Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

SPECIFICATIONS FOR

ONTARIO WATERWAYS UNIT (RIDEAU CANAL)

BOBS LAKE DAM REPLACEMENT

Project No. 30025767
Ref. No. EQ754-131096

ISSUED FOR TENDER
February 22, 2018

Prepared by:

CIMA+
600-3400 du Souvenir blvd
Laval QC
H7V 3Z2

PROJECT TITLE Bobs Lake Dam Replacement

PROJECT NUMBER 30025767

PROJECT DATE 2018-02-22

END OF SECTION

Prepared by :

2018/02/22

Josée Francoeur, Eng.
O.I.Q. membership number: 121879

Yann Berton, P.Eng.
PEO membership number : 100218108
O.I.Q. membership number : 5008041

Verified by :

John Konczynski, P.Eng.
PEO membership number: 100113465
O.I.Q. membership number: 32542

CIMA+
Partners in excellence

CIMA+
600-3400, du Souvenir blvd
Laval (QC)
H7V 3Z2

	DRAWING NUMBER	TITLE
0.1	A0138-A000492-CV-001-01	LOCATION MAP LIST OF DRAWINGS
0.2	A0138-A000492-CV-002-01	GENERAL ARRANGEMENT PLAN AND ACCESS ROAD
0.3	A0138-A000492-CV-002-02	ACCESS ROAD TO CONSTRUCTION SITE AND ROCK PROFILES SECTIONS
0.4	A0138-A000492-CV-002-03	CULVERT PIPE AND GUARDRAIL SECTIONS AND DETAILS
0.5	A0138-A000492-CV-002-04	LEASE AREAS PLAN
0.6	A0138-A000492-CV-003-01	EXISTING SITE PLAN DEMOLITION
0.7	A0138-A000492-CV-004-01	COFFERDAM STAGING PLAN
0.8	A0138-A000492-CV-005-01	DAM CONSTRUCTION PLAN SECTIONS AND DETAILS
0.9	A0138-A000492-CV-005-02	SLUICEWAY CONSTRUCTION PLAN SECTIONS AND DETAILS
0.10	A0138-A000492-CV-005-03	FOUNDATION TREATMENT PLAN SECTIONS AND DETAILS
0.11	A0138-A000492-CV-006-01	GAIN COVER PLAN, SECTIONS AND DETAILS
0.12	A0138-A000492-CV-006-02	WINCH FRAME AND STOP LOG RAIL SECTIONS AND DETAILS
0.13	A0138-A000492-CV-007-01	GUARDRAIL PLAN ELEVATIONS AND DETAILS
0.14	A0138-A000492-CV-008-01	STANDARD PUBLIC STYLE GUARDRAIL FABRICATION DETAILS
0.15	A0138-A000492-CV-009-01	SAFETY SIGNAGE AND BOOM ANCHORAGE DETAILS
0.16	A0138-A000492-CV-010-01	STREAM BED ENVIRONMENTAL REHABILITATION PLAN
0.17	A0138-A000492-CV-010-02	STREAM BED ENVIRONMENTAL REHABILITATION LONGITIDINAL AND CROSS SECTIONS
0.18	A0138-A000492-CV-010-03	STREAM BED ENVIRONMENTAL REHABILITATION DAM DEMOLITION AND RIPARIAN PLANTATION

DAM SAFETY SIGNS TEMPLATES (For reference only)		TITLE
0.19	A8 - EN	TAILRACE DANGER SIGN
0.20	A8 - FR	TAILRACE DANGER SIGN
0.21	B1	OPEN DAM DANGER SIGN
0.22	G3	TYPE 1 ADDRESS SIGN
0.23	G5	LIFE RING SIGN
0.24	G9	STRONG CURRENTS SIGN

EXISTING BOBS LAKE DAM DRAWING AND PICTURES (For reference only)		TITLE
0.25	RCBL 831 - 1983	BOBS LAKE DAM SOUNDINGS
0.26	RCBL 832 - 1983	BOBS LAKE DAM PLAN OF EXISTING DAM
0.27	RCBL 833 - 1983	BOBS LAKE DAM DECK DETAILS
0.28	CORCBL 85-R663	BOBS LAKE DAM REPAIRS DRILL HOLE LAYOUT
0.29	CORCBL 85-R664	BOBS LAKE DAM REPAIRS TYPICAL DETAILS
0.30	PICTURES	EXISTING BOBS LAKE DAM PICTURES

END OF SECTION

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

.1 Title and description of Work.

.2 Contract Method.

.3 Work sequence/planning.

.4 Contractor use of premises.

.5 Parks Canada Agency occupancy and operation.

.6 Alterations to existing site.

1.2 PRECEDENCE

.1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 RELATED REQUIREMENTS

.1 Section 01 14 00 – Work Restrictions

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 43 – Archaeological, Cultural and Environmental Procedures

.4 Section 01 41 00 – Regulatory Requirements

.5 Section 01 71 00 – Examination and Preparation

1.4 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises full demolition and reconstruction of Bobs Lake Dam of Rideau Canal, located near the hamlet of Bolingbroke, approximately 30 km west of the Town of Perth; and further identified as PCA Project No, 30025767.

.2 The Construction Work includes but is not limited to the following:

.1 Developing work / staging areas;

1.4 WORK COVERED BY CONTRACT DOCUMENTS (Cont'd)

.2 (Cont'd)

.2 Public/recreational traffic control / detour;

.3 Designing and constructing temporary and permanent access roads;

.4 Preparation and implementation of a Environmental Management Plan in accordance with Parks Canada Environmental Standards and Guidelines;

.5 Obtaining regulatory permits certificates of authorization and approvals;

.6 Cofferdams design, supply and installation and dewatering of work area, including maintenance of the dewatering system;

.7 Designing and constructing water diversion work, including maintenance and operation of diversion system through construction project and cofferdams;

.8 Protection of existing adjacent structures / properties and other works including embankments, during construction. Protection of historic rock crib dam with site cofferdam upstream of historic dam;

.9 Preparation and implementation of an Emergency Response Plan (ERP) for Contractor temporary works, Operation/Monitoring/Surveillance Plan (OMS) for Contractor's temporary works;

.10 Demolition of the existing concrete gravity dam structure, after construction of the new dam;

.11 Salvaging of the existing winches and other identified equipment;

.12 Construction of the new concrete dam structure and related work;

.13 River erosion protection and stream bed environmental rehabilitation, including bypass of minimal environmental flow through work area during construction;

.14 Removal of water diversion system, temporary construction access roads and other temporary works;

.15 Supply and installation of the new safety boom system;

.16 Dam commissioning and diversion during stream bed environmental rehabilitation and demolition of the old dam;

.17 Site reinstatement and restoration.

.18 In addition, the work under this contract, the Contractor will also be responsible for:

.1 Design, approvals and monitoring work associated with the temporary works (construction access roads, water diversion system, dewatering, sediment control, etc.).

1.4 WORK COVERED BY CONTRACT DOCUMENTS (Cont'd)

.3 The Contractor shall supply all labour, equipment, and material to perform the work as described in the contract plans and specifications, and will retain qualified personnel to perform the work.

1.5 CONTRACT METHOD

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

1.6 LOCATION OF WORK

.1 Bobs Lake Dam is located in the upper reach of the Tay River system at the outlet of Bobs Lake. The dam is located just west of the Hamlet of Bolingbroke, approximately 15 km north of the Village of Westport and 30 km west of the Town of Perth, Ontario. The legal location is: Lot 6, Concession III, Township of South Sherbrooke, County of Lanark, Province of Ontario.

.1 Coordinates: N 44°45'34" W 76°31'21",
.2 Topographic Map: 031C15 (Sharbot Lake),
.3 Access road: actually by foot through a farmer's field via Crow Lake Road.

1.7 EXAMINATION OF SITE

.1 Visit site before submitting tender. Examine site, adjacent premises, means of access and egress, and investigate and be fully informed of the nature and extent of the work required, difficulties in performing the work, facilities available for delivery, placing, operating plant and for delivery of materials.

.2 A mandatory site visit will be organized to allow Bidders to examine site, adjacent premises, and condition of existing structure(s) before submitting a bid.

.3 Be completely familiar with every detail and intent of these specifications and scope of work to be performed, and regulatory requirements governing the Work.

.4 The Contractor is advised that all elevations and dimensions shown on the plans are approximate only. The Contractor will be required to verify all existing dimensions and grades before preparing and submitting shop drawings and before planning and undertaking any construction work. The Contractor will immediately report all discrepancies, in writing, to the Consultant.

1.8 COST BREAKDOWN

.1 Within five (5) days of notification of acceptance of bid, provide the Consultant with a cost breakdown for both lump sum and unit price items as outlined in Section 01 22 01. Submit prices for each line item for the unit of measure specified.

.2 Submit breakdown in metric (SI) units.

.3 Upon approval from the Consultant cost breakdown will be used as basis for progress payments.

1.9 WORK BY OTHERS

.1 The Contractor shall for the purpose of the Ontario Occupational Health and Safety Act and Regulations for Construction Projects, and for the duration of the Work of the Contract:

.1 Assume the role of Constructor in accordance with the Authority Having Jurisdictions.

1.10 WORK SCHEDULE

.1 Within fifteen (15) days of award of the Contract, provide the Consultant with a copy of the Construction Schedule and estimated Cash Flow corresponding to the construction schedule.

.2 The Construction Progress Schedule is to be prepared in accordance with Section 01 32 16.

.3 Commencement of work will not be permitted until master plan and detailed schedule, as detailed in Section 01 32 16 - Construction Progress Schedule - Critical Path Method (CPM), has been reviewed and accepted by the Consultant, and revised and resubmitted by the Contractor, as required.

.4 Provide a schedule for the submission of shop drawings, plans and procedures.

.5 If progress of work should fall behind, take steps required to bring work back to schedule. Do not change schedule without Consultant's approval.

.6 Site work is not permitted before June 1st. In water work is not permitted until July 1st.

.7 In water work is permitted from July, 1st to October, 14th in any given year.

1.11 CONTRACTOR'S TECHNICAL SUPPORT TEAM

.1 Within five (5) days of acceptance of bid, submit a list of design engineers and specialists that will support Contractor to deliver the project.

.2 Contractor's Technical Support Team must include (but not limited to):
- .1 Environmental Specialist
- .2 Health and Safety Specialist
- .3 Hydraulic/Civil Engineer (Diversion System)
- .4 Dam/Structure/Geotechnical Engineer (cofferdams dewatering works, etc.)

1.12 WORK PLANNING

.1 Construct Work in stages to accommodate Owner's continued requirement to maintain equal lake levels upstream and downstream of cofferdams and to pass specified flow downstream of construction site during construction and to minimize interference with the operation of the water management of the TSW by Parks Canada Agency.

.2 Plan and schedule in-water work and any tree removal work as to not interfere with restricted time periods as outlined in Section 01 14 00.

.3 Maintain/protect all structures, services and utilities throughout the work. Undertake services relocation to the requirement of the local authorities.

.4 Required Stages:
- .1 Construction of the access road to the future dam and staging area.
- .2 Construction maintenance and monitoring of environmental mitigation measures.
- .3 Construction of the upstream and downstream cofferdams and installation of diversion system.
- .4 Overburden excavation and bedrock foundation preparation and treatment;
- .5 Construction of the new stop log sluices, the spillway crest and the gravity dams;
- .6 Removal of cofferdams and diversion system;
- .7 Installation of diversion system through stream bed rehabilitation area;
- .8 Demolition of existing dam.
- .9 Environmental rehabilitation of river channel and banks;
- .10 Work site rehabilitation.

.5 Ensure fire access / control to work area and adjacent properties are maintained at all time.

1.13 CONTRACTOR USE OF PREMISES

.1 Contractor has unrestricted use of site for the purpose of construction, as defined by the Construction Limit, until Substantial Performance of the Work.

.2 Site is not available to the Contractor until June 1st.

.3 Confine work, including temporary structures, plant, equipment and materials to established Construction Limit, unless otherwise agreed to in writing by the Consultant.

.4 Coordinate use of premises under direction of PCA with Departmental Representative.

.5 Obtain and pay for use of additional off site storage or work areas needed to carry out the work under this Contract. Provide copy of formal agreement with the landowner to the Consultant. Furthermore, at completion of the work, provide copy of landowner release letter stating the all land use agreement conditions have been met.

.6 Locate temporary buildings, access roads, drainage facilities, services and utilities as approved by the Departmental Representative and maintain in clean and orderly manner.

1.14 WATER MANAGEMENT AND CONTROL

.1 PCA will continue their responsibility of water management and control on the Bobs Lake throughout the duration of the construction period using the existing dam. PCA will instruct the Contractor on water control issues. Contractor will be responsible to maintain the water levels upstream and downstream of the new dam construction site to the same elevation with the diversion system.

.2 The Contractor will operate the water diversion system to balance the water levels of the upper and lower reach of the new dam construction site in accordance with PCA instruction. Refer to Section 01 14 00 Work Restrictions and Section 35 20 22 Dewatering and Diversion. Responsibilities will include (but not limited to):

.1 Record keeping of the diversion system operations including, but not limited to, upstream and downstream water levels.

.2 Contractor be available on a daily basis for water control (including weekends and statutory holidays) with the response time of 6 hours maximum.

1.14 WATER MANAGEMENT AND CONTROL (Cont'd)

.3 Unless otherwise instructed the Contractor is to maintain the water levels within the dam operating range by balancing levels on both sides of cofferdam by using adequately sized openings. The Contractor is not to allow the water levels to go above or below set operating range without prior authorization from PCA.

.4 Sequence of handover of water control operations:
- .1 PCA will continue the water control operations on the existing dam until the work on the new dam and water diversion system is completed, commissioned and ready for operation.
- .2 The Contractor is to carry out water control operations on the water diversion system until the work on the new dam has been completed, commissioned and accepted by the Consultant, and PCA has taken over the dam structure.

.5 The Contractor is to install necessary water monitoring equipment to assist with water management. As a minimum the following equipment shall be supplied:
- .1 Staff gauge, installed in calm water, upstream of the diversion system entrance. The size of markings on the gauge is to be such that it can be easily read from the water diversion control structure.
- .2 Staff gauge, installed in calm water, downstream of the construction area. The size of markings on the gauge is to be such that it can be easily read from the shore or temporary downstream access road.

