticipated loading conditions. Granular bedding should consist of at least 150 mm of gravel meeting the specifications for OPSS.PROV 1010 (Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material) Granular A. Additional bedding (i.e., 450 mm in total) may be required if wet or loose materials are encountered in the bottom of the trenches. From the springline to 300 mm above the invert of the pipe, sand cover meeting the specifications of OPSS.PROV 1004 (Material Specification for Aggregates – Miscellaneous) Winter Sand, should be used. All bedding and cover materials should be placed in maximum 150 mm loose lifts and should be uniformly compacted to at least 95 percent of standard Proctor maximum dry density. Clear stone bedding material should not be used in any case for pipe bedding or to stabilize the base.

Where the founding stratum is rock pipe, bedding should be as specified above. Loose or fractured rock should be removed from the base of the excavation to provide a uniform bearing stratum. Where a trench is excavated



in rock to reach a specified installation depth, horizontal and vertical clearance between the pipe and the rock face should be at least 300 mm.

The excavated materials from the site will generally consist of sand. The majority of the native soils are generally near or wet of optimum water contents for compaction and may require some drying prior to reuse for trench backfill. Excavated native soils, if permitted to dry and protected from precipitation so that they can be placed at suitable water contents, could be reused as trench backfill provided they are free of significant amounts of topsoil, organics or other deleterious material, and are placed and compacted as outlined below. All topsoil and organic materials should be removed or used for landscaping purposes. All oversized cobbles and boulders (i.e., greater than 150 mm in size) should be removed from the backfill.

All trench backfill, from the top of the cover material to 1 m below subgrade elevation, should be placed in maximum 450 mm loose lifts and uniformly compacted to at least 95 percent of standard Proctor maximum dry density. From 1 m below subgrade to subgrade elevation, the materials should be placed in maximum 300 mm loose lifts and uniformly compacted to at least 98 percent of standard Proctor maximum dry density.

Alternatively, if placement water contents at the time of construction are too high, or if there is a shortage of suitable in-situ material, then an approved imported sandy material which meets the requirements for OPSS.PROV 1010 Select Subgrade Material (SSM) could be used. It should be placed in loose lift thicknesses as indicated above and uniformly compacted to at least 95 percent of standard Proctor maximum dry density. Backfilling operations during cold weather should avoid inclusions of frozen lumps of material, snow and ice.

Normal post-construction settlement of the compacted trench backfill should be anticipated, with the majority of such settlement taking place within about six months following the completion of trench backfilling operations. This settlement will be reflected at the ground surface and may require local repairs. If the services are placed below the roads and require pavement reconstruction, then settlement can be compensated for by placing additional granular material prior to asphalt paving. Alternatively, if the asphalt binder course is placed shortly following the completion of trench backfilling operations in this area, any settlement that may be reflected by subsidence of the surface of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding. In any event, it is recommended that the surface course asphalt should not be placed over the binder course asphalt for at least twelve months.

6.3 Sanitary Pumping Station

One Pumping Station (PS) is currently proposed for replacement (designated in the “Schematic Design Report” as PS# 1) in the vicinity of BH16-21. The founding elevation of the new SPS is assumed to be similar to that of the existing SPS, which based on the “Schematic Design Drawings” has an invert of about elevation 182.2 m or about 2.7 m below existing ground surface.

Borehole BH16-21 consisted of fill overlying compact to loose sand. The groundwater level was measured at 1.4 mbgs (Elev. 183.5 m) upon completion of drilling in the open borehole. It should be noted that these founding soils are susceptible to disturbance by construction activity especially during wet weather and care should be taken to preserve the integrity of the material as a bearing stratum. To protect the founding soils from softening and disturbance during construction, a granular blanket or working slab of lean concrete could be placed at the bottom of the excavations.



Based on the assumed founding elevation, the bottom of the SPS will be within the loose to compact sand stratum. The geotechnical bearing resistance at Serviceability Limit State (SLS) of 100 kPa to limit settlement to 25 mm and a factored bearing resistance at Ultimate Limit State (ULS) of 200 kPa are considered appropriate for preliminary design and should be re-assessed when the final footing type/size/elevation are known. It is likely that bearing resistances will not govern foundation design since pumping station construction will result in a net unloading of the ground (the removed ground may weigh more than the weight of the SPS, sewage and pumps). Design of the SPS should be checked for resistance to hydraulic uplift pressures when the SPS is drained for periodic maintenance. The project specifications should identify criteria for limiting uplift pressures on the SPS base by dewatering during construction until construction is complete and stability against buoyancy can be assured.

As noted above, excavation for the SPS will extend below groundwater levels. Given the granular and relatively uniform nature of the native soil encountered at the site, the excavation is expected to yield significant volumes of water. Groundwater control measures will require active dewatering such as closely-spaced (less than 5 m centre to centre) vacuum well points, eductors and/or submersible wells. Based on the depth of sand below the anticipated bottom of excavation elevation, it is anticipated that a suitable submersible pump well system installed to sufficient depths could achieve drawdown and radius of influence conditions such that wells could be located at a few selected points around the excavation perimeter. It is anticipated that a Permit to Take Water will be required for this construction work.

6.3.1 Lateral Earth Pressure

SPS walls must be designed to resist lateral earth pressures. The earth pressure “p” (kPa) acting on subsurface walls at any depth “h” (m) can be calculated using the following equation:

$$p = k (\gamma h + q)$$

- Where: k = 0.5, the estimated earth pressure coefficient applicable to a rigid unyielding wall. For walls where some slight yielding for the wall is permissible, use 0.33.
- γ = 21.5 kN/m³ (estimated unit weight of compacted, drained sand and gravel or gravelly sand backfill).
- q = surcharge load in kPa, if any, acting adjacent to the wall

The above equation assumes that the backfill material will be fully drained granular materials. At this site, however, it is expected that full drainage cannot be achieved and may not be practical. In this case, a buoyant unit weight of 11.5 kN/m³ should be used in the above equation along with water pressures consistent with assuming the groundwater level to be at the ground surface.

6.3.2 Uplift Considerations

The SPS should be designed for uplift based on the stabilized groundwater level at the site. Resistance to uplift resulting from the friction between the backfill and concrete walls of the SPS should be calculated using a coefficient of friction of 0.35. If sufficient resistance with a suitable factor of safety cannot be achieved by using dead loads and sidewall friction, additional capacity can be achieved by extending the base of the SPS beyond the limits of the walls. Alternatively, grouted earth anchors could be installed to provide additional uplift capacity.



An uplift assessment should be carried out for the proposed PS. The factor of safety against uplift is estimated as:

$$\text{Factor of Safety against Uplift} = \frac{\text{Weight of Concrete Walls/Base} + \text{Side Friction Resistance}}{\text{Uplift Forces due to Groundwater}}$$

Only the weight of the SPS concrete walls and base should be considered in the assessment. The weight of all other proposed connected structures should be neglected. For this methodology, a minimum factor of safety against hydraulic uplift of about 1.3 should be used. If, however, resistance against uplift is based solely on gravity (weight of the structure), a factor of safety of 1.1 is considered appropriate. For design purposes, the groundwater levels should be assumed equal to the ground surface to account for full saturation of any backfill.

6.4 Frost Protection

The depth of frost penetration for this project should be taken as 2.2 m. To protect the forcemain and gravity sewers from freezing the obverts of the pipes should be below this depth. Based on Golder's review of Parson's "Schematic Design Drawings" we understand that all new and replaced linear sanitary services will be below the frost penetration depth.

7.0 MONITORING AND TESTING

The geotechnical and pavement aspects of the final design drawings and specifications should be reviewed by this office prior to tendering and construction, to confirm that the intent of this report has been met. During construction, sufficient in-situ materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes and to monitor conformance to the pertinent project specifications.

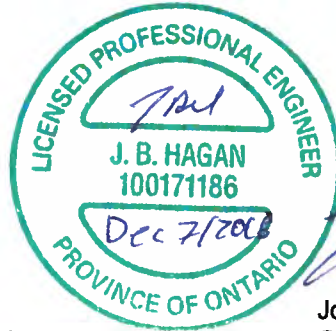


8.0 CLOSURE

We trust that this report provides sufficient geotechnical and pavement engineering information to facilitate the design of this project. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.

GOLDER ASSOCIATES LTD.