1.15 COMMUNICATION PROTOCOL

.1 Due to nature of the work of on going water management and control issues, a communication protocol will need to be established between the Consultant, the Contractor and PCA, prior to commencement of work.

.2 In general terms, the Communication Protocol will address:
- .1 Weekly communication related to water management and control;
- .2 Communication related to urgent safety concerns;
- .3 Communication related to scheduled and unscheduled Contractor or PCA operation activities;

1.15 COMMUNICATION PROTOCOL (Cont'd)

.2 (Cont'd)

.4 Recording and maintenance of records of water levels at installed stage gauges by Contractor. Provide water levels on a daily basis to Parks Canada Water Management staff.

.5 Communication related to construction and contract issues;

.6 Communication with the general public.

1.16 RECORD DRAWINGS

.1 As work progresses, maintain accurate records to show deviations from contract drawings. Submit one (1) set of record drawings just prior to the Consultant's inspection of the work for the issuance of the Final Certificate of Completion.

1.17 SIGNS

.1 Provide common use signs related to traffic and navigation control, information, instruction, use of equipment, public safety devices, etc, in both official languages or by the use of commonly understood graphic symbols to the Consultant's approval.

.2 No advertising will be permitted on this project.

1.18 REGULATORY REQUIREMENT

.1 Fee Permits, Certificates: Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of authority having jurisdiction.

.2 The submission of a tender will be construed as the Tenderer's declaration that they have discussed the approval requirements with the appropriate levels of government. All costs incurred by the Contractor associated with compliance with Section 1.19 will be borne by the Contractor. The Contractor will not make any claim for additional compensation due to delays on commencing work due to compliance with the above.

1.19 DOCUMENTATION

.1 Maintain on site, one copy of each document as follows:

- .1 Work Permit.
- .2 Contract Drawings.
- .3 Specifications.
- .4 Addenda.
- .5 Reviewed Shop Drawings.
- .6 List of Outstanding Shop Drawings.
- .7 Change Orders.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 MOL Notice of Project.
- .11 Site Specific Health and Safety Plan.
- .12 Environmental Management Plan.
- .13 Site Specific Safety Plan and Environmental Plan.
- .14 Other related documents as specified herein.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of adjacent premises. Make arrangements with Consultant to facilitate work as stated.

.2 Site work is not permitted before June 1st. Observe in water work restrictions. In water work is permitted from July 1st to October 14th.

.3 No site work including mobilization authorized until approval of Environmental Protection Plan and Site Specific Health and Safety Plan and issue of permit by Parks Canada.

1.2 ADVERTIING

.1 No advertising will be permitted on this project.

.2 The Contractor is not allowed to advertise this project on any website or in publications without permission from PWGSC.

1.3 EXISTING SERVICES

.1 Notify Consultant and utility companies of intended interruption of utilities and services and obtain required permission where applicable to site.

.2 Where Work involves breaking into or connecting to existing services, give Consultant forty-eight (48) hours of notice for necessary interruption of electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for personnel, pedestrian, boat and vehicular traffic control.

.4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.4 ENVIRONMENTAL RESTRICTIONS

.1 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures lists environmental restrictions, including in water work restrictions, and time frames that need to be considered in the planning of the work.

.2 Maintain existing flow pattern for the Bobs Lake Dam throughout the project period as directed by PCA.

.1 Diversion system discharge to be capable of flow control to maintain water supply in the Tay River and Rideau Canal systems.

.2 Diversion system discharge to be capable of flow control to maintain ecological flows in the Tay River system.

.3 Undertake Work in open water of the Bobs Lake outside the fishery spawning window. In-water and work adjacent to the open water is to be done in accordance with Section 01 35 43.

.4 Tree cutting and clearing work is not to be undertaken during the migratory bird nesting season, between April 1 and August 31. Tree cutting and clearing work is to be done in accordance with Section 01 35 43 and Section 31 11 00.

1.5 ROAD RESTRICTIONS

.1 Minimize traffic along access road and maintain safe speeds in accordance to local authorities regulations.

.2 Limit transportation activities from 08:00 to 17:00 hours.

.3 Where work involves disruption to and rerouting of vehicular traffic, provide Consultant with a Traffic Control Plan to the requirement of the local authorities and the standards set out in the Ontario Traffic Manual Book 7, Temporary Conditions.

.4 Provide a minimum of four (4) weeks formal notification for alterations to the local road access to the local authorities, emergency services, Canada Post and residents.

.5 Install road closure and construction advertising signs, two (2) weeks in advance of planned access changes.

1.6 REGIONAL ROAD AND AREA BRIDGES LOAD RESTRICTIONS

.1 County Road 36/Crow Lake Road (Bolingbroke, County of Lanark)
  .1 Note, there are three small bridges crossings along the County road 36 to Maberly, and there are no load restrictions on two of them and a load restriction on one of them (17 tonnes).
  .2 Note, there are two small bridge crossings along the County road 36 to Westport, and there are no load restrictions on all of them.
  .3 Half-load season on Crow Lake Road runs from March 1st to May 15th depending on county regulations.

1.7 SPECIAL REQUIREMENTS

.1 Carry out noise generating Work Monday to Friday from 07:00 to 18:00 hours.

.2 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedule - Bar (GANTT) Chart.

.3 Through the direction of the PCA Water Management Group, maintain water levels on the Bobs Lake and Tay River for navigation and other seasonal requirements through operation of the diversion structure.

.4 Coordinate any operation of the diversion system control structure with the Field and PCA Water Management Group to ensure optimal usage of the water supply in the Tay River an Rideau canal systems. Failure to do so could result in unacceptable water flows and levels, and possibly flooding of the downstream reach.

.5 Blasting for demolition and rock excavation is prohibited.

1.8 CONTRACTORS USE OF DEWATERED AREA

.1 Contractors use of the dewatered area is limited for the sole purpose of construction activity. The dewatered area shall not be used for:
  .1 the Contractor's construction camp or staging area, including site washroom facilities, and workers parking area;
  .2 fuel storage or refueling station;
  .3 storage of machinery, equipment or material; and

1.8 CONTRACTORS USE OF DEWATERED AREA (Cont'd)

1. (Cont'd)

.4 the Contractor's sediment trap, unless approved by the Consultant and that all environmental protection regulations can be met.

.2 All equipment and machinery used within the dewatered area are in good working condition and free of fuel, lubricants, coolant and other deleterious material that could enter the water body.

1.9 WATER LEVELS

.1 The general practice for Bobs Lake Dam is to manage water levels following a rule curve with operational level around 161.4 m until February with a gradual rise to 162.7 m in May through June and a gradual decrease to 161.4 m in October. Operation is conducted in order to supply the Tay and Rideau River with minimal flows for navigable water way operation. Operation is conducted using stop logs.

.2 Maximum conservation level is 162.8 m and minimum conservation level is 160.15.

.3 Design inflows to the lake are as follows:
2 years-23.1 cms; 5 years-29.6 cms;
10 years-33.1 cms.

.4 The contractor is solely responsible for making their own interpretation of the data included herein, and any received from the Agency.

.5 The contractor is cautioned that, while the Rideau Canal Waterway / Parks Canada Agency endeavors to manage the water levels within the indicated ranges, it cannot be held responsible for events, or the result of events, that are not under its control.

1.10 HOUR OF WORK

.1 The normal hours of work are Monday to Friday from 7:00 until 19:00 hours. Night shift is not allowed.

.2 The Contractor is not to work during the weekend and public holiday without prior authorization from the Department Representative. When weekend work is authorized, the hours of work shall be limited to 7:00 until 19:00 hours on Saturdays and 10:00 until 19:00 hours on Sundays and public holidays.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This section provides a list of work items that needs to be covered under the Contract Lump Sum Price and the procedures for payment that will be applied to these work items.

.2 This section covers the measurement of work for payment purposes, and the scope of work included in the pay items in the Unit Price Table.

1.2 LUMP SUM PRICE ITEMS

.1 Lump Sum Price - All Work other than that which is specifically designated in the Unit Price Table, shall be included in Contract Lump Sum Price. This item includes all costs to undertake the Work.

.2 The items of work listed below are not intended to be complete, but are provided to give an indication to the Contractor how the Contract Lump Sum Price will be broken down for payment purposes. As such, it is the Contractor's responsibility to ensure that all items of work not covered under the Unit Price Table are covered in the Contract Lump Sum Price.

.3 Items of work to be considered in the Contract Lump Sum Price are, but not limited to:

- .1 Mobilization/Demobilization (Payment Group 1), including:
  - .1 general site preparation, clearing and grubbing, soils stripping etc.;
  - .2 general maintenance and cleaning of work site, site access, and haul routes;
  - .3 site security;
  - .4 snow removal;
  - .5 construction control and monitoring;
  - .6 temporary utilities;
  - .7 temporary facilities;
  - .8 Contractor's and Consultant's Site Office;
  - .9 construction fencing and perimeter security measures around work area;
  - .10 shop drawings;

1.2 LUMP SUM PRICE ITEMS
(Cont'd)

3. (Cont'd)
1. (Cont'd)
.11 submittals, approvals, permits and fees(other than specified below);
.12 close-out submission;
.13 other items in Contract Documents that are noted as being included in Lump Sum Price;
.2 Environmental Protection (Payment Group 2), including:
.1 preparation of Environmental Management Plan by qualified environmental professionals;
.2 implementation of environmental measures identified in Environmental Protection Plan, specifications and Parks Canada Environmental Guidelines;
.3 temporary drainage, sediment and erosion control and treatment at work area, construction, maintenance and removal, for items such as silt fencing around staging area(s), etc.;
.4 dust and noise management;
.5 control work to provide effective environmental water body protection such as turbidity curtain(s), etc.;
.3 Temporary Construction Access Roads (Payment Group 3), including:
.1 design and approvals and construction and deconstruction of temporary works for access to upstream and downstream work areas and cofferdams;
.4 Cofferdams and Water Diversion System (Payment Group 4), including:
.1 design and approvals, construction, maintenance, operation (including record keeping), deconstruction and full land restoration (including backfilling, fine grading and vegetation restoration);
.2 diversion of minimal environmental flow through the river bed rehabilitation area and the old dam during this stage of construction;
.5 Excavating and Backfilling (Payment Group 5), including:
.1 excavation of work area as required, including hauling, stockpiling, backfilling and disposal.
.6 Demolition (Payment Group 5), including:
.1 removal and disposal of existing dam, cut-off walls and associated works;
.7 Salvage (Payment Group 6), including:
.1 removal, storage, re-installation of designated items, including transportation to and from Parks

1.2 LUMP SUM PRICE ITEMS
(Cont'd)

.3 (Cont'd)
7. (Cont'd)
.1 (Cont'd)
Canada compound in Smith Falls, ON;
.8 Grouting Works (Payment Group 7), including:
.1 mobilization and demobilization;
.2 admixes in grout
.9 Metal/Steel Work (Payment Group 8), including:
.1 gain liner;
.2 sill beam;
.3 deck framing;
.4 deck grating including gain covers and log sliders;
.5 railing and gates;
.6 other miscellaneous steel fabrications items;
.10 Mechanical Log Lifter (Payment Group 8), including:
.1 installation of all materials for the mechanical log lifter system;
.11 Dam Safety Signage Installation (Payment Group 8), including:
.1 all safety signage installation, as supplied by PCA;
.2 supply of all materials required for signage support and installation;
.12 Safety Boom Installation (Payment Group 8), including:
.1 supply and installation of safety boom assembly, including in-water and shore anchors (permanent);
.2 supply of all materials required for safety boom installation;
.13 General Landscaping (Payment Group 5), including:
.1 rough grading and subgrade preparation;
.2 all the work described in Section 32 94 00;
.14 River Bed Rehabilitation (Payment Group 9), including:
.1 excavation, disposal of excavated material, grading and backfilling of the area and associated works as required;
.2 riparian planting and maintenance;
.3 boulder clusters and large wood debris;
.15 Permanent Access Road and Parking (Payment Group 10), including:
.1 culverts, gates and fences;
.2 vehicle guardrail.

1.3 CONTRACT LUMP SUM PRICE WORK ITEMS PAYMENT PROCEDURES

.1 Items of Work will be paid within Contract Lump Sum Price at completion of the particular item of work, as set out below.

.2 Payment Group 1: "Mobilization/Demobilization" - 40% initial mobilization, 30% on completion of demobilization/acceptance of submittals, and 30% pro-rated over duration of contract.

.3 Payment Group 2: "Environmental Protection" - 20% initial activities (program development and approvals/installation of measures/initial work), 10% removal of measures/reporting and 70% maintenance/monitoring pro-rated over duration of the work item.

.4 Payment Group 3: "Temporary Construction Access Roads" - 70% construction activity and 30% on completion of deconstruction work.

.5 Payment Group 4:"Water Diversion System" - 5% design and approvals, 50% construction activities, 30% deconstruction activities, and 15% operation and maintenance activities pro-rated over duration of diversion system usage.

.6 Payment Group 5: "Excavating and Backfilling", "Demolition", "General Landscaping" - 100% pro-rated over duration of the work item. Work items with multi-items may be broken into individual items.

.7 Payment Group 6: "Salvage" - 50% for removal and storage, 50% for re-installation.

.8 Payment Group 7: "Grouting Works" - 100% pro-rated over duration of the work item. Work items with multi-items may be broken into individual items.

.10 Payment Group 8: "Metal/Steel Work", "Mechanical Log Lifter", "Dam Safety Signage Installation", Safety Boom Installation" - 100% on completion of work item. Work items with multi-items may be broken into individual items.

.11 Payment Group 9: "River Bed Rehabilitation" - 100% pro-rated over duration of the work item. Work items with multi-items may be broken into individual items.

.12 Payment Group 10: "Permanent Access Road and Parking" – 100% pro-rated over duration of the work item.

1.4 UNIT PRICE ITEM MEASUREMENT AND PAYMENT PROCEDURES

.1 Item No. 1 – Concrete Reinforcing.
- .1 Item No. 1 shall be paid at the contract unit price by the unit of tonne (1 000 kg).
- .2 This item shall include all work described in Section 03 20 00 related to concrete reinforcement.
- .3 Quantities and Payment for this item shall be based on the weight of the reinforcing bars installed, calculated from the approved reinforcement drawings.

.2 Item No. 2 – Cast-in-Place Concrete.
- .1 Item No. 2 shall be paid at the contract unit price by the unit of cubic meter (m^3).
- .2 This item shall include all work described in Section 03 30 00 related to cast-in-place concrete and in Section 03 10 00 related to concrete forming.
- .3 Quantities and Payment for this item shall be based on the volume of concrete placed within the new concrete dam, calculated from the dimensions shown on the tender drawings.

.3 Item No. 3 – Grouting Works.
- .1 Item No. 3 shall be paid at the following payment procedures:
  - .1 Mobilization and Demobilization: item paid within Contract Lump Sum Price.
  - .2 Drilling Grout Holes: Contract unit price by the unit of linear meter.
  - .3 Portland cement in Grout: Contract unit price by the unit of cubic meter (m^3) of dry cement.
  - .4 Sand in Grout: Contract unit price by the unit of cubic meter of dry sand.
  - .5 Admixes in Grout: item paid within Contract Lump Sum Price.
  - .6 Placing Grout: Contract unit price by the unit of number of grout stage.
  - .7 Pressure testing: Contract unit price by the unit of number of pressure test.
- .2 This item shall include all work described in Section 03 37 15 related to grouting works.

.4 Item No. 4 – Rock Removal.
- .1 Item No. 4 shall be paid at the contract unit price by the unit of cubic meter (m^3).
- .2 This item shall include all work described in Section 31 23 16.26 related to rock removal.
- .3 Quantities will be taken from cross section showing original rock surface and actual grade line set by Consultant, except that minimum depth of rock required to be excavated to be considered as 300 mm.

1.4 UNIT PRICE ITEM MEASUREMENT AND PAYMENT PROCEDURES (Cont'd)

.5 Item No. 5 – Foundation Treatment.
.1 Item No. 5 shall be paid according to the following payment procedures:
.1 Shotcrete: Contract unit price by the unit of cubic meter (m^3).
.2 Concrete Backfill: Contract unit price by the unit of cubic meter (m^3).
.3 Liquid Mortar: Contract unit price by the unit of liter.
.4 Rock Dowel: Contract unit price by the number of units placed.
.2 This item shall include all work described in Section 31 30 16 related to foundation treatment.

.6 Item No. 6 - Rip-Rap and Rockfill (erosion protection downstream and upstream).
.1 Item No. 6 shall be paid according to the following payment procedures:
.1 Zone 1 – Rip Rap ϕ300-500 mm: Contract unit price by the unit of tonne (1 000 kg).
.2 Zone 2 – River Rockfill ϕ300-500 mm: Contract unit price by the unit of tonne (1 000 kg).
.3 Zone 3 – River Rockfill ϕ50-300 mm: Contract unit price by the unit of tonne (1 000 kg).
.2 This item shall include all work described in Section 31 37 00 related to supply and installation of heavy rip-rap and rockfill.
.3 Quantities and Payment for this item shall be based on truck tickets and materials of each type placed within the designated work area including any material consolidation to the required depth and extent.

.7 Item No. 7 – Organic Soil.
.1 Item No. 7 shall be paid at the contract unit price by the unit of tonne (1 000 kg).
.2 This item shall include work described in Section 35 42 25 related to the organic soil fill.
.3 Quantities and Payment for this item shall be based on the mass of organic soil fill placed within the stream bed rehabilitation area.

.8 Item No. 8 – Sand Fill.
.1 Item No. 8 shall be paid at the contract unit price by the unit of tonne (1 000 kg).
.2 This item shall include work described in Section 35 42 25 related to sand fill.
.3 Quantities and Payment for this item shall be based on the mass of sand fill placed within the stream bed rehabilitation area.

PART 2- PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Project meeting will be scheduled at a maximum of one (1) month intervals throughout the progress of the work and at the call of the Consultant.

.2 The Contractor is to provide physical space and make arrangements for meetings.

.3 The Consultant will preside over the meetings.

.4 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents, must be present as requested by Consultant.

1.2 PRECONSTRUCTION MEETING

.1 Within 15 days of Contract award, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Departmental Representative, Consultant, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include:

- .1 Appointment of official representative of participants in the Work.
- .2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
- .3 Schedule of submission of shop drawings, samples, etc. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Requirements for temporary facilities, site sign, offices, storage sheds, portable toilets, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.

1.2 PRECONSTRUCTION MEETING (Cont'd)

.5 (Cont'd)
- .5 Schedule of submission of the Site Specific Health and Safety Plan in accordance with Section 01 35 29 Health and Safety Requirements, Site Specific Environmental Protection Plan in accordance with Section 01 35 43 Archaeological, Cultural and Environmental Procedures.
- .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .8 Owner provided products.
- .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and two weeks prior to project completion, schedule progress meetings on bi-weekly basis.

.2 Contractor, major Subcontractors involved in Work, Departmental Representative, Consultant and Parks Canada Project Manager are to be in attendance.

.3 Agenda to include the following:
- .1 Review, approval of minutes of previous meeting.
- .2 Review of Work progress since previous meeting.
- .3 Health and Safety issues and concerns.
- .4 Environmental Protection issues and concerns.
- .5 Water control and diversion operations.
- .6 Field observations, including monitoring reports, problems, conflicts.
- .7 Problems which impede construction schedule.
- .9 Review of off-site fabrication delivery schedules.
- .10 Corrective measures and procedures to regain projected schedule.

.11 Revision to construction schedule.
.12 Progress schedule, during succeeding work period.

1.3 PROGRESS MEETINGS (Cont'd)

.3 (Cont'd)
.13 Review submittal schedules: expedite as required.
.14 Maintenance of quality standards.
.15 Review proposed changes for affect on construction schedule and on completion date.
.16 Cost/schedule claims.
.17 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

1.1 DEFINITIONS (Cont'd)

.9 Project Planning, Monitoring and Control System: overall system operated by Consultant to enable monitoring of project work in relation to established milestones.

1.2 PRECEDENCE

.1 Division 1 Sections take precedence over technical specifications sections elsewhere in these specifications.

1.3 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.

.5 Make allowance for obtaining of regulatory permits, other agency approvals, obtaining of additional lands for staging areas, receiving permission to temporarily relocate utilities, and establishing a waste management and disposal plan.

1.4 SUBMITTALS

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

.2 Submit to Consultant within 5 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Consultant within 5 working days of receipt of acceptance of Master Plan.

1.5 KEY PROJECT DATES

.1 Project milestones form interim targets for Project Schedule.
- .1 In water work restrictions.
- .2 At Bobs Lake, water levels follow a rule curve with operational level around 161.5 m until February with a gradual rise to 162.7 m in May through June and a gradual decrease to 161.5 m in October. Operation is conducted in order to supply the Tay and Rideau River with minimal flows for navigable water way operation. Operation is conducted using stop logs.

1.6 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Departmental Representative and Consultant will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.7 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
- .1 Award.
- .2 Shop Drawings, Samples.
- .3 Design submission of the temporary works.
- .4 Permits.
- .5 Mobilization and site camp/staging area preparation.
- .6 Construction of temporary construction access road.
- .7 Environmental controls.
- .8 Salvage of identified items/materials.
- .9 Construction of diversion and erosion protection measures including safety booms.
- .10 Construction upstream and downstream cofferdams.
- .11 Excavation work.
- .12 Bedrock foundation treatment and grouting.
- .13 Structural concrete of dam stop log sluices, spillway crest and gravity sections.

1.7 PROJECT SCHEDULE (Cont'd)

.14 Installation of dam deck, handrails and winch system.
.15 Backfill and erosion control work.
.16 Removals of diversion work and cofferdams.
.17 Removal of old dam.
.18 River bed reconstruction
.19 Installation of permanent fencing.
.20 Installation of dam safety and navigation safety signage.
.21 Installation of upstream and downstream boom assembly with anchors.
.22 Conversion of temporary construction access road to a permanent access road.
.23 Site and camp restoration including landscaping work.
.24 Restoration of staging areas including environmental testing as required.
.25 Inspection for completion of all work and issuing of Substantial Certificate of Completion.
.26 Other activities as specified by the Department Representative or the Consultant.

1.8 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.9 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

1.10 PROGRESS PAYMENT REQUEST RELEASE

.1 Project schedule reporting as described above is condition for Progress Payment release by the Department Representative.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section specifies general requirements and procedures for contractor's submissions of shop drawings, product data and samples to Consultant for review.

.2 Additional specific requirements for submissions are specified in individual sections of Divisions 01 to 32.

1.2 ADMINISTRATIVE

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

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

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

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

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

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

1.2 ADMINISTRATIVE (Cont'd)

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Present calculation briefs containing all information required to support detailed design of structures as indicated in these specifications.

.9 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

.10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

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

.12 Submit two (2) hard copies specified for each type of submittal and also submit in electronic format as pdf files. Forward pdf files through email or alternate means as specified by the Consultant.

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.

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

.4 Allow 10 working days for Consultant's review of each submission.

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

1.3 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

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

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

.8 Submissions include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of design, installation, performance verification and decommissioning of temporary and permanent works, including load bearing structures duly stamped by a professional engineer (with Canadian related experience to items of work being designed) as specified in the respective Sections including:
  - .1 Design methodology including criteria, assumptions, and standards.
  - .2 Calculations.
  - .3 Details.
- .6 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Consultant's review and acceptance, distribute copies.

1.3 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.10 Submit three hard copies and one electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.11 Submit three hard copies and one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit three hard copies and one electronic copy of test reports for requirements requested in specification Sections and as requested by Consultant.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit three hard copies and one electronic copy of certificates for requirements requested in specification Sections and as requested by Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit three hard copies and one electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.16 Submit three hard copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.

1.3 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.17 Delete information not applicable to project.

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

.19 Verify field measurements and affected adjacent work are coordinated.

.20 Submit MSDS sheets as required in Section 01 35 29 - Health and Safety Requirements.

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

.22 The review of shop drawings by Consultant is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that the Consultant approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

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

1.4 SAMPLES

.1 "Samples" means examples of materials, equipment, quality, finishes, workmanship.

.2 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.3 If delivering samples prepaid to Consultant's business address, courier must be prepaid.

1.4 SAMPLES (Cont'd)

.4 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.5 Where colour, pattern or texture is criterion, submit full range of samples.

.6 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.7 Make changes in samples which Consultant may require, consistent with Contract Documents.

.8 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers Safety and Insurance Board Experience.

.2 Submit transcription of insurance immediately after award of Contract.

1.6 ELECTRONIC FILES

.1 When submissions are created electronically, the contractor is to make copies of all electronic records which are produced for the submissions listed in this section. This includes, but is not limited to, drawings, documents, and spreadsheet files.

.1 All files are to be properly labeled and placed in a well organized folder structure.

.2 The data is to be stored on a memory stick.

.3 The following are the preferred file formats:

.1 Drawings: AutoCAD version 2015 or latest version,or Adobe PDF.

.2 Documents: MS Word or Adobe PDF.

.3 Spreadsheet: MS Excel or Adobe PDF.

.4 Product Sheets: Adobe PDF.

.4 Three identical memory sticks containing all electronic records each, are to be submitted before the Certificate of Final Completion.

1.7 MEASUREMENT AND PAYMENT

.1 The work covered by this section will not be considered separately for payment but will be considered as incidental to Work of the specification.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 National Building Code 2015 (NBC):
- .1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.

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

.3 Province of Ontario:
- .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and:
  - .1 Regulations for Construction Projects, O. Reg. 213/91 as amended.
  - .2 Regulations for Diving Operations, O. Reg. 629/94 as amended.
- .2 Workplace Safety and Insurance Act, 1997.
- .3 Municipal statutes and authorities.

.4 Fire Commissioner of Canada (FCC):
- .1 FC-301 Standard for Construction Operations, June 1982.
- .2 FC-302 Standard for Welding and Cutting, June 1982.

Labour Program
Fire Protection Engineering Services
4900 Yonge Street 8th Floor
North York, Ontario M2N 6A8

and copies may be obtained from:

Human Resources and Social Development Canada
Labour Program
Fire Protection Engineering Services
Ottawa, Ontario K1A 0J2

1.2 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must

1.2 SUBMITTALS (Cont'd)

.2 (Cont'd)
include:

.1 Site-specific safety hazard assessment and measures to be taken to address the anticipated hazards.

.2 Contractor's and Sub-contractor's Safety Communication Plan. Must include contact information for all key contacts. Departmental Representative will provide contact information for other key government agencies.

.3 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. The portion of the ERP covers contingency issues for the construction and operation of the water diversion system.

.4 Emergency Preparedness Plan (EPP) to be prepared by the Contractor for external use, defining hazards posed by the Contractor water diversion system, the role and responsibilities of all parties and notification to be made.

.5 Contractor's Health and Safety Policy.

.6 Name of Health and Safety Coordinator and his/her alternate.

.3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

.4 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.5 Submit copies of Contractor's authorized representative's work site health and safety inspection reports to Consultant monthly.

.6 Submit Construction Safety Checklists after completion.

.7 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.8 Submit copies of incident and accident reports.

.9 Submit WHMIS MSDS - Material Safety Data Sheets to Department Representative.

1.2 SUBMITTALS (Cont'd)

.10 Submit Workplace Safety and Insurance Board (WSIB)-Experience Rating Report.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

.2 Submit copies of Notice(s) of Project to the Consultant.

.3 File all other required notices in accordance with Acts and Regulations of Province of Ontario.

.4 Keep copy of Notice of Project on site at all times.

1.4 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative and Consultant prior to commencement of Work.

1.5 REGULATORY REQUIREMENTS

.1 Comply with the Acts and regulations of the Province of Ontario.

.2 Comply with specified standards and regulations to ensure safe operations at site.

1.6 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with the following hazardous materials:
- .1 Silica in concrete (from the concrete demolition).
- .2 Pressure treated lumber (existing timber deck of the dam).
- .3 Bird droppings on the structure.
- .4 Corroded metals.
- .5 Benzene in fuel oil, paints and adhesives (for new materials).
- .6 Lead (from paint on the existing railing on the dam.