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DPM/JH/SJB/leb/plc

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ATTACHMENTS

**Figures 1 to 3
Record of Borehole Logs**



BH16-01

BORE HOLE 1
N: 5384258.53
E: 552908.53
EL: 191.40m

BH16-02

BORE HOLE 2
N: 5384071.37
E: 552732.74
EL: 190.88m

BH16-03

BORE HOLE 3
N: 5383883.71
E: 552567.18
EL: 190.92m

BORE HOLE 4
N: 5383866.96
E: 552635.52
EL: 191.02m

BORE HOLE 5
N: 5383395.58
E: 552614.16
EL: 190.93m

BORE HOLE 6
N: 5383967.01
E: 552426.30
EL: 192.48m

Lagoon Access Road
(Area Road)

Administration Centre
Parking Lot

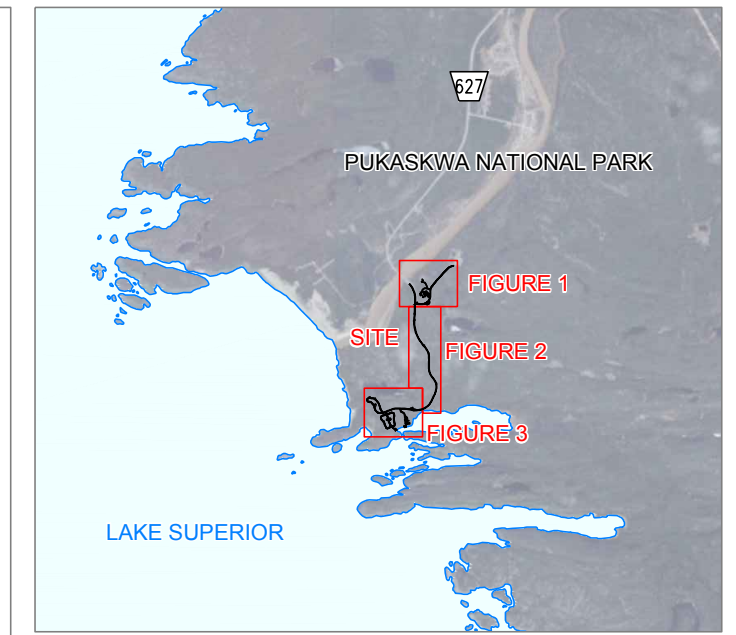
Administration Centre
Parking Lot

Administration Building
Access Road
(Circulation Road)

Pukaskwa Entrance Road
(Primary Access Road)



BH16-05

BH16-04



REGIONAL LOCATION 1:100000 m

LEGEND

-  BOREHOLE LOCATION
-  PAVEMENT BOREHOLE LOCATION

NOTES


1. DATUM UTM NAD 83 ZONE 16
2. MAPPING BASED ON CALLON DIETZ INC. ONTARIO LAND SURVEYORS (DRAWING NO. 16-20450 SHEET 1-3)



CLIENT
PARKS CANADA

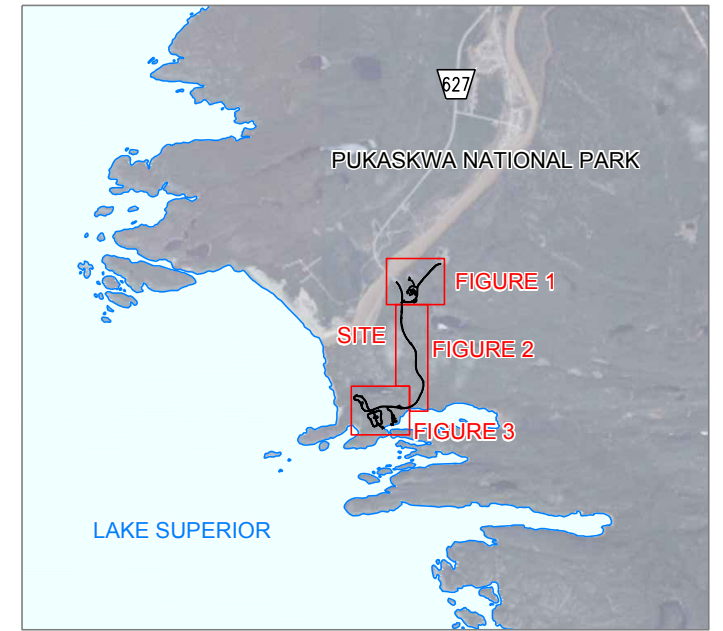
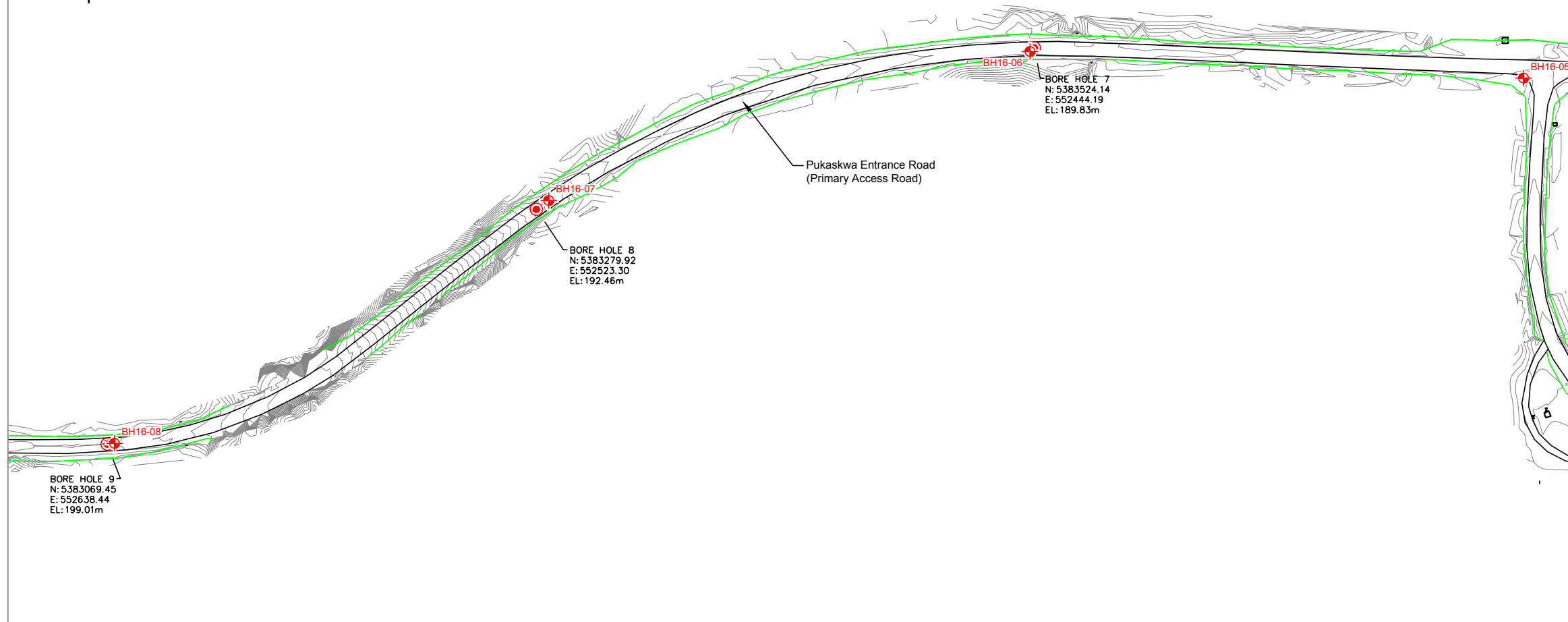
PROJECT
ROAD RECONSTRUCTION
PUKASKWA NATIONAL PARK
HERON BAY, ONTARIO

TITLE
BOREHOLE LOCATION PLAN

CONSULTANT	YYYY-MM-DD	2016-10-05
	PREPARED	STB
	DESIGN	
	REVIEW	JBH
	APPROVED	ALB

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



REGIONAL LOCATION 1:100000 m

LEGEND

- BOREHOLE LOCATION
- PAVEMENT BOREHOLE LOCATION

NOTES

1. DATUM UTM NAD 83 ZONE 16
2. MAPPING BASED ON CALLON DIETZ INC. ONTARIO LAND SURVEYORS (DRAWING NO. 16-20450 SHEET 1-3)



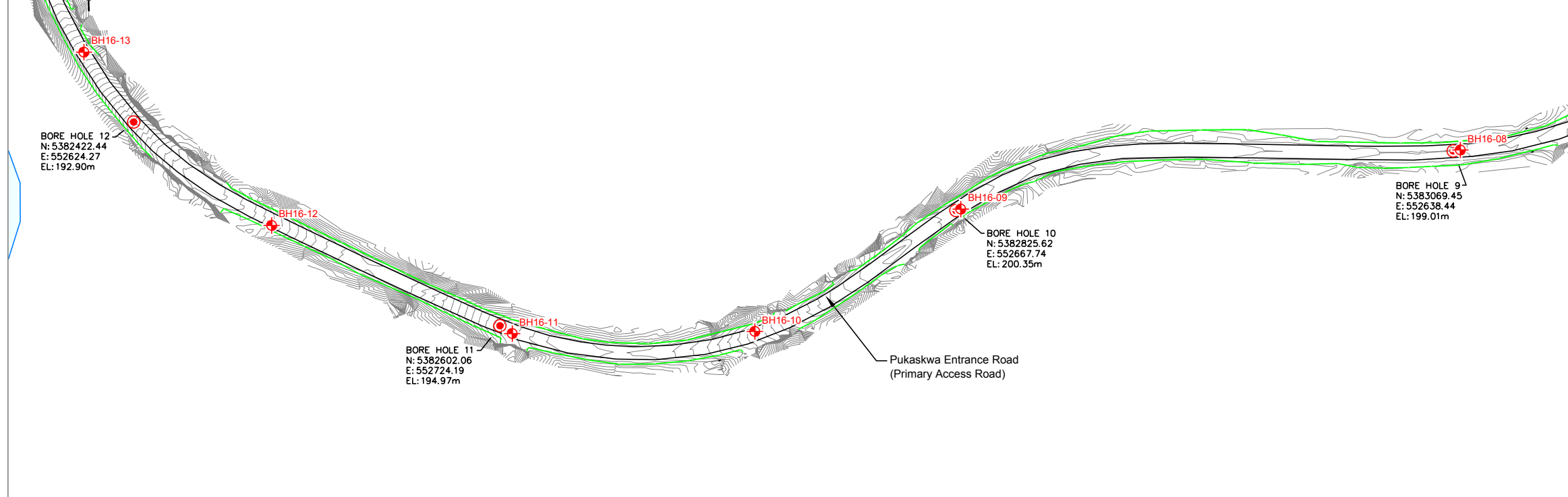
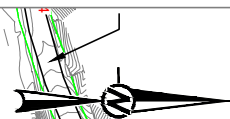
CLIENT
PARKS CANADA