.2 Hazards on-site include but are not limited to:
- .1 Working around moving equipment.
- .2 Working near or above water.
- .3 Icy surfaces.
- .4 Falling hazards.

1.6 PROJECT/SITE CONDITIONS (Cont'd)

.2 (Cont'd)
.5 Animals and pests.
.6 Extreme temperatures or weather conditions.

.3 More specifically hazards associated with working near and on an operational dam include but are not limited to:
.1 General hazard around dams structures:
.1 Low head weir poses considerable danger to workers on boats or floating work platforms. Underwater hydraulics at the base of these structures can trap and drown workers who may fall in the water near them.
.2 Low head weirs may have no visible structure above water line. Workers on a boat or work platform approaching a weir from the upstream side may not be aware of the dangers present. Workers needs to always watch for and obey signs, safety boom and markers near these structures.
.3 Upstream leakage between and around stop logs may suck in a worker who may be in the water and hold him below the water level with such force that he cannot escape.
.4 Objects in foaming water are less buoyant than in still water. Air trapped in water reduces the buoyancy and therefore workers caught in such conditions have greater difficulty staying afloat even with the aid of personal flotation device.
.5 Changing water levels and flows below a dam or water diversion system can occur rapidly and without warning. Workers should never place themselves in a situation where they cannot leave area they boated in or have accessed by boat.
.6 Retaining walls and steep embankment above or below dams could block exit routes for workers trying to escape dangers associated with dams.
.7 During the winter months, workers need to be aware of thin ice that may develop near the dam due to operations of the dam or diversion system.
.8 Dam operations often result in lowering the water levels throughout the winter and spring, which can result in ice collapsing onto lower water levels and water seeping up under the snow resulting in slush conditions over the ice making travelling or movement difficult.
.2 Furthermore, in addition to the hazards described above, the following hazards exist at the site:

1.6 PROJECT/SITE .3 (Cont'd)

CONDITIONS (Cont'd)

.2 (Cont'd)

.1 The upstream safety boom is improperly located and may mislead workers in believing that they are in a safe location while working upstream of the dam.

.2 There is no downstream safety boom.

.3 There is no system/anchor point in place for the workers to tie themselves off while working on the dam or the lock.

.4 The areas immediately upstream and downstream are not fenced off thus allowing free access to these hazardous water areas.

.5 Steep and slippery embankments can make accessing the downstream side of the dam hazardous.

.6 The stop log lifting winches are the original winches for the dam, and have no safety features. Improper use of the winches could result in serious injuries.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Site-specific Health and Safety Plan needs to cover all sub trades utilized on the project, with the exception of diving operations, which require a separate site-specific Health and Safety Plan.

.3 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.

1.8 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, Canada Labour Code Part II, and Canada Occupational Safety and Health Regulations.

1.9 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

1.9 RESPONSIBILITY (Cont'd)

.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 Where applicable, the Contractor shall be designated "Constructor", as described by Occupational Health and Safety Act for the Province of Ontario.

.4 Ensure a clear delineation in time and/or space between Parks Canada staff and Contractor's own forces such that Contractor shall maintain designation as "Constructor" as defined by the Occupational Health and Safety Act for the Province of Ontario.

1.10 UNFORSEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Consultant verbally and in writing.

.2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience specific to activities associated with similar dam reconstruction projetcs.

.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 Site Supervisor.

1.12 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 of Ontario, and in consultation with Consultant.

.2 Provide documents as follows and post on site:
- .1 Contractor's Health and Safety Policy.
- .2 Contractor's (Constructor's) Name.
- .3 Notice of Project.
- .4 Name, trade, and employer of Health and Safety Coordinator.
- .5 Ministry of Labour orders and reports.
- .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
- .7 Address and phone number of nearest Ministry of Labour office.
- .8 Material Safety Data Sheets.
- .9 Written Emergency Response Plan.
- .10 Site Specific Health and Safety Plan.
- .11 Copy of valid certificate of first-aid personnel on duty.
- .12 WSIB "In Case of Injury At Work" poster.
- .13 Location of toilet and cleanup facilities.
- .14 Any special handling or procedures specific to the site.

.3 Comply with Provincial general posting requirements.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.

.2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Consultant may stop Work if a perceived non-compliance of health and safety regulations or a potential issue is perceived to have not been immediately corrected.

1.14 BLASTING

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

1.15 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after submittal of full justification for the requirement of their use and receipt of written permission from Consultant.

1.16 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.

.2 Assign responsibility and obligation to Health and Safety Coordinator to stop or start Work when, at Health and Safety Coordinator's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative or his/her designate may also stop Work for health and safety considerations.

1.17 EQUIPMENT LOCK-OUT/TAG-OUT

.1 The Contractor shall coordinate and comply with Parks Canada/PWGSC lock-out/tag-out procedures for the equipment at the site. The more stringent of the Provincial Safety Regulation shall take precedence. The Parks Canada/PWGSC procedure involves a multi lock system.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This Section describes requirements for the protection of the environment that apply to the Work. These requirements apply to all Sections of this Specification, without limiting the conditions and approvals imposed by statute.

.2 Control Work to provide effective environmental, water body and fish habitat protection. Consultant will monitor environmental protection measures and will identify whenever such protection is found to be ineffective. Change protective measures or work procedures as directed by the Department Representative.

.3 Contractor to follow site specific Environmental Management Plan based on Parks Canada Environmental Standards and Guidelines and prepared after award.

.4 Issue of construction permit by Parks Canada is contingent on acceptance by Parks Canada of Contractor Environmental Management Plan.

.5 As per the Historic Canal Regulations, a permit signed by Parks Canada's Ontario Waterways Director will be required to authorize the project work prior to commencement of project activities. Release of permit requires an accepted Environmental Management Plan and Health and Safety Plan by Parks Canada.

1.2 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid,

1.2 DEFINITIONS (Cont'd)

.2 (Cont'd)
chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

.3 Deleterious Materials: any substance that, if added to a water body, could degrade water quality or impact fish, fish habitat and aquatic wildlife. This includes, but is not limited to:
.1 Concrete dust.
.2 Soils (clay, silt).
.3 Oil, diesel or gasoline.
.4 Chipped or fresh concrete and admixtures.
.5 Alkali water resulting from fresh concrete or cementitious grout.
.6 Salt.
.7 Solvents.

.4 Drip line: means the location on the ground surface directly beneath a theoretical line described by the tips of the outermost branches of the trees.

1.3 SUBMITTALS

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

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Management Plan for review and acceptance by Departmental Representative. Environmental Management Plan is to present comprehensive site specific overview of known or potential environmental issues to be addressed during construction. Parks Canada permit to start site work, including mobilization, will not be issued until the Environmental Management Plan is approved.

.3 The Environmental Management Plan shall be developed by a qualified environmental professional experienced in turbidity, sediment control and dewatering treatment systems associated with dam construction and also experience in fisheries terrestrial wildlife and SAR. Address topics at level of detail commensurate with environmental issue and required construction tasks.

.4 Environmental Management Plan to include:
.1 Mitigations identified in the Parks Canada Environmental Standards and Guidelines ONW 2017 including but not limited to:
.1 Pre- Construction Works and Activities Erosion Control ESG-1-Pre;
.2 Sediment Control ESG-2-Pre;
.3 Soil Stripping, Grubbing and Stockpiling ESG-3-Pre;
.4 Tree Protection and Hording ESG-4-Pre;
.5 Vegetation Clearing and Protection ESG-5-Pre;

1.3 SUBMITTALS (Cont'd)

.4 (Cont'd)

.1 (Cont'd)

.6 Construction Works and Activities Abrasive Blasting ESG-1-C;

.7 Borehole and Rock Drilling ESG-3-C;

.8 Chipping and Cutting ESG-4-C;

.9 Concrete Pour Operations and Grouting ESG-5-C;

.10 Dredging and Sediment Removal ESG-6-C;

.11 Fish Exclusion, Salvage and Relocation ESG-7-C;

.12 Fugitive Dust Control During Construction ESG-8-C;

.13 Grinding and Welding ESG-9-C;

.14 Installation and Removal of Cofferdams and Isolation Structures ESG-10-C;

.15 Invasive Species Management ESG-11-C;

.16 Pile Driving ESG-12-C;

.17 Refueling and Spill Management ESG-13-C;

.18 Treatment of Discharge Waters ESG-14-C;

.19 Use and Maintenance of Heavy Equipment ESG-15-C;

.20 Vehicle and Equipment Washing and Cleaning ESG-16-C;

.21 Wildlife and Species at Risk Protection During Construction ESG-17-C;

.22 Winter Weather Stabilization and Operations ESG-18-C;

.23 Post-Construction Works and Activities Revegetation ESG-1-Post;

.2 Environmental Protection Plan shall be prepared by a qualified environmental consultant. Contractor shall refer to Parks Canada Detailed Impact Analysis (DIA) and Environmental Standards and Guidelines when preparing their Environmental Protection Plan.

.3 Names of persons responsible for ensuring adherence to Environmental Management Plan.

.4 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.5 Names and qualifications of persons responsible for training site personnel.

.6 Descriptions of environmental protection personnel training program.

.7 Erosion turbidity and sediment control plan which identifies type and location of erosion turbidity and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion turbidity and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.8 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage

1.3 SUBMITTALS (Cont'd)

.4 (Cont'd)

.8 (Cont'd)
areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.9 Provisions for protection of stockpile material, such as vegetating of material, for stockpile material that are to be inactive for a period exceeding 30 days are to form part of the erosion and sediment control plan.

.10 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.

.11 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.12 Spill Prevention Plan: including location/procedures for storage and refueling of all fuel and fuel operated equipment located near waterway. Fuel containers are to have secondary containment, overfill and spill protection. Fueling area is to be contained to address potential spillage. All heavy equipment used near waterway is to be in good condition. Any equipment that is leaking any fluid is to be removed from the site.

.13 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris. Where waste materials are not to be incorporated into the works and are to be disposed off-site at an approved landfill as part of the Solid Waste Management Plan, provide to the Departmental Representative a letter from the receiving station agreeing to accepting the waste material and Waste Site Certificate of Approval. Carry out disposal to the requirements on Ontario Regulation 347.

.14 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.15 Contaminant Prevention Plan identifying that: identifies potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.16 Waste Water Management Plan that identifies methods and procedures for management and/or discharge of waste waters which are directly

1.3 SUBMITTALS (Cont'd)

.4 (Cont'd)

.16 (Cont'd)
derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines and dewatering of work areas within cofferdams.

.17 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.18 Noise Control Plan: including notifying local residents in advance of potential disruption from noise activities. Establish a communications protocol / plan acceptable to the Departmental Representative.

.19 Flood Contingency Plan: identifying measures to be undertaken in the event of significant flows in the waterway. Measures to include storage of equipment and material out of the waterway that have not been secured or form part of the construction works.

1.4 FIRES

.1 Fires and burning of rubbish on site are not permitted on this project.

1.5 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

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

1.6 SPECIES AT RISK

.1 The EMP must detail procedures (e.g. exclusion fencing) for preventing turtle entry/nesting within disturbed project gravels/soils during all stages of project activity.

.2 Species at risk training shall be provided to all employees before they begin work on site (materials can be part of the Environmental Management Plan). Employees must be able to identify potential species at risk and know the proper procedures to follow when they encounter a species at risk. Special emphasis will be made on Blanding's Turtle sightings.

1.6 SPECIES AT RISK (Cont'd)

.3 Should any suspected species at risk – snakes or turtles and/or eggs be encountered during construction – project staging, implementation or demobilization – work would halt immediately and Parks Environmental Assessment Staff would be notified. The species must not be harmed or harassed. Stand back and allow the animal to leave the site. If the species does not leave or cannot leave the site, the contractor must immediately stop the works and contact the Departmental Representative and PCA's Environmental Assessment Officer immediately. Additional measures to avoid impacts may be required before work can restart.

.4 Temporary reptile fencing, such as polythene/ woven geotextile secured with timber stakes, or material of a similar nature/function, should be installed completely around gravel stockpiles to prevent turtle nesting in the project area. For guidance on how to plan and install exclusion fencing, refer to the document titled "*Ontario Ministry of Natural Resources and Forestry. April 2016. Best Management Practices for Mitigating the Effects of Roads on Amphibians and Reptile Species at Risk in Ontario*."

.5 Synthetic plastic Erosion Control Blankets/Mats should not be utilized, particularly during nesting season, as they pose as an entrapment hazard to turtles. Fibre-based bio-degradable Erosion Control Blankets/Mats are only to be utilized.

.6 If a turtle is found within the limits of the fencing, it should be left alone to leave the area if possible, or the animal should be gently placed outside of the construction site. Typically, animals should be released not more than 250 m from the capture site. Release sites should be near water with vegetation cover for shelter.

1.7 INVASIVE SPECIES

.1 Any equipment or vehicles which are to be used in water, should be thoroughly cleaned before and after use of any visible mud, vegetation, mussels, etc.:
- .1 Vessels/equipment should be drained of standing water.
- .2 Vessels/equipment should be cleaned with high pressure water (>250 psi).

.2 Cleaning of vessels/equipment should be conducted away from waterbodies at a recommended distance of at least 30 m from the shoreline.

.3 Use weed-free seed and confirm that seed mix to be used for re-vegetation purposes does not (potentially) contain invasive plants.

1.7 INVASIVE SPECIES (Cont'd)

.4 Seed purchased commercially should have a label that states the following:
- .1 Species;
- .2 Purity: Most seed should be no less than 75% pure and preferably over 85% pure. The rest is inert matter, or other seed;

.5 Move only weed/contaminate-free materials into non-infested areas. Moving materials from one infested location to another within a particular zone may not cause contamination, but moving materials from infested to non-infested areas could lead to the introduction and spread of invasive plants.

.6 If removal of invasive species occurs, individuals will be disposed of appropriately, off site to ensure no further propagation.

1.8 TURBIDITY CONTROL AND DRAINAGE WATER

.1 Control turbidity of all water released during the Work.