PROJECT
ROAD RECONSTRUCTION
PUKASKWA NATIONAL PARK
HERON BAY, ONTARIO

TITLE
BOREHOLE LOCATION PLAN

CONSULTANT	YYYY-MM-DD	2016-10-05
	PREPARED	STB
	DESIGN	
	REVIEW	JBH
	APPROVED	ALB

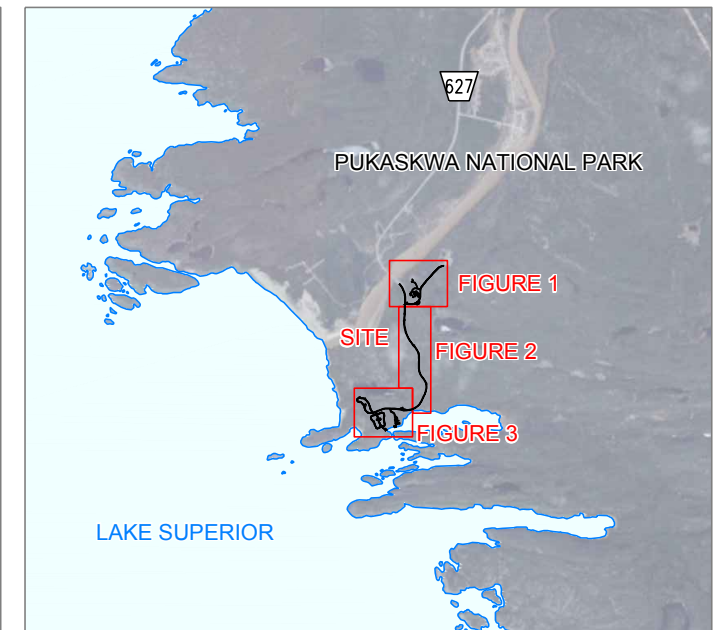
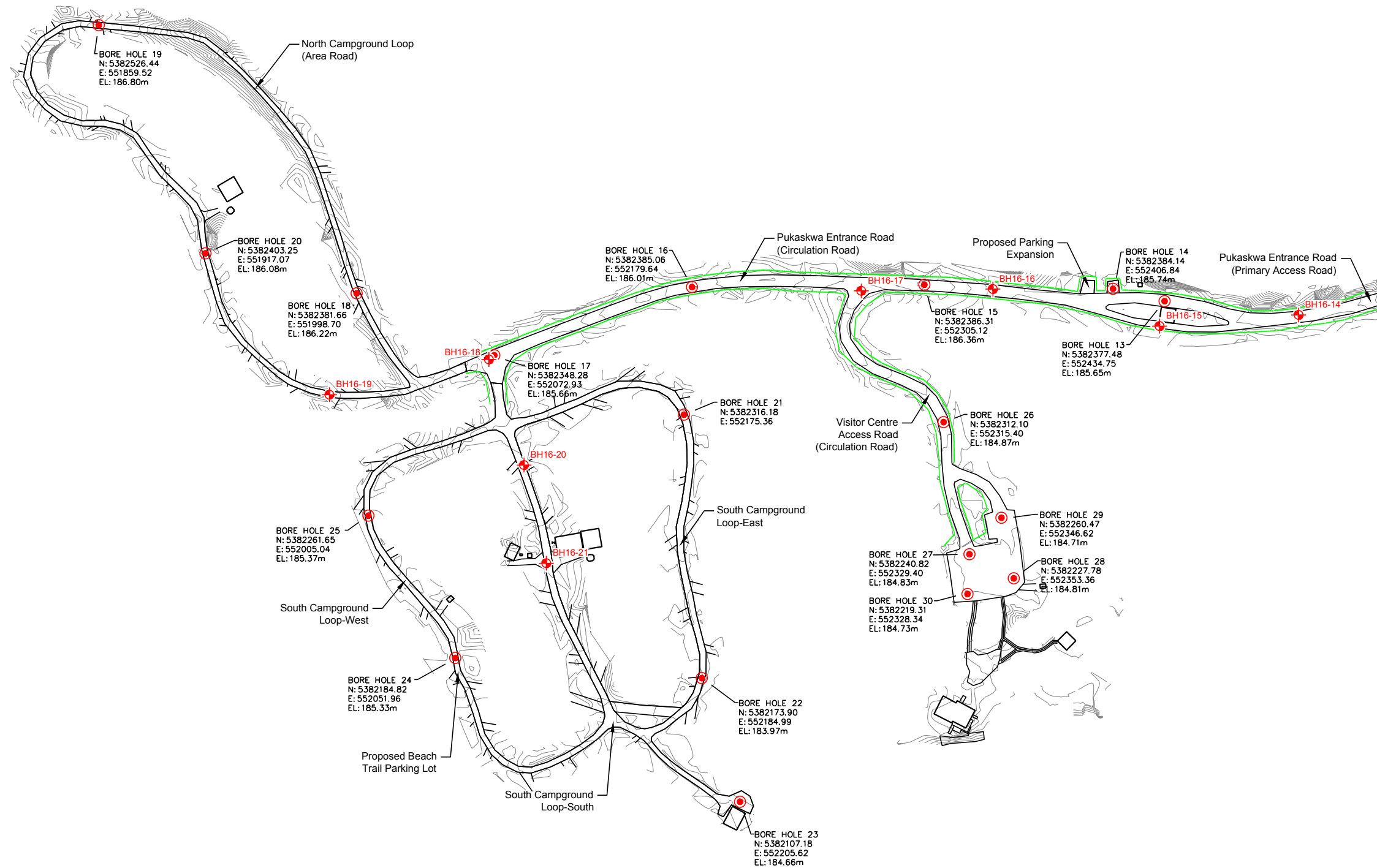
PROJECT No. 1545167 Phase - Rev. AA Figure 2



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25 mm



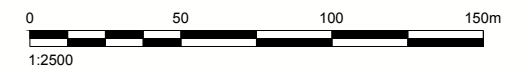
REGIONAL LOCATION 1:100000 m

LEGEND

- BOREHOLE LOCATION
- PAVEMENT BOREHOLE LOCATION

NOTES

1. DATUM UTM NAD 83 ZONE 16
2. MAPPING BASED ON CALLON DIETZ INC. ONTARIO LAND SURVEYORS (DRAWING NO. 16-20450 SHEET 1-3)



CLIENT
PARKS CANADA

PROJECT
**ROAD RECONSTRUCTION
PUKASKWA NATIONAL PARK
HERON BAY, ONTARIO**

TITLE
BOREHOLE LOCATION PLAN

CONSULTANT	YYYY-MM-DD	2016-10-05
	PREPARED	STB
	DESIGN	
	REVIEW	JBH
	APPROVED	ALB

Path: \\golder\gis\m\1545167\1545167_Parks_Canada_Geotech\16_Parks_Canada_Geotech\16_PROJ\1545167_Parks_Canada_Geotech\16_PROJ\1545167_16S_0001.dwg

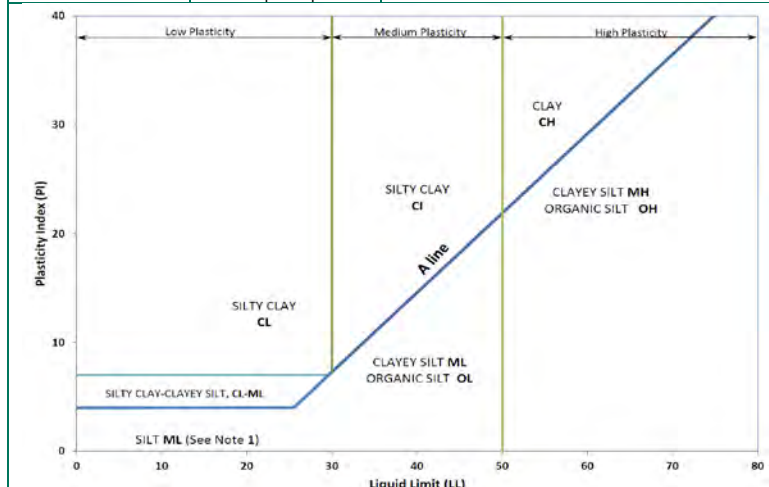
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B 25 mm



METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil	Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$	Organic Content	USCS Group Symbol	Group Name							
INORGANIC (Organic Content $\leq 30\%$ by mass)	COARSE-GRAINED SOILS ($>50\%$ by mass is larger than 0.075 mm)	GRAVELS ($>50\%$ by mass of coarse fraction is larger than 4.75 mm)	Poorly Graded	<4	≤ 1 or ≥ 3	$\leq 30\%$	GP	GRAVEL							
			Well Graded	≥ 4	1 to 3		GW	GRAVEL							
			Below A Line	n/a			GM	SILTY GRAVEL							
			Above A Line	n/a			GC	CLAYEY GRAVEL							
			SANDS ($\geq 50\%$ by mass of coarse fraction is smaller than 4.75 mm)	Poorly Graded	<6		≤ 1 or ≥ 3	SP	SAND						
				Well Graded	≥ 6		1 to 3	SW	SAND						
		Below A Line		n/a			SM	SILTY SAND							
		Above A Line		n/a			SC	CLAYEY SAND							
		Organic or Inorganic		Soil Group	Type of Soil		Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
								Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
		INORGANIC (Organic Content $\leq 30\%$ by mass)	FINE-GRAINED SOILS ($\geq 50\%$ by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50		Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	$<5\%$	ML	SILT	
							Slow	None to Low	Dull	3mm to 6 mm	None to low	$<5\%$	ML	CLAYEY SILT	
Liquid Limit ≥ 50	Slow to very slow				Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT				
	Slow to very slow				Low to medium	Slight	3mm to 6 mm	Low to medium	$<5\%$	MH	CLAYEY SILT				
CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30				None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY			
					None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY			
	Liquid Limit ≥ 50			None	High	Shiny	<1 mm	High	CH		CLAY				
	Peat and mineral soil mixtures			Predominantly peat, may contain some mineral soil, fibrous or amorphous peat						30% to 75%	PT	SILTY PEAT, SANDY PEAT			
										75% to 100%		PEAT			



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
 Note 2 – For soils with $<5\%$ organic content, include the descriptor “trace organics” for soils with between 5% and 30% organic content include the prefix “organic” before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML. For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between “clean” and “dirty” sand or gravel. For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML. A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.





ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (i.e., SAND and GRAVEL, SAND and CLAY)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.).

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

- PH:** Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size
TP	Thin-walled, piston – note size
WS	Wash sample

SOIL TESTS

w	water content
PL, w _p	plastic limit
LL, w _L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D _R	relative density (specific gravity, G _s)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness²

Term	SPT 'N' (blows/0.3m) ¹
Very Loose	0 - 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects.
 2. Definition of compactness descriptions based on SPT 'N' ranges from Terzaghi and Peck (1967) and correspond to typical average N₆₀ values.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N' ¹ (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.



LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
$\ln x$	natural logarithm of x
$\log_{10} x$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress = $(\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
C_v	coefficient of consolidation (vertical direction)
C_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = $\tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

Notes: 1
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$

PROJECT: 1545167
 LOCATION: N 5384380.00; E 552992.00

RECORD OF BOREHOLE: BH16-01

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 11, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
								20	40	60	80	nat V. +	rem V. ⊕			Q -	U -
0		GROUND SURFACE		186.00													
		FILL-(SP) SAND, some silt; brown, contains rootlets; moist, compact		0.00	1	AS											
1					2	SS	25								M		
		(SP) SAND, some silt; brown; moist, compact		184.55													
				1.45	3	SS	25								M		
2					4	SS	9										
3	Truck Mount CME 75 6" O.D. Auger	grey below 3.1 mbgs			5	SS	10										
4					6	SS	15										
5				180.82													
		End of Borehole		5.18													
6		NOTE: 1. Groundwater measured at a depth of 1.6 m below existing grade (Elev. 184.4 masl) upon completion of drilling September 11, 2016.															
7																	
8																	
9																	
10																	

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PROJECT: 1545167
 LOCATION: N 5384172.00; E 552827.00

RECORD OF BOREHOLE: BH16-02

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 11, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
								20	40	60	80	nat V. +	rem V. ⊕	Q -			U -
0		GROUND SURFACE		190.50													
		FILL-(SP) SAND, some silt, trace gravel; brown; moist, loose		0.00	1	AS											
1		ORGANIC SILT, black, containing rootlets from 1.0 to 1.1 mbgs			2A												
					2B	SS	7										
		(SP) SAND, trace to some silt; brown; moist, very loose to compact		189.05													
				1.45													
2					3	SS	2										
3	Truck Mount CME 75 6" O.D. Auger				4A	SS	11										
					4B												
					5	SS	27										
4																	
5					6	SS	17										
6		End of Borehole		185.32													
		NOTE: 1. Groundwater measured at a depth of 1.8 m below existing grade (Elev. 188.7 masl) upon completion of drilling September 11, 2016.		5.18													
7																	
8																	
9																	
10																	

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DEPTH SCALE
1 : 50



LOGGED: AK
CHECKED: DM



PROJECT: 1545167
 LOCATION: N 5383987.00; E 552669.00

RECORD OF BOREHOLE: BH16-03

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 11, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa		WATER CONTENT PERCENT					
								20	40	60	80	10 ⁻⁶	10 ⁻⁵		
0		GROUND SURFACE		189.60											
		FILL-(SP) SAND, some silt, trace gravel; brown; moist		0.00	1	AS									
1		(SP) SAND, trace gravel, trace to some silt; brown, containing silt pockets; moist to wet, loose to compact		188.91	2	SS	7								
				0.69											
2					3	SS	8								
					4	SS	8								
3					5	SS	8								
					6	SS	17								
5		End of Borehole		184.42											
				5.18											
6		NOTE: 1. Groundwater measured at a depth of 1.1 m below existing grade (Elev. 188.5 masl) upon completion of drilling September 11, 2016.													
7															
8															
9															
10															

DEPTH SCALE
 1 : 50



LOGGED: AK
 CHECKED: DM

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PROJECT: 1545167
 LOCATION: N 5383805.00; E 552626.00

RECORD OF BOREHOLE: BH16-04

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 11, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								Cu, kPa		nat V. rem V.		+ Q - U				Wp	
0		GROUND SURFACE		190.80													
		ASPHALT		190.80 0.07													
		FILL-(SM) gravelly SILTY SAND; brown; moist			1	AS											
		(SP) SAND, trace gravel, trace to some silt; brown; moist to wet, very loose to compact		190.11 0.69													
1					2	SS	22										
2					3	SS	4										
3					4	SS	0										
4					5	SS	3										
5					6	SS	24										
6		End of Borehole		185.62 5.18													
		NOTE: 1. Groundwater measured at a depth of 1.6 m below existing grade (Elev. 189.2 masl) upon completion of drilling September 11, 2016.															
7																	
8																	
9																	
10																	

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DEPTH SCALE
 1 : 50



LOGGED: AK
 CHECKED: DM

PROJECT: 1545167
 LOCATION: N 5383764.00; E 552459.00

RECORD OF BOREHOLE: BH16-05

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 11, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								Cu, kPa		nat V. rem V.		+				-	
0		GROUND SURFACE		189.70													
		ASPHALT		188.05													
		FILL-(SM) SILTY SAND, some gravel; brown; moist		189.01	1	AS											
1		(SP) SAND, trace to some silt; brown; moist to wet, compact		0.69	2	SS	15										
					3	SS	10										
2					4	SS	13										
		grey below 2.3 mbgs			5A	SS	15										
					5B												
4		SILTY SAND; grey; wet, compact from 3.5 to 4.1 mbgs			6	SS	20										
		trace gravel below 4.6 mbgs															
5				184.52													
		End of Borehole		5.18													
6		NOTE: 1. Groundwater measured at a depth of 1.7 m below existing grade (Elev. 188.0 masl) upon completion of drilling September 11, 2016.															
7																	
8																	
9																	
10																	

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DEPTH SCALE
1 : 50



LOGGED: AK
CHECKED: DM

PROJECT: 1545167
 LOCATION: N 5383522.00; E 552446.00

RECORD OF BOREHOLE: BH16-06

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 11, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa		WATER CONTENT PERCENT					
								20	40	60	80	10 ⁻⁶	10 ⁻⁵		
0		GROUND SURFACE		189.80											
		ASPHALT		189.80											
		FILL-(SM) gravelly SILTY SAND; brown; moist, compact		188.35	1	AS									
1				188.35	2	SS	21								
		(SP) SAND, trace gravel, some silt; brown to grey, containing silty sand pockets; wet, loose to compact		184.62											
2				184.62	3	SS	10								
3	Truck Mount CME 75 6" O.D. Auger			184.62	4	SS	9								
4				184.62	5	SS	13								
5				184.62	6	SS	17								
6		End of Borehole		184.62											
7		NOTE: 1. Groundwater measured at a depth of 1.4 m below existing grade (Elev. 188.4 masl) upon completion of drilling September 11, 2016.		5.18											
8															
9															
10															

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PROJECT: 1545167
 LOCATION: N 5383286.00; E 552519.00

RECORD OF BOREHOLE: BH16-07

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 11, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								Cu, kPa		nat V. rem V.		+				Q - U	
0		GROUND SURFACE		192.10													
		ASPHALT		192.10													
		FILL-(SM) gravelly SILTY SAND; brown, containing rock fragments; moist, dense		190.65	1	AS											
1					2	SS	40										
		(SP) SAND, trace gravel, trace to some silt; brown; moist to wet, very loose to compact		190.65													
				1.45	3	SS	18										
2					4	SS	3										
					5	SS	2										
3					6	SS	9										
5				186.92													
		End of Borehole		5.18													
6		NOTE: 1. Groundwater measured at a depth of 3.1 m below existing grade (Elev. 189.0 masl) upon completion of drilling September 11, 2016.															