.2 The pumping of turbid water directly back into the waterbody is not permitted. Water which is in exceedance of the following performance criteria must be treated/managed appropriately:
- .1 Maximum increase of suspended sediment concentration shall not be more than 25 mg/L over background levels during any short term exposure period (i.e., less than 24 hours). For longer term operations (i.e., more than 30 days), average suspended sediment concentrations shall not be increased by more than 5 mg/L over background levels. Note: the field measurement for turbidity will be in NTU. Total suspended solids (mg/L) is only acceptable from lab results and will only be used if there is exceedances and potential enforcement action.
- .2 Maximum increase of 8 NTU from background levels for a short-term exposure (i.e., 24 hours). Maximum average increase of 2 NTU from background levels for a longer term exposure (e.g., more than 30 days). Should there be exceedances then Parks Canada/Contractor may analyze Suspended Solids (SS) concentration with lab samples. Measurements should be taken upstream (background) within the work area and downstream directly in the receiving water.
- .3 Receiving waters at the point of discharge shall be routinely tested and compared to background to confirm compliance with performance standards (e.g., pH readings should be taken if there is any concrete work being completed).

1.8 TURBIDITY CONTROL AND DRAINAGE WATER (Cont'd)

.3 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.4 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.5 Do not discharge water containing suspended materials into waterways or drainage systems. Do not cause water turbidity due to construction activities. The Ministry of Environment and Climate Change has set a criteria wherein the allowable increase in total suspended solids (TSS) beyond background levels is 25 mg/l, or 8 NTU.

.1 The Contractor shall provide a protocol and methodology for monitoring the total suspended solids from any discharge point (treated or untreated) to the watercourse at three locations i) upstream of the work area; ii) at the discharge area; iii) downstream of the work area, including: measurement location; depth from water surface; frequency of measurement.

.2 The plan will cover additional monitoring in the event of incidents to track scope, severity and length of incident.

.3 After construction of any containment/treatment works, the Contractor shall demonstrate that the water quality is not impacted by their construction activities as established by the CCME criteria.

.4 The Contractor shall cease discharge and modify their treatment of any discharge water from the construction operations to meet the CCME criteria. If an exceedance is measured, the frequency and location of monitoring shall be modified to accurately represent the scale of impact.

.6 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements and Environmental Management Plan.

.7 Where any in-water work is approved, the work area shall be enclosed by a turbidity curtain (silt curtain) to prevent any sediment to escape the enclosed area. Turbidity curtains are to be installed and maintained as described in Section 35 49 25.

1.8 TURBIDITY CONTROL AND DRAINAGE WATER (Cont'd)

.8 For concrete waste water:

.1 At the discharge point into the watercourse, pH will be maintained between 6.5 and 9.0. Water with pH > 9 cannot be released directly back into the watercourse, but must be treated prior to release. Water with a pH ≥ 12.5 is considered toxic and treated as a hazardous waste under Ontario Regulation 347 of the Environmental Protection Act. Wastewater in this condition must be removed from the site.

.2 Departmental Representative shall be notified within 48 hours prior to the commencement of any significant concrete pour operations (e.g., foundations) and for all Tremie pour operations.

.3 Maintain complete isolation of cast-in-place concrete for a minimum of 48 hours if the ambient air temperature is above 0°C (for the entire period) and for a minimum of 72 hours if ambient air temperature is below 0°C.

.4 All water that contacts uncured or partly cured concrete, all leachates or wastewater with high pH (greater than 9) shall be captured in a wastewater containment area.

.5 The waste water containment area shall be designed by a Qualified Professional(s) and sized to hold twice the volume of anticipated water run-off, leachate or wastewater.

.6 Carbon dioxide (CO_2) or neutralizing acids shall be used to neutralize waters with high pH (greater than 9).

.7 Sufficiently sized carbon dioxide (CO_2) tanks with regulators, hoses and gas diffuser, shall be readily available during normal concrete pour operations. The tank shall be used to release carbon dioxide gas into an affected area to neutralize pH levels should a concrete spill occur. Workers shall be trained in the use of the tank.

.8 Neutralizing acids must be contained in a professionally established system operated by a Qualified Professional.

.9 Any use of carbon dioxide (CO_2) or neutralizing acids to modify pH levels shall be reported to Departmental Representative as soon as reasonably possible.

1.9 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties as 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 minimum.

1.9 SITE CLEARING AND PLANT PROTECTION (Cont'd)

.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 or designated by Consultant.

.6 Do not admix (i.e., mixing topsoil with other material). This helps to preserve topsoil value.
- .1 If subsoil becomes compacted, soil de-compaction measures shall be implemented (See Revegetation (ESG-1-Post)).
- .2 All topsoil must be retained for re-use during the post-construction period if free of invasive plants.
- .3 No vegetation shall be removed or soil shall be disturbed in riparian areas (i.e., next to wetlands and watercourses), unless identified in the site-specific Environmental Management Plan and accepted by Parks Canada.

.7 All soil stripping locations and volumes must be identified in the site-specific Environmental Management Plan and accepted by Parks Canada.
- .1 Restrict topsoil stripping to areas that will be disturbed by the construction activities. Project staging must be described in the Construction Plan of the site-specific Environmental Management Plan.
- .2 Sediment control measures must be in place prior to commencement of soil stripping activities. Erosion control measures shall be implemented for all areas following stripping;
- .3 Vegetated buffer strips;
- .4 Ensure full salvage of topsoil and upper root zone while avoiding admixing soil layers.

1.10 MIGRATORY BIRD PROTECTION

.1 Tree cutting and clearing work is not to be undertaken during the migratory bird nesting season, between April 1st and August 31st.

.2 If tree cutting and clearing work during the nesting season, a nest survey will need to be conducted by a qualified avian biologist immediately (within two days) prior to commencement of work to identify and locate active nests of species.

.3 If active nest are present, the Contractor shall develop a mitigation plan to address any potential impact on migratory birds or their active nests. The plan must be reviewed by the Parks Canada Environmental Assessment Officer prior to implementation.

1.11 WILDLIFE PROTECTION

.1 The Site Specific EMP must demonstrate procedures for avoiding disturbance/harm to wildlife.

.2 Exclusion zones or "no go" areas will be established to protect areas with known residences (e.g., hibernacula, dens, nests).

.3 Conduct "Pre-stressing" activities within a few days prior to the onset of site preparation (vegetation clearing and grubbing) to encourage wildlife to move away from a site.

.4 On a daily basis, an inspection or "sweep" of the work area shall be performed prior to commencement of project works and activities to ensure wildlife are not present in the work area (include in site checklist).

.5 Field information regarding incidental encounters with wildlife (non-SAR wildlife) shall be compiled and reported on a daily basis.

.6 For incidental encounters, the following information should be recorded in the field:
- .1 Locations, dates and time of day where the species were encountered;
- .2 Names of species encountered;
- .3 Photographs of the species, if taken;
- .4 Condition of animal.

.7 If injured/dead wildlife are encountered report to PCA immediately.

.8 All vehicles and equipment used by project personnel will follow any construction zone speed limits to reduce the risk of hitting wildlife, as enforced by the site supervisor.

.9 Work areas will be kept clean and free of potential hazards to wildlife such as wire, cable, tubing, plastic, antifreeze or other materials that wildlife may eat or become entangled in.

.10 Waste will be stored, handled, and transported in accordance with the Waste Management Plan, including storage of all solid waste in sealed, bear-proof containers.

.11 Feeding of wildlife is prohibited.

1.12 WORK ADJACENT TO WATERWAYS

.1 Do not use waterway beds for borrow material beyond the work area.

1.12 WORK ADJACENT TO WATERWAYS (Cont'd)

.2 Do not dump excavated fill, waste material or debris in waterways beyond the work area.

.3 Ensure all equipment and temporary access structures such as scaffolding placed in water bodies are in good working condition and free of debris, fuel, lubricants, coolant and other Deleterious Material that could enter the water body.

.4 Should site conditions at the site indicate that there are unforeseen negative impacts to fish or their habitat, all works shall cease until the problem has been corrected and/or any required input can be obtained from Parks Canada. Any concrete wash water shall be directed to a collection basin or vegetated area to effectively remove all suspended solids, dissipate velocity and prevent Deleterious Material from entering the watercourse. Control turbidity of all water released to watercourse during work. In the event of silting or turbidity caused by construction activity, contractor shall stop work and install additional silt barriers as necessary to ensure watercourse is protected.

.5 Stockpiled, excavated or fill materials must be stored and stabilized away from the water. Runoff from the excavated or fill material must be prevented from entering the waterway.

1.13 IN-WATER WORK

.1 In-water work is permitted from July 1st to October 14th. Any work outside this window would require Parks Canada approval. Contractor is responsible for preparing required application, related documentation and applying/obtaining such exemption.

.2 All amphibians, reptiles or fish that have been trapped in the work area shall be salvaged and transferred "live" immediately upstream or downstream of the work. The work program shall be overseen and coordinated by a fisheries biologist to ensure proper capture and handling of fish. The biologist shall confirm that there are no species at risk (SAR). If encountered, Parks Canada is to be notified immediately. Stop work. Review the protocol for the transfer of amphibians, reptiles or fish with PCA, and proceed with the transfer with the approval of PCA.

.3 Ensure that there is a fish screen that complies with DFO *Freshwater Intake End-of-Pipe Fish Screen Guideline* when pumping in fish-bearing water to prevent impingement or entrainment of fish.

1.13 IN-WATER WORK (Cont'd)

.4 Fish shall be removed from the work area prior to complete de-watering and released in adjacent water body.

.1 Parks Canada shall be advised 24 hours prior to fish rescue.

.2 Minimize the length of time fish are out of the water.

.3 Use appropriate equipment to remove any stranded fish in the dewatered area. As water levels drop in the work area monitor the deeper pool areas where fish are congregating. If safe to do so, Seine nets or Dip nets can be operated by field staff to remove the fish.

.4 Contact Parks Canada Environmental Officer should there be any issues with fish removal.

.5 Any fish found within the dewatered cofferdam areas will be documented by species, counted and removed and placed downstream if found in the downstream cofferdam and upstream if found upstream.

.6 Round gobies or other invasive species found during dewatering activities shall be euthanized and not returned to the water system; this shall be reported to Parks Canada.

1.14 HAZARDOUS MATERIALS

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, and regarding labelling and the provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources and Skills Development Canada, Labour Program.

.3 Store Hazardous Materials in secure areas on impermeable pads, provide berms if necessary.

1.15 CLEAN-UP

.1 Clean-up work area as work progresses. At end of each work period, and more often if directed by the Consultant, remove debris from site, neatly stack material for use, and clean up generally.

.2 Permit no undue amounts of debris, trash or garbage to accumulate.

.3 Do not bury rubbish on site.

1.15 CLEAN-UP (Cont'd)

.4 Separate and recycle all materials that can be recycled.

.5 Dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner by taking them to a special designated waste facility. Do not dump these into waterways, storm or sanitary sewers.

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

.7 The use of heavy equipment and other machinery near water is generally required on many PCA construction and maintenance projects on Ontario Waterways. Refueling and routine maintenance of this machinery occur at the work site on a daily basis. Although most machinery is mobile, some equipment such as pumps and cranes cannot practically be relocated for fueling and maintenance. Fuel, grease and other mechanical fluids are pollutants and considered a deleterious substance under the Fisheries Act. The proximity of PCA's assets to natural areas and fish bearing waterbodies elevates the need to address refueling and routine maintenance through the application of these standards and guidelines. Most Ontario Waterways sites do not have space to allow for refueling in areas greater than 30 m from the water.

.1 Description of Activity:

.1 Refueling and maintenance refer to the regular activity of providing fuel, upkeep and light duty repair to heavy equipment and other construction machinery throughout the construction period. The most common form of potential fuel contamination on work sites occurs from drips and spills released from fueling nozzles and gas can spouts as they are moved between the fuel tank and the equipment. Being a daily activity, the potential for drips and minor spills is a common and frequently occurring potential environmental hazard.

.2 Environmental Standards and Guidelines:

.1 General

.1 A Fuel Management plan, including refueling procedures, shall be developed as part of the site-specific EMP and accepted by PCA.

.2 A Spill and Emergency Management Plan will be developed as part of the site-specific EMP and accepted by PCA. The Spill and Emergency Management plan shall use a risk based approach. It shall be tailored to seasonal conditions at the site.

1.15 CLEAN-UP (Cont'd)

7 (Cont'd)

.2 (Cont'd)

.2 Fuel Storage:

.1 Fuel storage facilities and containers shall comply with the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products. Double-walled storage containers must be used and located within a berm or impermeable containment boom.

.2 All fuel storage and containment must be intact, monitored and replaced as required through all phases of the project.

.3 Refueling:

.1 Vehicle, heavy equipment and machinery re-fueling shall be conducted in a designated, flat and low sensitive area. Commonly, this area is the same location that fuel and other chemicals are stored.

.2 Designated refueling areas shall be constructed with impermeable containment such as berms, booms and liners. They shall contain an adequately sized drip tray or other impermeable layer to capture and contain drips form the nozzle and minor spills. Snow and water must be managed from the drip trays to prevent contamination of the water. Drip trays must be on level ground. Any contaminated soil or aggregate must be disposed of properly. Spill containment for refueling shall be sized adequately to accommodate the volume of the fuel source container.

.3 The use of small volume fuel cubes is preferred for refueling immobile equipment and equipment operating in or near water.

.4 Fuel trucks and hoses cannot be used on cofferdam or within dewatered areas.

.4 Spill Management and Reporting:

.1 All construction staff should be trained and familiar with the Spills and Emergency Management plan, including roles and responsibilities, locations and contents of spill kits, and use of equipment. A check list approach should be developed for staff to

1.15 CLEAN-UP (Cont'd)

.7 (Cont'd)
.2 (Cont'd)
.4 (Cont'd)
.1 (Cont'd)
sign-off and confirm training.

.2 Upon identification of a spill, immediate containment is required. All areas affected by the spill shall be remediated.

.3 Spill response equipment shall be located and maintained on-site and utilized in accordance with the applicable spill containment procedures. Multiple spill kits (number to match the scale of the project and to isolate a contaminated area) shall be placed in covered, accessible structures around the construction site.

.1 Typical spill response equipment (spill kit) shall include as a minimum: absorbent spill pads, berms, cover drains and personal protective equipment (materials for both in-water and on land spill) to be used to contain the spill as appropriate. Replace or repair material after use.