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DEPTH SCALE
 1 : 50



LOGGED: AK
 CHECKED: DM






PROJECT: 1545167
 LOCATION: N 5383073.00; E 552638.00

RECORD OF BOREHOLE: BH16-08

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 10, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH		WATER CONTENT PERCENT					
								Cu, kPa	nat V. rem V. + ⊕ - ⊙	Wp	W	Wi			
0		GROUND SURFACE		199.00											
		ASPHALT		198.98											
		FILL-(SM) gravelly SILTY SAND; brown; moist		198.31	1	AS									
1	Truck Mount CME 75 6" O.D. Auger	(SP) SAND, trace gravel, trace silt; grey to brown; moist to wet, loose to compact		197.20	2	SS	20								
				197.20	3A										
2		(ML) SILT, trace sand; grey, containing rootlets; moist, loose		196.79	3B	SS	8								
				196.79	4	SS									
		(CL-ML) SILTY CLAY to CLAYEY SILT, trace sand; grey; w>PL, hard		196.43	4	SS	50/127 mm							MH	
3		End of Borehole Inferred Bedrock		196.43											
3		NOTE: 1. Groundwater measured at a depth of 1.6 m below existing grade (Elev. 197.4 masl) upon completion of drilling September 10, 2016.		2.57											

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PROJECT: 1545167
 LOCATION: N 5382828.00; E 552667.00

RECORD OF BOREHOLE: BH16-09

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 9, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa		WATER CONTENT PERCENT		WATER CONTENT PERCENT			
								20	40	60	80	10 ⁻⁶	10 ⁻⁵		
0	Truck Mount CME 75 6" O.D. Auger	GROUND SURFACE		200.30											
		ASPHALT		199.88	0.05										
		FILL-(SM) gravelly SILTY SAND; brown; moist		199.61	0.69	1	AS								
1		(SP) SAND, some gravel, some silt; brown, containing crushed rock fragments; moist, very dense		198.39	1.91	2A	SS	52							
2		End of Borehole Inferred Bedrock		198.39	1.91	3	SS	64/229 mm							
3		NOTE: 1. Borehole dry upon completion of drilling September 9, 2016.													
4															
5															
6															
7															
8															
9															
10															

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PROJECT: 1545167
 LOCATION: N 5382727.00; E 552727.00

RECORD OF BOREHOLE: BH16-10

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 9, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
								20	40	60	80	nat V. +	rem V. ⊕			Q - ●	U - ○
0	Truck Mount CME 75 6" O.D. Auger	GROUND SURFACE		198.00													
		ASPHALT		0.00 0.07	1	AS											
		FILL-(SM) SILTY SAND, some gravel; brown; moist		197.31 0.69	2	SS	61/178 mm										
1		(SP) SAND, trace silt, trace gravel; brown; moist, very hard		196.91 1.09													
		End of Borehole Inferred Bedrock															
		NOTE: 1. Borehole dry upon completion of drilling September 9, 2016.															
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

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PROJECT: 1545167
 LOCATION: N 5382608.00; E 552728.00

RECORD OF BOREHOLE: BH16-11

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 9, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa		WATER CONTENT PERCENT		WATER CONTENT PERCENT			
								20	40	60	80	10 ⁻⁶	10 ⁻⁵		
0	Truck Mount CME 75 6" O.D. Auger	GROUND SURFACE		195.30											
		ASPHALT		0.00											
		FILL-(SM) gravelly SILTY SAND; brown, containing rock fragments; moist, very dense		0.05	1	AS									
1		End of Borehole Inferred Bedrock		194.41	2	SS									
		NOTE: 1. Borehole dry upon completion of drilling September 9, 2016.		0.89		50/127 mm									
2															
3															
4															
5															
6															
7															
8															
9															
10															

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DEPTH SCALE
1 : 50



LOGGED: AK
CHECKED: DM

PROJECT: 1545167
 LOCATION: N 5382490.00; E 552675.00

RECORD OF BOREHOLE: BH16-12

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 9, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								Cu, kPa		nat V. rem V.		+				Q - U	
0	Truck Mount CME 74 6" O.D. Auger	GROUND SURFACE		194.00													
		ASPHALT		194.00													
		FILL-(SM) gravelly SILTY SAND; brown; moist		193.39													
		Supsected Rock Fill		193.39													
1		End of Borehole Probable Rock Fill		0.61													
		NOTE: 1. Borehole dry upon completion of drilling September 9, 2016.															
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

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DEPTH SCALE
1 : 50



LOGGED: AK
CHECKED: DM

PROJECT: 1545167
 LOCATION: N 5382398.00; E 552590.00

RECORD OF BOREHOLE: BH16-13

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 9, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								Cu, kPa		nat V. + rem V. ⊕ ⊙		Q - U - ⊙				Wp	
0	Truck Mount CME 75 6" O.D. Auger	GROUND SURFACE		189.10													
		ASPHALT		189.04													
1		FILL-(SM) gravelly SILTY SAND; brown, containing crushed rock fragments; moist, very dense			1	AS											
					2	SS	84/223 mm										
1.14		End of Borehole Inferred Bedrock		187.96													
2		NOTE: 1. Borehole dry upon completion of drilling September 9, 2016.		1.14													
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

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PROJECT: 1545167
 LOCATION: N 5382370.00; E 552507.00

RECORD OF BOREHOLE: BH16-14

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 9, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa		WATER CONTENT PERCENT		Wp	W			Wi
								20	40	60	80					
0		GROUND SURFACE		186.00												
		ASPHALT		185.99												
		FILL-(SM) gravelly SILTY SAND; brown; moist			1	AS										
1		(SP) SAND, trace to some silt, trace gravel; brown; moist, very loose to compact		185.31												
				0.69	2	SS	19									
2					3	SS	19								M	
		wet below 2.5 mbgs			4	SS	4									
3					5	SS	4									
4					6	SS	50/51 mm									
5		End of Borehole Inferred Bedrock		181.38												
		NOTE: 1. Groundwater measured at a depth of 2.7 m below existing grade (Elev. 183.3 masl) upon completion of drilling September 9, 2016.		4.62												

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DEPTH SCALE
 1 : 50



LOGGED: AK
 CHECKED: DM

PROJECT: 1545167
 LOCATION: N 5382364.00; E 552432.00

RECORD OF BOREHOLE: BH16-15

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 9, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								20 40 60 80		nat V. + Q - rem V. ⊕ U - ○		10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³				Wp W Wi	
0		GROUND SURFACE		185.50													
		ASPHALT		185.00													
		FILL-(SM) gravelly SILTY SAND; brown; moist		184.81	1	AS											
1		(SP) SAND, trace gravel, trace to some silt; brown; moist, very loose to compact		184.69	2	SS	9										
2		wet below 2.3 mbgs			3	SS	6										
3					4	SS	15										
4					5	SS	4										
5		Fibrous ORGANICS 10mm thick at 5.0 mbgs		180.32	6	SS	3										
5.18		End of Borehole		180.32													
6		NOTE: 1. Groundwater measured at a depth of 2.2 m below existing grade (Elev. 183.3 masl) upon completion of drilling September 9, 2016.															
7																	
8																	
9																	
10																	

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DEPTH SCALE
1 : 50



LOGGED: AK
CHECKED: DM

PROJECT: 1545167
 LOCATION: N 5382384.00; E 552342.00

RECORD OF BOREHOLE: BH16-16

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 9, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
								20	40	60	80	nat V. +	Q -			rem V. ⊕	U -
0		GROUND SURFACE		185.60													
		ASPHALT		184.91													
		FILL-(SM) gravelly SILTY SAND; brown; moist		184.91	1	AS											
1		(SP) SAND, trace to some silt, trace gravel; brown; moist, very loose to compact		184.91	2	SS	18										
2					3	SS	9										
3		wet below 2.3 mbgs			4	SS	19										
4		grey below 3.0 mbgs			5	SS	7										
5		Fibrous ORGANICS from 4.9 to 5.0 mbgs			6A	SS	4										
					6B	SS											
5		End of Borehole		180.42													
		NOTE: 1. Groundwater measured at a depth of 2.0 m below existing grade (Elev. 183.6 masl) upon completion of drilling September 9, 2016.		5.18													

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DEPTH SCALE
1 : 50



LOGGED: AK
CHECKED: DM

PROJECT: 1545167
 LOCATION: N 5382383.00; E 552271.00

RECORD OF BOREHOLE: BH16-17

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 8, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								Cu, kPa		nat V. rem V.		+		Q - U			Wp
0		GROUND SURFACE		185.60													
		ASPHALT		185.60													
		(SM) gravelly SILTY SAND; brown; moist		184.91	1	AS											
1		(SP) SAND, trace gravel, trace to some silt; brown; moist, loose to compact		184.91	2	SS	9										
2					3	SS	10										
3	Truck Mount CME 75 Solid Stem 6" O.D. Auger	wet below 2.3 mbgs			4	SS	11										
4					5	SS	8										
5					6	SS	5										
5		End of Borehole		180.42													
6		NOTE: 1. Groundwater measured at a depth of 2.1 m below existing grade (Elev. 183.5 masl) upon completion of drilling September 8, 2016.		5.18													
7																	
8																	
9																	
10																	

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PROJECT: 1545167
 LOCATION: N 5382346.00; E 552070.00

RECORD OF BOREHOLE: BH16-18

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 8, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
								20	40	60	80	nat V. rem V.	+ ⊕	- ⊖			Wp
0		GROUND SURFACE		185.60													
		ASPHALT		185.00													
		FILL-(SM) gravelly SILTY SAND; brown; moist		184.91	1	AS											
1		(SP) SAND, trace to some silt, trace gravel; brown; moist, loose to compact		184.91	2	SS	14										
2					3	SS	8										
3		wet below 2.3 mbgs			4	SS	13										
4					5	SS	22										
5		grey below 4.1 mbgs			6	SS	20										
5		End of Borehole		180.42													
6		NOTE: 1. Groundwater measured at a depth of 1.8 m below existing grade (Elev. 183.8 masl) upon completion of drilling September 8, 2016.		5.18													

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PROJECT: 1545167
 LOCATION: N 5382327.00; E 551984.00

RECORD OF BOREHOLE: BH16-19

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 8, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								Cu, kPa		nat V. rem V.		+		Q - U			Wp
0		GROUND SURFACE		185.80													
		FILL-(SM) SILTY SAND, trace gravel; brown; moist		0.00	1	AS											
1		(SP) SAND, trace gravel, trace to some silt; brown; moist to wet, loose to compact		185.11	2	SS	12										
				0.69													
2					3	SS	6										
3					4	SS	11										
4					5A	SS	18										
		grey below 3.4 mbgs			5B	SS											
5					6	SS	13										
				180.62													
		End of Borehole		5.18													
6		NOTE: 1. Groundwater measured at a depth of 1.7 m below existing grade (Elev. 184.1 masl) upon completion of drilling September 8, 2016.															
7																	
8																	
9																	
10																	

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DEPTH SCALE
 1 : 50



LOGGED: AK
 CHECKED: DM



PROJECT: 1545167
 LOCATION: N 5382289.00; E 552089.00

RECORD OF BOREHOLE: BH16-20

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 8, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
								Cu, kPa		nat V. rem V.		+		Q - U -			Wp
0		GROUND SURFACE		185.20													
		FILL-(SM) SILTY SAND, trace gravel; brown; moist		0.00	1	AS											
1		(SP) SAND, trace gravel, trace to some silt; brown; moist to wet, compact		184.51	2	SS	11										
				0.69													
2					3	SS	11										
3					4	SS	11										
					5A	SS	19										
		grey at 3.3 mbgs			5B	SS	19										
4																	
5					6	SS	21										
				180.02													
		End of Borehole		5.18													
6		NOTE: 1. Groundwater measured at a depth of 1.2 m below existing grade (Elev. 184.0 masl) upon completion of drilling September 8, 2016.															
7																	
8																	
9																	
10																	

DEPTH SCALE
 1 : 50



LOGGED: AK
 CHECKED: DM

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PROJECT: 1545167
 LOCATION: N 5382236.00; E 552101.00

RECORD OF BOREHOLE: BH16-21

SHEET 1 OF 1
 DATUM: Geodetic

BORING DATE: September 8, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		STRATA PLOT	ELEV. DEPTH (m)	SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	NUMBER			TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa		WATER CONTENT PERCENT					
								20	40	60	80	nat V. rem V.	+		
0		GROUND SURFACE			184.90 0.00										
		FILL-(SM) SILTY SAND, some gravel; brown; moist				1	AS								
1		(SP) SAND, trace to some silt; brown; moist, loose to compact			184.21 0.69										
		wet below 1.5 mbgs				2	SS	19							
2															
		wet below 1.5 mbgs				3	SS	8							
3															
		grey below 2.2 mbgs													
						4	SS	22							M
5															
						5	SS	17							
6															
						6	SS	13							
7															
						7	SS	9							M
8		End of Borehole Start of DCPT			177.60 7.30										
8		End of DCPT			176.98 7.92										
9		NOTE: 1. Groundwater measured at a depth of 1.4 m below existing grade (Elev. 183.5 masl) upon completion of drilling September 8, 2016.													
10															