.2 Concrete spill response equipment (spill kit) will include as a minimum: sand bags (number to match the scale of the project and to isolate a contaminated area); impermeable material to line sandbags; Impermeable turbidity curtains; and CO2 Bubblers. Replace or repair material after use.

.4 Wastes that are generated from remedial operations that are considered to be hazardous wastes under Ontario Regulation 347 of the Environmental Protection Act must be contained in sealed containers and temporarily stored on the project site until they are collected for disposal by a licensed waste hauler.

.5 All other non-hazardous waste generated by a concrete pour operation shall be disposed according to Ontario Regulation 558/00. R.R.0. 1990 (General – Waste

1.15 CLEAN-UP (Cont'd)

.7 (Cont'd)
.2 (Cont'd)
.4 (Cont'd)
.5 (Cont'd)
Management).
.6 Environmental permits shall be obtained by the Contractor for any off-site disposal.
.7 Any spill into water, onto ice or in a dewatered area must be reported immediately to PCA's Environmental Authority, the Departmental Representative and the Ontario Ministry of Environment and Climate Change's Spills Action Centre (SAC).
.8 Any spill on land must be reported immediately to PCA's Environmental Authority and the Departmental Representative. Any spill on land meeting the criteria set out in Ontario's Environmental Protection Act, O. Reg. 675/98 must be reported immediately to the Ontario Ministry of Environment and Climate Change's Spills Action Centre (SAC).

.8 Spills:
.1 Report all spills immediately to the Departmental Representative, to the Consultant and to the Ontario Spills Action Centre (Telephone No. 1-800-268-6060). All spills of any size shall be documented and reported to PCA regardless of whether it is required to be reported by law, if so contact SAC.
.2 Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal.
.3 Be responsible for all costs of clearing up any spills to the satisfaction of PCA.
.4 Provide and maintain an environmental emergency response plan in place and a spill kit readily available.
.5 Further information on dangerous goods emergency cleanup and precautions including a list of companies performing this work can be obtained from the Transport Canada 24-hour number (613) 996-6666 collect.

.9 Remove all scaffolding, temporary protection and surplus materials, tools, plant, rubbish and debris and dispose of them in an approved manner off Crown property at the following times:
.1 At the completion date of the work for all areas.

1.15 CLEAN-UP (Cont'd)

.10 Clean areas under contract to a condition at least equal to that previously existing and to acceptance of the Consultant.

1.16 AIR QUALITY AND NOISE

.1 Minimize the noise levels from construction activities by using proper muffling devices, in addition to appropriate timing and location of these activities to reduce or minimize the effect of noise on nearby residents, recreational users, and wildlife.

.2 Comply with any Municipality Noise By-Laws

.3 Monitor and mitigate public complaints by keeping a record of complaints and addressing any issues raised by the public.

.4 Use well-maintained heavy equipment and machinery, fitted with fully functional emission control systems/muffler/exhaust baffles, engine covers, etc.; machines shall not be left to unnecessarily idle in order to avoid emissions.

.5 Keep idling of construction equipment to a minimum.

1.17 TRANSPORTING WASTE MATERIALS

.1 All waste subject to Regulation 558 of the Ontario Environmental Protection Act must be transported with a valid "Certificate of Approval for a Waste Management System" to a site approved by the Ontario Ministry of the Environment to accept that waste.

.2 Be responsible for obtaining all Waste Generator Numbers, permits, manifests, and all other paperwork necessary to comply.

1.18 HISTORICAL/ ARCHAEOLOGICAL CONTROL

.1 Before any on-site mobilization/construction work commences, Departmental Representative Archaeology Staff will identify any archaeologically sensitive areas. These areas will be deemed no-go zones for staging, vehicular traffic and machinery. Allow access for Archaeology staff for recording of historic dam (five days) as noted on drawings and five days for investigation of stream bed rehabilitation area once area is de-watered.

1.18 HISTORICAL/ ARCHAEOLOGICAL CONTROL (Cont'd)

.2 Main vehicular access routes and staging areas will be restricted to roadways and designated staging areas. The use of protective covering such as geotextile protective mats with a wood chip lift or granular "A" gravel is required. All protective covering must be removed following construction and the area restored to pre-construction state.

.3 If unrecorded archaeological resources (e.g. structural features or artifact concentrations) are encountered during construction activities, work will cease in the immediate area, the findings photographed, and the Departmental Representative informed. Work shall not resume until unauthorized by Departmental Representative. Exposed underwater cultural materials are kept submerged and/or wet while waiting for direction.

.4 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and/or identifies procedures to be followed (see Detailed Impact Assessment for Bobs Lake(DIA)) if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.

.5 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and the Consultant.

1.19 NOTIFICATION

.1 Consultant will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, DIA and other elements of Contractor's Environmental Management Plan.

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

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

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

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

1.2 INSPECTION

.1 Allow Consultant and Parks Canada staff access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Consultant instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

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

1.3 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work, above and beyond those required of the Contractor. Cost of such services will be borne by Departmental Representative.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

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

1.3 INDEPENDENT INSPECTION AGENCIES (Cont'd)

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

1.4 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.5 PROCEDURES

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

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant 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 Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.7 REPORTS

.1 Submit three (3) copies of inspection and test reports to Consultant.

.2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.8 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 Work under this section relates to condition surveys and monitoring of structures and buildings which are adjacent to the construction site and which may be affected by excavation, dewatering and vibration producing activities (such concrete demolition work, excavation of frozen ground, and operation of heavy construction equipment.)

.2 The Contractor is advised that structures, buildings and water supply wells are located close to the proposed work and that construction activities are to be conducted in such a manner to preclude damage to these structures, buildings and wells. The Contractor shall be responsible for any damage caused by their activities.

.3 The contractor shall undertake environmental monitoring of the sediment and erosion control system including water quality of discharge from dewatering operations.

.4 The scope of work described in this section is a minimum requirement for conducting a condition survey and monitoring of the work. Monitoring will include terrestrial wildlife and SAR monitoring (e.g. daily sweeps to protect individuals). The Contractor Design Engineer together with the Monitoring Engineer are to review and advise Consultant on movement and vibration criteria and any additional monitoring requirements.

.5 The monitoring work under the present scope only covers the construction area and immediate surroundings. The Contractor shall take full responsibility for other areas as part of their construction operation including haul routes.

1.2 RELATED SECTIONS

.1 Section 01 11 00 - Summary of Work

.2 Section 01 33 00 - Submittal Procedures

.3 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures

.4 Section 01 77 00 - Closeout Procedures

1.2 RELATED SECTIONS (Cont'd)

.5 Section 02 41 16 – Structure Demolition

.6 Section 31 23 33 – Excavating and Backfilling

.7 Section 35 20 22 – Dewatering and Diversion

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost in the Contract Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 An Independent Inspection/Monitoring Firm(s) shall be retained by the Contractor for the purpose of inspecting and/or monitoring portions of Work as described in this section. Cost of such services will be borne by the Contractor.

.2 The Independent Inspection/Monitoring Firm(s) team shall be qualified and competent in:

.1 performing condition surveys;
.2 the determination of allowable movement including displacement and vibration at structures and embankments;
.3 the protection of adjacent buildings, shoreline structures and embankments;
.4 the protection of groundwater wells;
.5 the establishment of measurement procedures and their implementation;
.6 monitoring and reporting.

.3 The Condition Survey shall be undertaken by a qualified and competent inspector.

.4 If requested by the Consultant, submit the inspector and monitoring specialist qualification and experience.

1.5 DEFINITIONS

.1 Monitoring Engineer: refers to the independent inspection / monitoring firm which is responsible for the work under this section.

1.5 DEFINITIONS (Cont'd)

.2 Design Engineer: refers to the engineer/engineering firm retained by the Contractor to design and oversee the construction of the temporary and permanent works (cofferdam, temporary construction access roads and diversion system and any other temporary works) required to complete the work under the Contract.

1.6 CONSTRUCTION CONTROL AND MONITORING

.1 At least fifteen (15) days prior to start of work, the Contractor shall submit their Construction Control and Monitoring (CCM) plan. The plan shall be prepared in conjunction with the work area dewatering and water diversion construction plans, demolition plan and environmental management plan for sediment and erosion control.

.2 As a minimum the CCM plan is to cover:
- .1 the format of the Condition Survey;
- .2 the extent of the Condition Survey;
- .3 the methodology to be used to monitor existing cracks in existing buildings and other structures including embankments;
- .4 the extent and methodology for soil movement monitoring program at existing structures and embankments, including establishment of critical movement criteria, type of monitoring equipment and frequency of measurement.
- .5 the vibration monitoring program, including influence vibration zone, safe and critical vibration levels and anticipated vibration levels at the closest structure, including type of monitoring equipment and frequency of measurement.
- .6 the turbidity control and drainage water as part of the sediment and erosion control plan.
- .7 the format for report reading of CCM plan.
- .8 measures to protect existing groundwater wells and their services.

.3 Prior to commencement of the work meet with Departmental Representative and Consultant to discuss the CCM plan, report format, report frequencies, emergency report and distribution list.

1.7 TURBIDITY CONTROL AND DRAINAGE WATER

.1 The Contractor shall undertake quality (turbidity) monitoring of any discharge water to a receiving settling pond as part of their sediment and erosion control plan as set out in Section 01 35 43 and 35 42 19.

1.8 CONDITION SURVEY

.1 Prior to commencement of the work, a Pre-Construction Condition Survey Report of adjacent properties and structures, within 50 meters of the defined construction limit at a minimum, that may be affected by the work under this contract shall be submitted by the Contractor.

.2 The Condition Survey shall be undertaken by the Contractors qualified inspector together with the Consultant, private landowners and Township/municipality representatives (as applicable).

.3 The survey shall include the location and condition of adjacent properties.

.4 As a minimum the building and shoreline structures Condition Survey Reports are to cover the above and sub-grade accessible interior walls, exterior visible walls, ceiling, roof and floors, stone open fire pit, stone retaining walls and stairs. The reports shall detail, by sketches, video tape, photographs, and/or notes, the existing structural and cosmetic condition, but should not be limited to areas of building exhibiting distress (damage). Any significant cracks are to be identified and monitored.

.5 Condition Surveys are to be performed for all building and structures located within 40 metres from the edge of excavation and dewatering work, and/or 50 metres from vibration producing activities. As a minimum, the following properties and structures are be surveyed:
.1 Buildings shown on site plan.
.2 Coordinate survey with the Consultant.

.6 Furthermore, Condition Survey is to be performed for:
.1 Township and municipalities roads to be used as Haul Routes.
.2 Staging areas.
.3 Shoreline at perimeter of construction areas.

.7 The Contractor shall perform a monthly inspection of the Haul Routes and Crow Lake Road and report their findings to the Township/Municipality and Consultant. Repair and make good any damage to the satisfaction of the Local Authorities, the Departmental Representative and the Consultant.

.8 Upon completion of the work under the contract a Post-Construction Condition Survey shall be performed on all properties, buildings or structures that were surveyed as part of the Pre-Construction Condition Survey. The survey needs to focus on the same issues

1.8 CONDITION SURVEY (Cont'd)

.8 (Cont'd)
that were identified under the original survey, plus any new issues that may have developed during the construction period.

1.9 CONDITION SURVEY REPORT

.1 Prepare and submit a DRAFT Pre-Construction Condition Survey Report for review and approval by the Consultant prior to construction commencement.

.2 Revise as required by the Consultant and submit Final version of survey report.

.3 For each property surveyed, provide four (4) copies of the Condition Survey Report (PDF or approved alternative) with annotation of location of interest and comments on the existing conditions.

.4 One copy of the approved report is to be provided to the respective individual landowner and/or township/municipality. One copy is to be maintained on site.

1.10 MONITORING

.1 The Contractor will be responsible to carry out monitoring. Monitoring work is to include:
- .1 monitoring of cracks in buildings and other structures which were identified as part of the Pre-Construction Condition Surveys;
- .2 vibration (seismographic) monitoring.

.2 Cracks in buildings and structures monitoring:
- .1 Displacement monitoring gauges shall be installed across any significant existing crack to monitor for any additional building/structure distress due to work under this contract.
- .2 Location and number of gauges will be established by the Contractor, the Departmental Representative and the Consultant.
- .3 Gauges shall be read prior to commencement of construction activities and shall continue on a weekly basis until the completion of vibration producing construction activities.
- .4 The Consultant are to be advised of any significant crack displacement detected by the monitoring gauges.

.3 Take appropriate measures to reduce vibration to adjacent properties and structures. If vibration measurements exceeds set criteria, immediately stop all construction activity and inform Design engineer

1.10 MONITORING (Cont'd)

.3 (Cont'd)
and Departmental Representative of the situation. Provide and implement remedial action to rectify the situation. Obtain written permission from Consultant prior to resuming construction activities.

.4 Immediately repair any damage to any adjacent structure to the satisfaction of the Consultant.

.5 Turbidity control and drainage water:

.1 The monitoring firm shall provide a protocol and methodology for monitoring the total suspended solids (TSS) from any discharge point to a watercourse as set out in Section 01 35 43, section 1.6.

.2 The Canadian Council of the Ministers of Environment (CCME) has established criteria wherein the allowable increase in TSS from background levels is 25 mg/l.

.3 Reporting shall be undertaken as set out in this Section.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Temporary utilities.

.2 Temporary heating.

.3 Temporary power and light.

.4 Temporary communication facilities.

.5 Temporary fire equipment.

.6 Temporary pumping for dewatering.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29 - Health and Safety Requirements.

.3 Section 01 35 43 – Archaeological, Cultural and Environmental Procedures.

.4 Section 01 52 00 - Construction Facilities.

.5 Section 01 56 00 - Temporary Barriers and Enclosures.

.6 Section 01 77 00 - Closeout Procedures.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost in the Contract Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.4 SUBMITTALS

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

.2 Heating Plan including heater numbers, types, locations, capacities.

1.4 SUBMITTALS (Cont'd)

.3 Fan numbers, types, locations, capacities.

.4 Number and location of fire extinguishers.

.5 Location, type and service for sanitation facilities.

1.5 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.6 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water in accordance to Section 35 20 22.

.2 Provide standby equipment (generator and pumps) to ensure continuous and safe operation of dewatering works.