DEPTH SCALE
 1 : 50



LOGGED: AK
 CHECKED: DM

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APPENDIX A

Important Information and Limitations of This Report



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



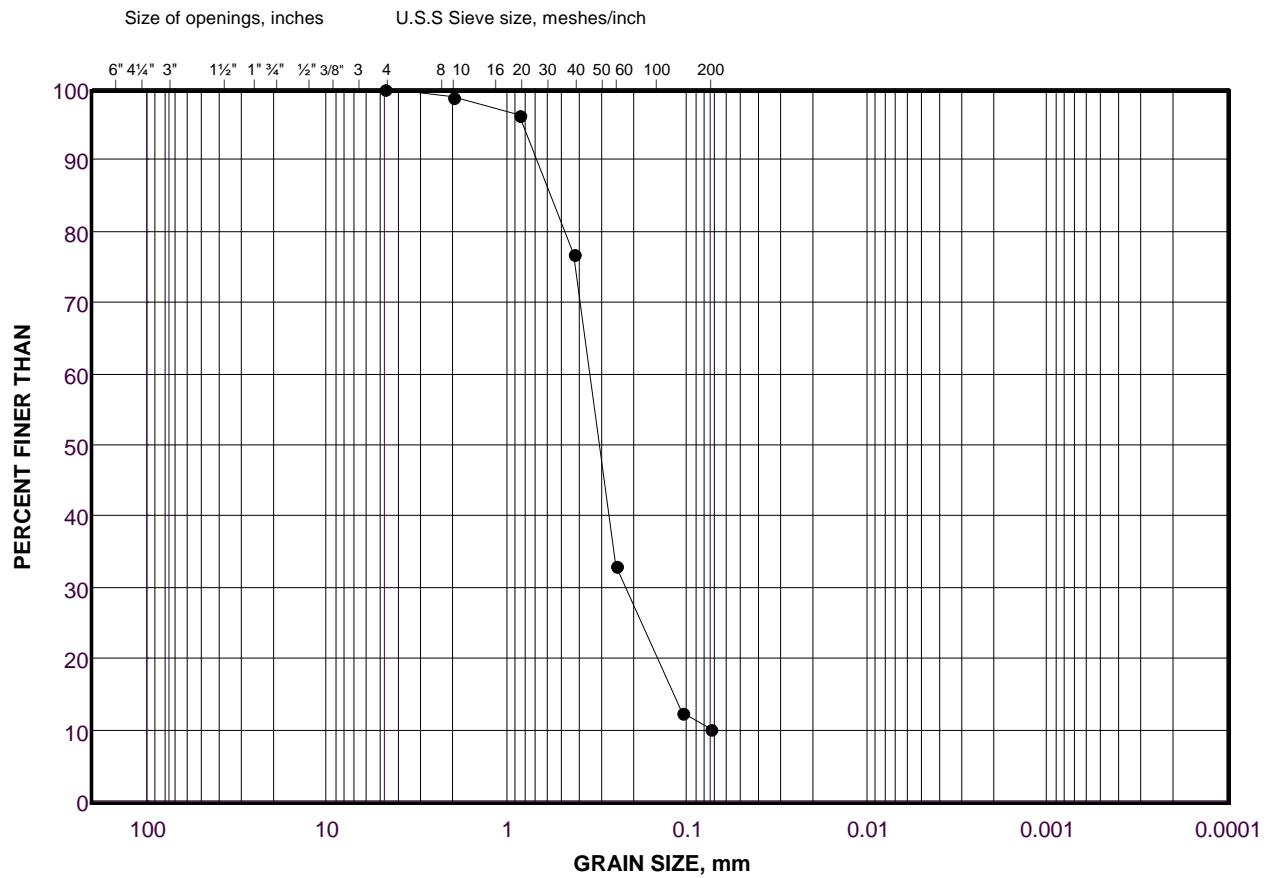
APPENDIX B

Figures B1 to B6

GRAIN SIZE DISTRIBUTION

FILL - (SP) SAND

FIGURE B1



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH16-01	SS2	0.76 - 1.37

Project Number: 1545167

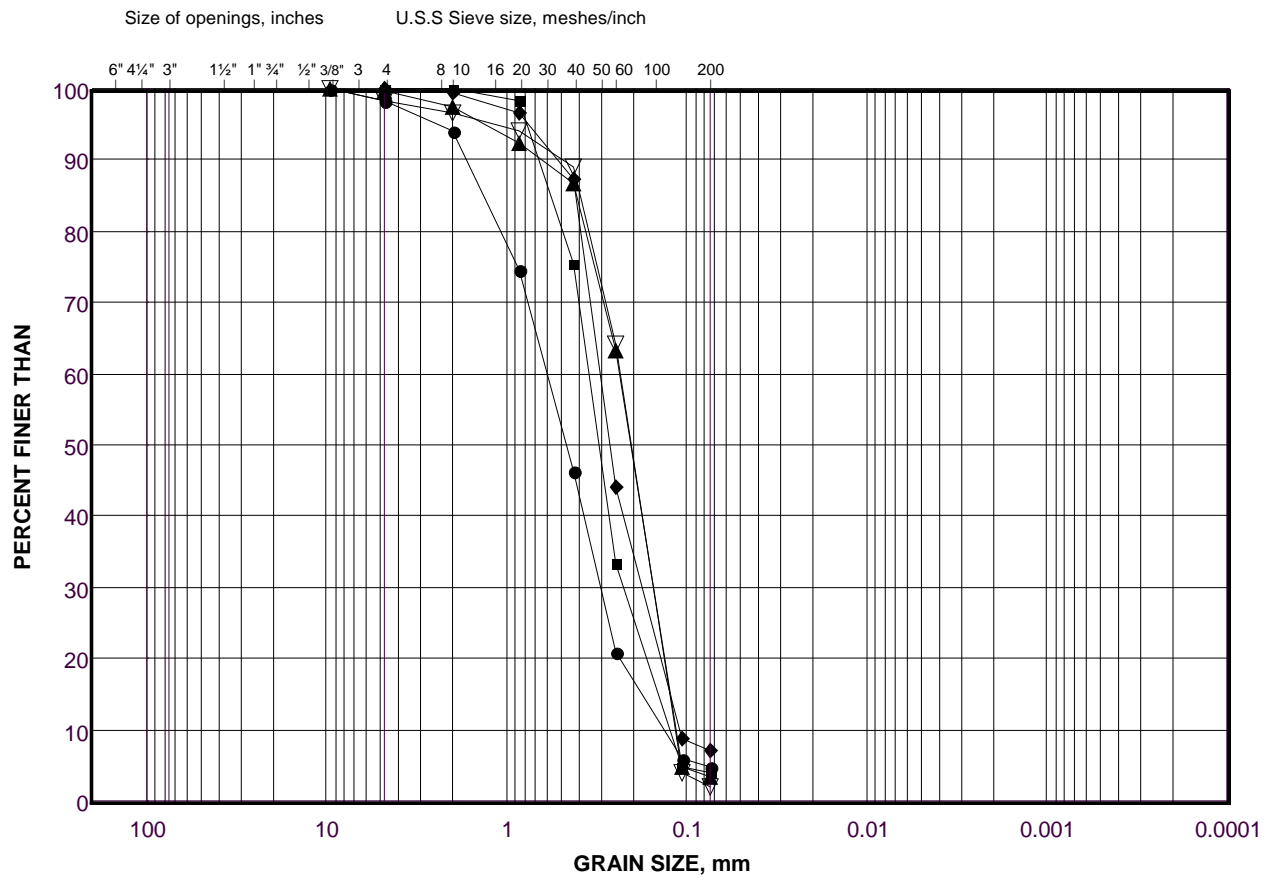
Checked By: DPM

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Date: 05-Oct-16

GRAIN SIZE DISTRIBUTION (SP) SAND

FIGURE B2



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH16-03	SS2	0.76 - 1.37
■	BH16-14	SS3	1.52 - 2.13
◆	BH16-01	SS3	1.52 - 2.13
▲	BH16-05	SS4	2.29 - 2.90
▽	BH16-05	SS6	4.57 - 5.18

Project Number: 1545167

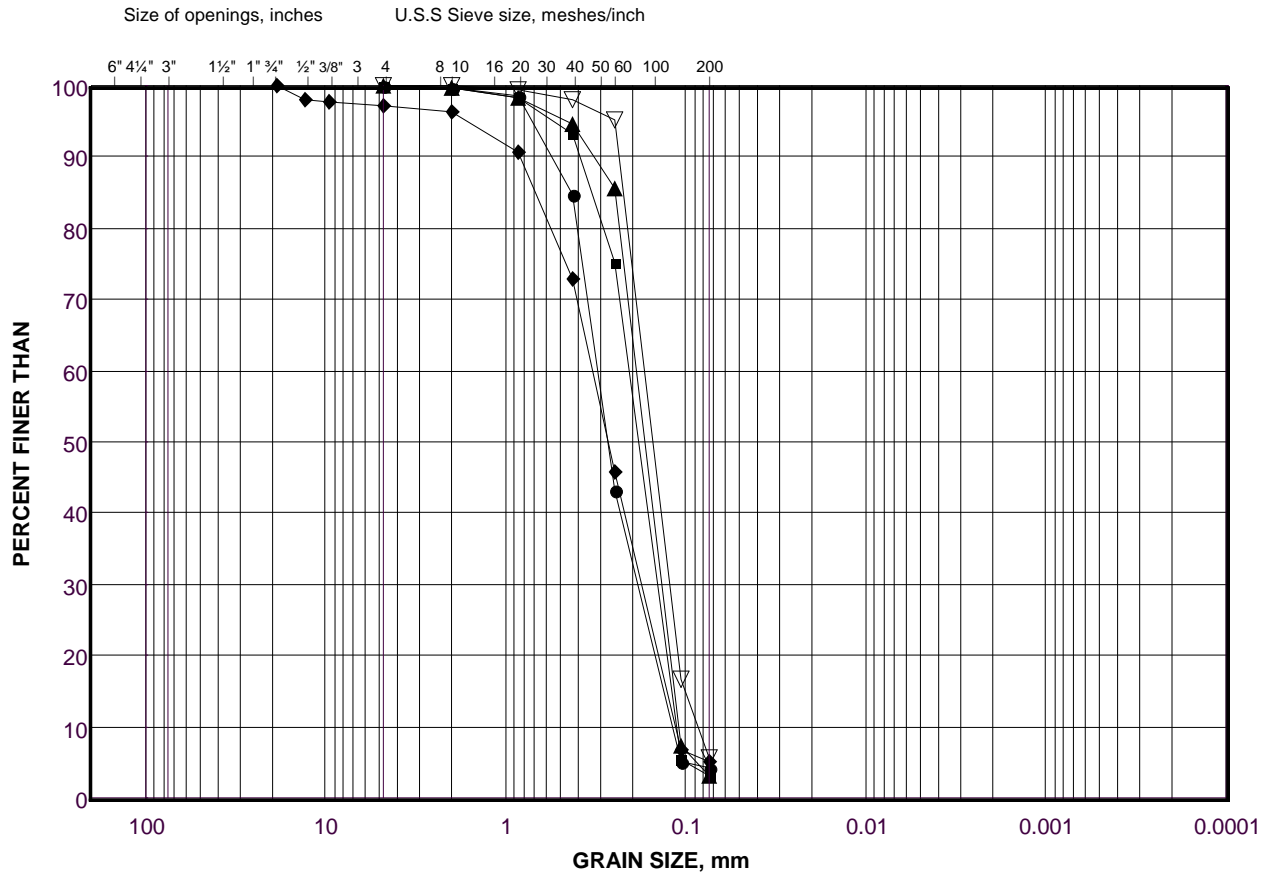
Checked By: DPM

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Date: 05-Oct-16

GRAIN SIZE DISTRIBUTION (SP) SAND

FIGURE B3



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH16-18	SS3	1.52 - 2.13
■	BH16-21	SS4	2.29 - 2.90
◆	BH16-15	SS4	2.29 - 2.90
▲	BH16-19	SS6	4.57 - 5.18
▽	BH16-21	SS7	6.10 - 6.71

Project Number: 1545167

Checked By: DPM

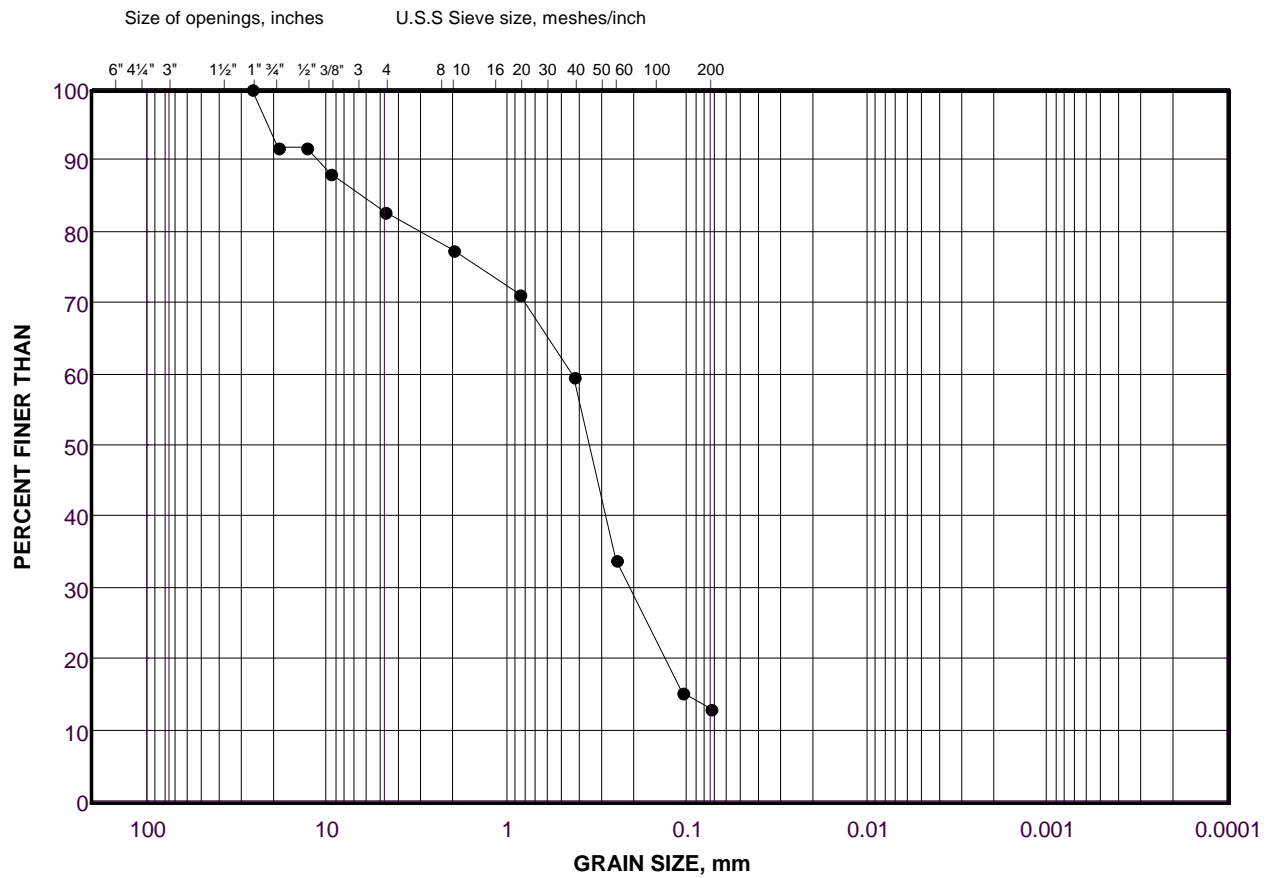
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GRAIN SIZE DISTRIBUTION

FILL - (SM) gravelly SILTY SAND

FIGURE B4



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
	GRAVEL SIZE		SAND SIZE			

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH16-07	SS2	0.76 - 1.37

Project Number: 1545167

Checked By: DPM

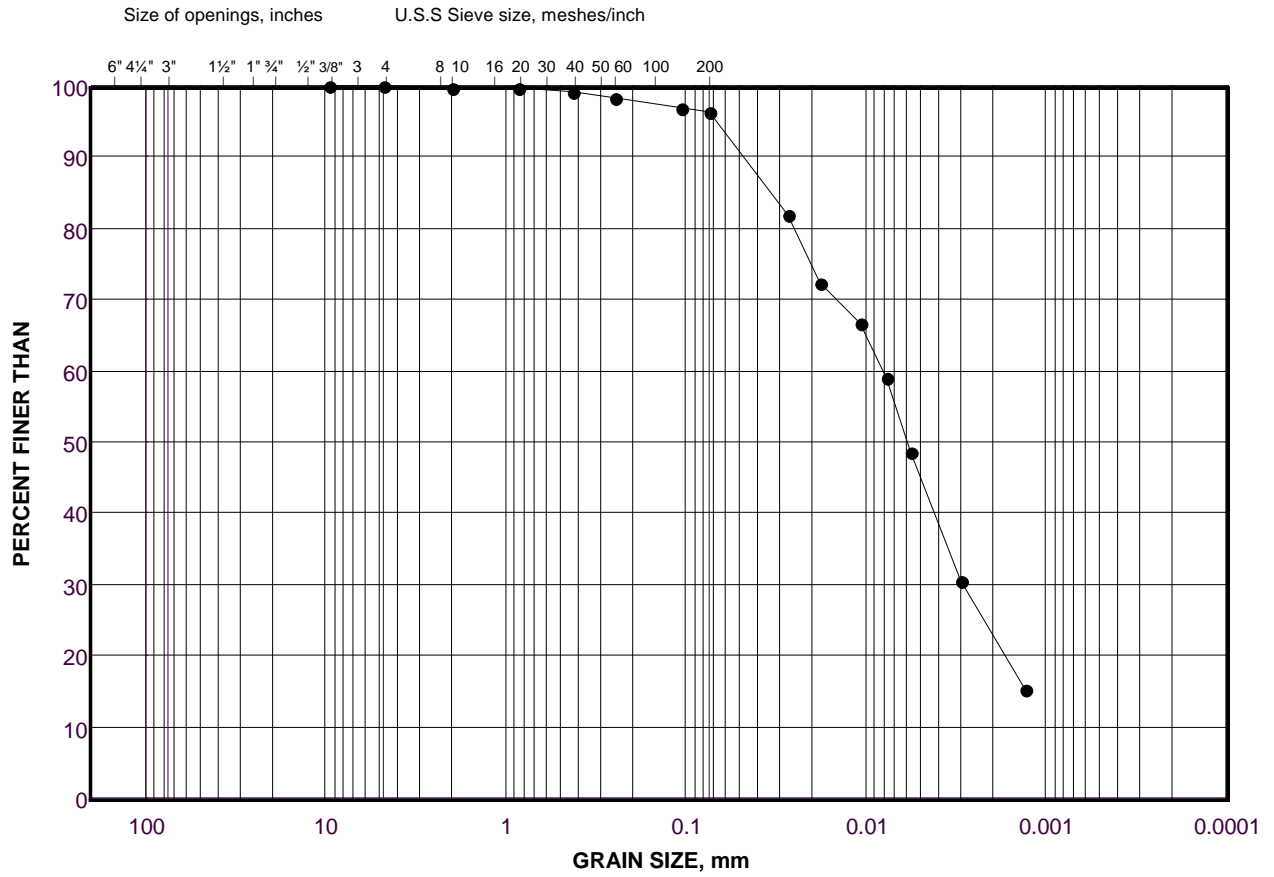
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GRAIN SIZE DISTRIBUTION

(CL-ML) SILTY CLAY to CLAYEY SILT

FIGURE B5



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH16-08	SS4	2.29 - 2.90

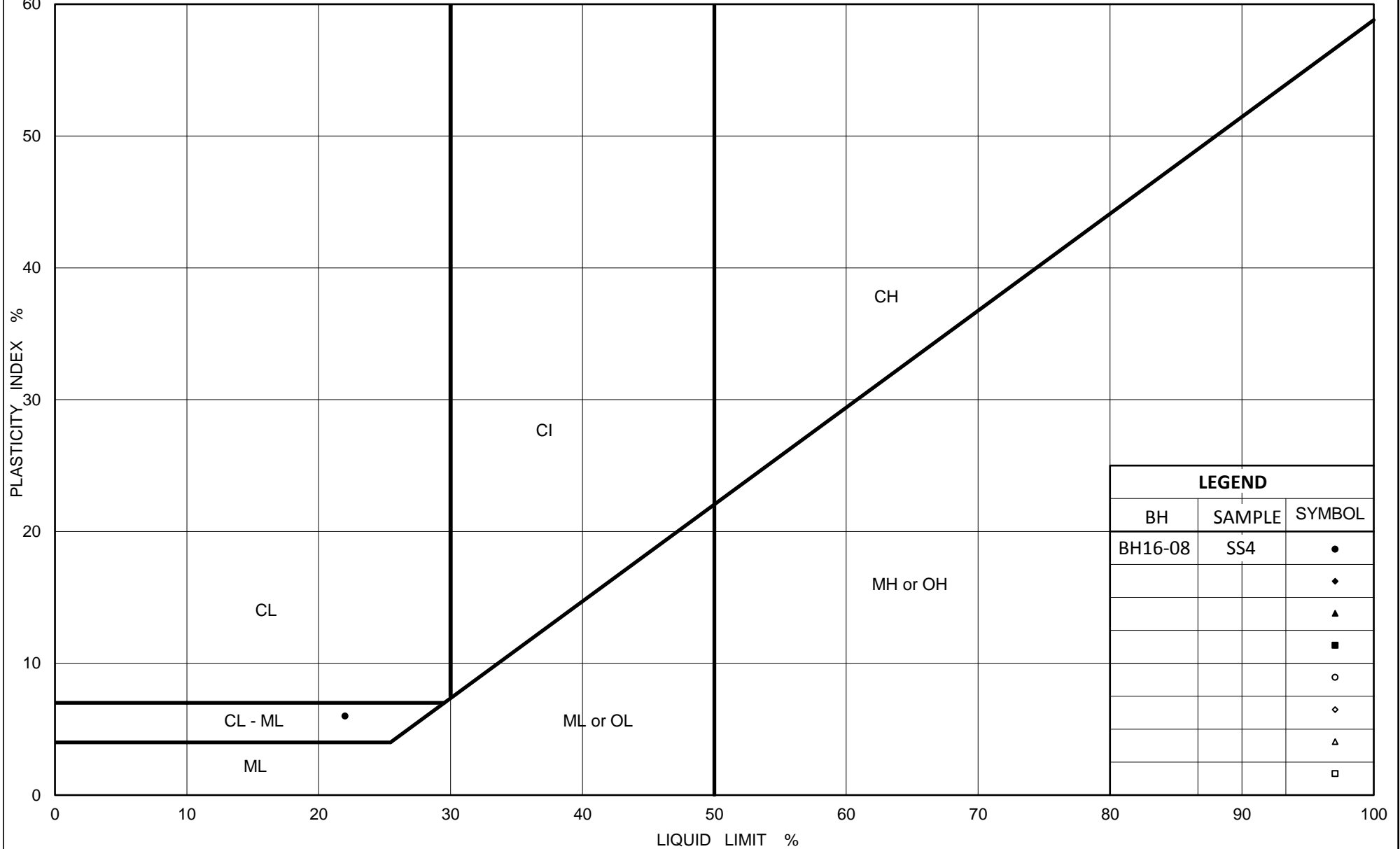
Project Number: 1545167

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Date: 05-Oct-16

LEGEND



LEGEND		
BH	SAMPLE	SYMBOL
BH16-08	SS4	●
		◆
		▲
		■
		○
		◇
		△
		□



**PLASTICITY CHART
(CL-ML) SILTY CLAY to CLAYEY SILT**

Figure No. B6

Project No. 1545167

Checked By: DPM

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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