1.7 WATER SUPPLY

.1 The Contractor is responsible to arrange and pay for supply of water for the construction purpose and for potable water for personal use of their crew.

1.8 HEATING EQUIPMENT

.1 Use only heating equipment type acceptable to the Consultant.

.2 Heating fuels:

.1 Use electrical, gas, diesel oil or other fuels acceptable to the Consultant.

.2 Fuel Storage: to requirements of Fire Commissioner of Canada. Fuel storage is to be located away from domestic water wells, water course, sediment settling pond or any other water surfaces. Fuel storage location to be accepted by the Consultant.

.3 Heating Equipment Refueling and Containment: equipment that needs to be located near open water, or within the excavated area is to be placed in a containment system which can contain any spillage or leaking of fuel.

1.8 HEATING EQUIPMENT (Cont'd)

.2 (Cont'd)
.3 (Cont'd)
Containment system to be accepted by Consultant.
.4 Provide and maintain temporary fire protection equipment during performance of work commensurate with fuel source selected.

.3 Ensure that heating requirement is met by providing, at optimum efficiency of equipment, capacity of 125% of heat requirement and sufficient number of standby heaters ready for use on site.

.4 Vent exhaust of heating equipment to outside of housing and well clear of combustible materials and air intakes.

1.9 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 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 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
.4 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain minimum temperatures within enclosed area as specified in individual Section for items of work.

.5 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.

1.9 TEMPORARY HEATING AND VENTILATION (Cont'd)

.5 (Cont'd)
.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.

.6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
.1 Conform with 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.

.7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

.8 Provide heating adequate to meet temperature requirements listed in the following Sections:
.1 For concrete work: to Section 03 30 00 - Cast-In-Place Concrete.
.2 For other sections where heating is required for cold-weather protection, heating requirements shall be in accordance with manufacturer's recommendations or applicable codes, regulations and standard.

1.10 TEMPORARY POWER AND LIGHT

.1 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal and on-going utilization cost.

1.11 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost in the Contract Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork.

.3 CSA-O121-08 (R2013), Douglas Fir Plywood.

.4 CAN/CSA-S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.

.5 CSA Z797-09 (R2014), Code of Practice for Access Scaffold.

.6 CAN/CSA-Z321-96 (R2006), Signs and Symbols for the Occupational Environment.

1.4 SUBMITTALS

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

1.5 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues

1.5 INSTALLATION AND REMOVAL (Cont'd)

.1 (Cont'd) of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be graveled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.6 SCAFFOLDING

.1 Scaffolding in accordance with CSA-Z797.

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

1.7 HOISTING

.1 Provide, operate and maintain hoists/cranes required for moving of workers, materials and equipment.

.2 Hoists/cranes shall be operated by qualified operator.

1.8 SITE STORAGE/LOADING

.1 Confine work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.9 CONSTRUCTION PARKING

.1 Parking will be permitted for the Contractor within designated area within the Construction Limits only or within the additional land that the Departmental Representative may make arrangements for. No parking will be allowed on Crow Lake Road.

.2 Provide and maintain adequate access to project site.

1.9 CONSTRUCTION PARKING (Cont'd)

.3 Provide snow removal at work site and access road during period of Work.

.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

1.10 SECURITY AND MONITORING

.1 The Contractor shall pay for responsible security personnel to guard site and contents of site after working hours and during holidays as they deem necessary.

.2 Contractor shall pay for monitoring of the site during periods of no construction activity and to maintain and service dewatering and heating equipment.

.3 Contractor shall pay for the operation of the diversion works as required to maintain seasonal operating levels, including periods of no construction activity.

1.11 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table. Provide lock and key for it.

.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 Consultant's Site office.

.1 Provide temporary office for Consultant.

.2 Inside dimensions minimum 3.6 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 4 50% opening windows and one lockable door.

.3 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.

.4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colors. Finish floor with 19 mm thick plywood.

1.11 OFFICES (Cont'd)

.4 (Cont'd)

.5 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10 % upward light component. Provide electric power.

.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 1 x 2 m table, 4 chairs, 4 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.

.8 Maintain in clean condition.

1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.13 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 Provide and maintain two public use washroom facilities at location indicated on the drawings. Chemical or flushable portable toilets are acceptable.

1.14 CONSTRUCTION SIGNAGE

.1 Provide and erect, within three weeks prior to Contractor mobilization, a project sign in a location designated by Departmental Representative.

.2 Construction sign 1.2 x 2.4 m, of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.

1.14 CONSTRUCTION SIGNAGE (Cont'd)

.3 Indicate on sign, name of Owner, Consultant, Contractor and Subcontractor with logo, of a design style acceptable to the Consultant.

.4 No other signs or advertisements, other than warning signs, are permitted on site.

.5 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.

.6 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Consultant.

1.15 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Consultant.

.2 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.3 Protect travelling public from damage to person and property.

.4 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.5 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.6 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.7 Dust control: adequate to ensure safe operation at all times.

.8 Provide snow removal during period of Work.

1.16 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material as set out in Section 01 74 11.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 Work under this section relates to temporary construction measures to facilitate the work and specifies requirements for designing, supplying, installing, inspecting, maintaining, and removing:
- .1 Cold weather protection, consisting of temporary housing and supplementary heating for the workspaces and the work, as described by the specifications. The requirements of this section apply to all sections of specifications that call for cold weather protection.
- .2 Work not included in this Section:
  - .1 Provision of separate air supply for workers which is part of Contractor's responsibility under Health and Safety regulations for construction.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29 - Health and Safety Requirements.

.3 Section 01 35 43 – Archaeological, Cultural and Environmental Procedures.

.4 Section 01 77 00 - Closeout Procedures.

.5 Section 02 41 16 - Structure Demolition.

.6 Section 35 20 22 - Dewatering and Diversion.

1.3 REFERENCES

.1 Ontario Provincial Standard Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD).

.2 Ontario Ministry of Transportation, Book 7 of the Ontario Traffic Manual – Temporary Conditions.

.3 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.

1.3 REFERENCES (Cont'd)

.4 Canadian Standards Association (CSA International)
.1 CSA-O121-08 (R2013), Douglas Fir Plywood.

.5 Province of Ontario
.1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990 as amended, O. Reg. 213/91 as amended.
.2 Air Pollution - Local Air Quality (O. Reg. 419/05)

1.4 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost in the Contract Lump sum Price.

.2 Payment of this Section shall be as set out in Section 01 22 01.

1.5 WORK AREA DELINEATION

.1 Erect and maintain temporary site enclosures and barriers to delineate the work area as identified on the drawings and other measures as necessary to define the Work area and restrict access of the public to the Work area.

.2 Place construction warning signage at the work area and construction camp.

.3 Provide lockable truck entrance gate(s). Equip gates with locks and keys.

.4 Provide and maintain temporary floating barriers to define the Work area in the waterway and to restrict access to boating public to dewatering and diversion Works, as indicated on the drawings and as set in Section 35 42 15.

1.6 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating and ventilation as set out in Section 01 51 00.

1.7 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations.

1.8 TREE PROTECTION

.1 Provide barrier around trees and plants designated to remain. Protect from damage by equipment and construction activities.

1.9 ACCESS TO SITE

.1 Provide and maintain access roads, ramps and construction runways as may be required for access to the work area and staging areas.

1.10 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.

1.11 FIRE ROUTES

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

1.12 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.

1.13 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Field engineering survey services to measure and stake site.

.2 Survey services to establish and confirm inverts for Work.

.3 Installation of geodetic bench mark to the new dam structure on top of the concrete wing wall tied-in with existing referenced bench mark elevation.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost in the Contract Lump Sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.3 REFERENCES

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

1.4 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Ontario, acceptable to Consultant.

1.5 SURVEY REFERENCE POINTS

.1 Locate, confirm and protect control points prior to starting site work. Relocate and place permanent reference points during construction and after completion of Work.

.2 Make no changes or relocations without prior written notice to Consultant.

.3 Report to Consultant when reference point is lost or destroyed, or requires relocation because of necessary

changes in grades or locations.

1.5 SURVEY REFERENCE POINTS (Cont'd)

.4 Require surveyor to replace control points in accordance with original survey control.

1.6 SURVEY REQUIREMENTS

.1 Establish 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, new construction features, fill and topsoil placement and landscaping features.

.4 Stake batter boards for foundations.

.5 Establish new foundation, sill elevations, wall and deck elevations.

.6 Verify critical elevations including sill and crest elevation prior to and after concrete placement with a qualified surveyor.

.7 Prior to concrete placement, confirm sill elevations, dams wall elevations and deck elevation. Provide record of confirmation.

1.7 EXISTING SERVICES

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

.2 Remove abandoned service lines within 5 m of structures. Cap or otherwise seal lines at cut-off points as directed by Consultant.

1.8 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of dam sill, dam walls, dam deck, new structures 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 SUBMITTALS

.1 Submit name and address of Surveyor to Consultant.

.2 On request of Consultant, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final cleaning.

1.2 PROJECT CLEANLINESS

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

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

.3 Clear snow and ice from access to project site and staging areas. Temporary bank/pile snow within work limits and/or remove form site as required.

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

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

.6 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.7 Remove waste materials and debris from site and deposit in waste container at end of each working day.

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

.9 Clean and maintain haul routes on a weekly basis, or in accordance with the authorities having jurisdictions, whichever is more stringent.

1.3 FINAL CLEANING

.1 When Work is Substantially Performed, remove surplus products, surplus stockpiled material, tools,

1.3 FINAL CLEANING (Cont'd)

.1 (Cont'd)
construction machinery and equipment not required for performance of remaining Work from project site and staging areas.

.2 Remove waste products and debris and leave Work clean and suitable for occupancy.

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

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of surplus of stock piles material, waste and debris.

.5 Remove stains, spots, marks and dirt from railing, signs, safety boom and dam equipment.

.6 Inspect finishes and equipment and ensure specified workmanship and operation.

.7 Broom clean and wash exterior walks, steps and dam deck surfaces; rake clean other surfaces of grounds.

.8 Remove dirt and other disfiguration from surfaces.

.9 Remove debris and surplus materials from site, including staging areas.

.10 Remove snow and ice from dam and dam access.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION AND DEMOLITION WASTE

.1 Carefully deconstruct and source separate materials and divert from waste destined for landfill to maximum extent possible. Target for this project is 50 % diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.

.2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
- .1 Provide facilities for collection, handling and storage of source separated wastes.
- .2 Source separate the following waste:
  - .1 Brick and Portland cement concrete.
  - .2 Corrugated cardboard.
  - .3 Wood, not including painted or treated wood or laminated wood.
  - .4 Steel.

.3 Submit a waste reduction work plan indicating the materials and quantities of material that will be recycled and diverted from landfill.
- .1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested.

.4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.2 WASTE PROCESSING SITES

.1 Province of: Ontario.
- .1 Ministry of Environment and Energy, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
- .2 Telephone: 800-565-4923 or 416-323-4321.
- .3 Fax: 416-323-4682.

.2 Recycling Council of Ontario: 215 Spadina Avenue, #225, Toronto, ON, M5T 2C7.
- .1 Telephone: 416-657-2797

.2 Fax: 416-960-8053

1.2 WASTE PROCESSING SITES (Cont'd)

.2 (Cont'd)
.3 Email: rco@rco.on.ca.
.4 Internet: http://www.rco.on.ca/.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment:

Province	Address	General Inquiries	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
	Environment Canada Toronto ON	416-734-4494	

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 The requirements for the inspection of the Works by the Consultant for substantial acceptance and final completion.

1.2 RELATED SECTIONS

.1 Section 01 22 01 Measurement for Payment

.2 Section 01 33 00 Submittal Procedures

.3 Section 01 32 16 Construction Progress Schedule

.4 Section 01 35 43 Archaeological, Cultural and Environmental Procedures

.5 Section 01 45 00 Quality Control

.6 Section 01 48 00 Construction Control and Monitoring

.7 Section 01 74 21 Construction / Demolition Waste Management and Disposal

.8 Section 35 20 22 Dewatering and Diversion

.9 Section 35 42 15 Safety Boom Installation

.10 Section 35 42 19 Preservation of Watercourses

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost in the Contract Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.4 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

1.4 INSPECTION AND DECLARATION (Cont'd)

.1 (Cont'd)

.1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and submit verification that corrections have been made.

.2 Request Consultant's Inspection.

.2 Consultant's Inspection: Departmental Representative, Consultant and Contractor will perform inspection of Work to identify defects and deficiencies. Contractor to correct Work accordingly.

.1 Environmental testing of soils is to be undertaken by the Contractor at the external staging areas to confirm that there has been no impact to the soils. Any issues arising from the testing shall be addressed by the Contractor at their expense.

.2 The Contractor shall provide a release from owners of adjacent lands indicating that there are no impacts to their services and utilities (water, sanitary, storm drainage; electricity, communications) as a result of the Bobs Lake Dam Replacement construction activities. The Departmental Representative will provide all testing information related to groundwater monitoring to the Contractor for their usage.

.3 The Contractor shall provide a release from the municipality and/or County regarding restoration of the haul road.

.4 The Contractor shall provide a release from any waste transfer / receiving station and/or registered landfill as part of the Waste Management Work Plan.

.5 The Contractor shall provide a release from landowners whose lands have been used as a construction staging area indicating their acceptance of the site clean-up / grading / restoration.

.3 Completion: submit written certificates 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 and fully operational.

.4 Operation of systems has been demonstrated to Owner's personnel.

.5 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative, Consultant and Contractor. If Work is deemed incomplete by Consultant, complete outstanding items and request re-inspection.

1.4 INSPECTION AND DECLARATION (Cont'd)

.4 (Cont'd)

.1 Upon final acceptance by the Consultant, the Contractor shall formally request that the dam operation be taken over by the Parks Canada Agency on a particular date acceptable to the Departmental Representative.

1.5 CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning.

.2 Remove waste and surplus materials, rubbish and construction facilities form the site in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 – EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 As-built drawings and specifications.

.2 Equipment.

.3 Warranties and bonds.

.4 Final site survey.

1.2 RELATED SECTIONS

.1 Section 01 22 01 - Measurement for Payment

.2 Section 01 33 00 - Submittal Procedures

.3 Section 01 32 16 - Construction Progress Schedule

.4 Section 01 35 43 – Archaeological, Cultural and Environmental Procedures

.5 Section 01 45 00 - Quality Control

.6 Section 01 48 00 - Construction Control and Monitoring

.7 Section 01 74 20 - Construction / Demolition Waste Management and Disposal

.8 Section 35 20 22 - Dewatering and Diversion

.9 Section 35 42 15 - Safety Boom Installation

.10 Section 35 42 19 - Preservation of Watercourses

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost in the Contract Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.4 FORMAT

.1 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

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

.3 Arrange content by under Section numbers and sequence of Table of Contents.

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

.5 Provide 1:1 scaled CAD files in dwg format on CD.

1.5 AS-BUILT AND SAMPLES

.1 Maintain at site for Consultant one record copy of:
 .1 Contract Drawings.
 .2 Specifications.
 .3 Amendments.
 .4 Change Orders and other modifications to Contract.
 .5 Reviewed shop drawings, product data, and samples.
 .6 Field test records.
 .7 Inspection certificates.
 .8 Manufacturer's certificates.

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

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

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

.5 Keep record documents and samples available for inspection by Consultant.

.6 Turn one set, paper copy of red-lined AS-BUILT drawings and specifications over to Consultant on completion of work.

1.5 AS-BUILT AND SAMPLES (Cont'd)

.7 If project is completed without significant deviations from Contract drawings and specifications submit to Consultant one set of drawings and specifications marked "AS-BUILT".

1.6 RECORDING ACTUAL SITE CONDITIONS

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

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

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

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

.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 Amendments and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, Contractor monitoring results as set out in Section 01 48 00 Construction Control and Monitoring, waste management per Section 01 74 21 Construction / Demolition Waste Management and Disposal as required by specifications sections.

1.7 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 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 days after completion of applicable item of work.

.4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until 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 submittal.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This section specifies requirements for demolition of structures and parts of structures, and the removal and salvage of various items as described by the Contract drawings and the specifications.

.2 The work includes but is not necessarily limited to:

.3 The demolition and disposal including any recycling of materials comprising the existing Bobs Lake Dam and adjoining walls on each side in a such way as to allow to complete the Work.

.4 The salvage of existing stop log winch assemblies; stop logs; water level measuring system; warning and advisory signage; safety equipment including dam safety buoys; and such other items as may be directed by the Departmental Representative.

1.2 RELATED REQUIREMENTS

.1 Section 01 22 01 - Measurement and Payment.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 29 - Health and Safety Requirements.

.4 Section 01 35 43 – Archaeological, Cultural and Environmental Procedures.

.5 Section 01 56 00 - Temporary Barriers and enclosures.

.6 Section 01 71 00 - Examination and preparation.

.7 Section 01 74 21 - Construction/Demolition waste management and disposal.

.8 Section 31 23 33 – Excavating and backfilling.

.9 Section 35 20 22 – Dewatering, diversion and temporary construction access roads.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measurement Procedure: work under this section will not be measured for payment and shall be form part of the Contract Lump Sum Price.

1.3 MEASUREMENT AND PAYMENT PROCEDURES (Cont'd)

.2 Payment of this Section shall be as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.4 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 Department of Justice Canada.
- .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
- .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
  - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
  - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.5 DEFINITIONS

.1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not be limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or well being or environment if handled improperly.

.2 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related required submittal and reporting requirements.

.3 Waste Audit (WA): detailed inventory of materials in the dam and surrounds. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation projects. Indicate quantities of reuse, recycling and landfill.

.4 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.

1.6 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures and Section [01 74 21 Construction/Demolition Waste Management Disposal.

.2 WMC is responsible for fulfilment of reporting requirements.

.3 Prior to beginning of Work on site submit three (3) copies of detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal and indicate:

- .1 Descriptions of and anticipated quantities in tonnes of materials to be salvaged, reused, recycled and landfilled where applicable.
- .2 Number and location of dumpsters per type of waste material.
- .3 Anticipated frequency of tippage.
- .4 Name and address of haulers, waste receiving and recycling facilities.
- .5 Receiving facilities of material containing potential hazardous material. These materials are to be disposed in accordance with applicable regulations and not be designated for re-use.
- .1 Existing deck timber may contain CCA; and
- .2 Painted steel may contain lead.

.4 Submit four (4) copies of certified receipts from authorized disposal sites and reuse and recycling facilities for material removed from site on a monthly basis upon request of Consultant.

- .1 Written authorization from Consultant is required to deviate from receiving organizations listed in Waste Reduction Workplan.

.5 Prior to demolition of the existing structure, establish reference points (minimum of 4) that will allow the transfer of the coordinates and elevations of the existing geodetic bench mark to the new geodetic bench mark on the new structure or such other approach as approved by the Consultant. Provide all data regarding the reference points to the Consultant. Survey work shall be undertaken by an Ontario Legal Survey.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, and applicable Provincial/Territorial and Municipal regulations.

1.7 QUALITY ASSURANCE (Cont'd)

.2 Meetings:
- .1 Prior to start of Work arrange for site visit with Departmental Representative and Consultant to examine existing site conditions adjacent to demolition work.
- .2 Hold project meetings biweekly.
- .3 Ensure the Contractor and appropriate subcontractor WMC representatives attend the meeting along with the Departmental Representative and the Consultant.
- .4 WMC must provide written report on status of waste diversion activity at each meeting.
- .5 Consultant will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in a manner acceptable to the Consultant and in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Divert excess materials from landfill to site approved by Departmental Representative.

1.9 EXISTING SITE AND STRUCTURE PROTECTION

.1 Protect existing site features designated to remain and materials designated for salvage. In event of damage, immediately replace such items or make repairs to the satisfaction of the Consultant and at no additional cost to the Owner.

.2 Provide a pre-construction condition survey and assessment of adjoining structures and infrastructure, utilities and services in accordance with Section 01 48 00.

1.10 ENVIRONMENTAL PROTECTION

.1 Ensure Work is done in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.2 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

1.10 ENVIRONMENTAL PROTECTION (Cont'd)

.3 Fires and burning of waste or materials is not permitted on site.

.4 Do not bury rubbish waste materials.

.5 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.

.1 Ensure proper disposal procedures are maintained throughout project.

.6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties that are outside the approved construction limits.

.7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction and by the Consultant.

.8 Protect trees, plants and foliage on site and adjacent properties where indicated.

.9 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

.10 Do not use dust control agent without Consultant approval.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Measures shall be provided to protect site works to remain and other temporary measures installed by the Contractor for the construction.

.2 Equipment shall be sized adequately for the work.

.3 Minimize machinery running time to only while in use.

.4 Machinery used for concrete demolition must minimize air borne pollution.

PART 3 - EXECUTION

3.1 PROTECTION

.1 Protect layout and reference and control points during demolition work.

3.2 PREPARATION

.1 Inspect site and verify with the Consultant items designated for demolition as identified on the contract drawings, and items to be salvaged, reused, recycled, and disposed according to the Waste Reduction Workplan.

.2 Take and record all dimensions and elevations necessary to establish the reconstruction to the correct alignment, and in its correct location.

.3 Make templates in sufficient numbers to ensure successful re-installation of items including winch assemblies with respect to gain opening.

.4 Do Work in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.5 Undertake a condition assessment of items to be salvaged.

3.3 SAFETY CODE

.1 Do demolition work in accordance with Section 01 35 29 Health and Safety Requirements.

.2 Blasting operations are not permitted during demolition.

3.4 REMOVAL OF HAZARDOUS WASTES

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

.2 Prior to start of demolition work remove contaminated or hazardous materials as approved by Consultant from site and dispose at designated disposal facilities in safe manner and in accordance with applicable requirements and Section 01 74 21.

3.5 DEMOLITION

.1 Obtain the Consultant's approval to start the demolition part of the work.

.2 Perform demolition work in accordance with CSA S350-M-1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.3 Remove materials to be salvaged and reused at the new structure and/or delivered to the Parks Canada Agency yard in Smith Falls, ON. Store and protect these items. Leave ready for installation at other stages of the work. Items include:
- .1 Stop logs (Parks Canada Agency storage yard);
- .2 Stop logs hangers (Parks Canada Agency storage yard);
- .3 Safety Buoys (Parks Canada Agency storage yard);
- .4 Site notification, warning and advisory signage (Parks Canada storage yard);
- .5 Water Level Measuring Equipment (Parks Canada Agency storage yard).

.4 Items identified to be salvaged and stored on site for future re-installation are to be stored in a safe manner as to ensure that they will not be damaged. Replace at Contractors cost, any damaged salvaged items.

.5 Demolish in a manner to minimize dust. Wetting of materials is to be conducted to the extent that there is no surface runoff from the structure being demolished. Provide other temporary measures to prevent the migration of air-borne particulate.

.6 Remove, recycle and dispose of demolished materials in accordance with the Waste Reduction Workplan including authorities having jurisdiction.

.7 Stockpile materials in a safe manner for workers and equipment until removed from the work area. Remove all stockpiled materials from the construction area at the end of each day.

.8 At end of each day's work, leave Work in safe and stable condition.

3.6 REPORTING

.1 Through data gathered from weigh bills or other methodology approved by the Consultant, report the following information weekly to the satisfaction of the Consultant.
- .1 Description of material;
- .2 Weight, quantity of material;
- .3 Breakdown of re-use, recycling and landfill quantities;
- .4 End destination of material.

3.7 RESTORATION

.1 Upon completion of work, remove debris, trim surfaces and leave work site clean.

.2 Demonstrate to the Consultant that other site works have not been physically or structurally damaged as a result of demolition works to the requirements of Section 01 48 00.

.3 Provide a methodology of repair for other site works damaged by the demolition work acceptable to the Consultant. Undertake repairs to the satisfaction of the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.2 Section 03 20 00 - Concrete Reinforcement.

.3 Section 03 30 00 - Cast-in-Place Concrete.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost of concrete forming in the price of the concrete work described in Section 03 30 00 – Cast-in-Place Concrete.

.2 Payment shall be made as set out in Section 01 22 01.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CAN/CSA-O86-14, Engineering Design in Wood.
- .3 CSA O121-08 (R2013), Douglas Fir Plywood.
- .4 CSA O151-09 (R2014), Canadian Softwood Plywood.
- .5 CSA O153-13, Poplar Plywood.
- .6 CSA S269.1-16, Falsework and formwork.
- .7 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork.

.2 Council of Forest Industries of British Columbia (COFI)
- .1 COFI Exterior Plywood for Concrete Formwork.

1.4 SHOP DRAWINGS

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

.2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

1.4 SHOP DRAWINGS (Cont'd)

.3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

.4 Indicate sequence of erection and removal of formwork as approved by Consultant.

.5 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 Conform to municipal, provincial and national codes relating to design and construction of formwork.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.2 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

.3 Divert wood materials and plastic from landfill to a recycling facility.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Formwork materials:
.1 Use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA-O153.

.2 Form ties:
.1 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.3 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm^2 /s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

PART 3 - EXECUTION

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.

.2 Do not place shores and mud sills on frozen ground.

.3 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.4 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2 or as specified on other related sections.

.5 Align form joints and make watertight. Keep form joints to minimum.

.6 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless matching original profiles or specified otherwise.

.7 Radius at coping edges as specified on the drawings.

.8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.9 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.10 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 FORM RELEASE AGENT

.1 Surface preparation:

- .1 Protect adjacent surfaces not designated to receive concrete form release.
- .2 Clean and prepare surfaces to receive form release in accordance with manufacturer's instructions.
- .3 Clean form surfaces thoroughly prior to application.
- .4 Remove all rust, scale and/or previously used form release agents from the forms in accordance with good concrete practices.
- .5 When using new wooden forms, form release shall be applied and re-applied until complete

3.2 FORM RELEASE AGENT (Cont'd)

.1 (Cont'd)
.5 (Cont'd)
saturation has been accomplished prior to first use.

.2 Application:
.1 Apply concrete form release in accordance with manufacturer's instructions.

3.3 REMOVAL AND RESHORING

.1 Leave formwork in place for seven (7) days after placing concrete or until 80% of design strength is reached.

.2 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.3 Re-use formwork subject to requirements of CSA-A23.1/A23.2.

3.4 INSPECTION ACCESS

.1 Contractor shall not close forms prior to reinforcing bar inspection and acceptance by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section specifies the requirements for concrete reinforcement as described by the drawings and the specification.

1.2 RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 30 00 - Cast-in-Place Concrete.

.3 Section 01 33 00 - Submittal Procedures.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measurement Procedures: in accordance with Section 01 22 01 - Measurement and Payment.

.2 The work will be measured and paid for under payment item included in the Unit Price Table:

.1 Item No. 1 – Concrete Reinforcing: This item covers the work described in subsection 1.1.1.

.3 Measure concrete reinforcing in tonnes of material installed within the new dam, as set out in Section 01 22 01.

.1 No separate payment will be made for the preparation of the installation drawings and the reinforcement drawings and for the supply and installation of all the required accessories.

1.4 REFERENCES

.1 American Concrete Institute (ACI)

.1 SP-66-[04], ACI Detailing Manual 2004.

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.2 ACI 350 and ACI 1350.1 for water tightness.

1.4 REFERENCES (Cont'd)

.2 ASTM International
.1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
.2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 CSA International
.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
.2 CAN/CSA-A23.3-14, Design of Concrete Structures.
.3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
.4 CSA G30.3-M1983 (R1998), Cold Drawn Steel Wire for Concrete Reinforcement.
.5 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.6 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)
.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.5 SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.1 Indicate placing of reinforcement and:
.1 Bar bending details.
.2 Lists.
.3 Quantities of reinforcement.
.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.
.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
.1 Provide type B tension lap splices unless otherwise indicated.

1.5 SUBMITTALS (Cont'd)

.3 (Cont'd)
.3 Detail placement of reinforcing where special conditions occur.

1.6 QUALITY ASSURANCE

.1 Mill Test Report: upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum two (2) weeks prior to beginning reinforcing work.
.1 Upon request, submit in writing to Consultant proposed source of reinforcement material to be supplied.

1.7 DELIVERY, STORAGE AND HANDLING

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

.2 Storage and Handling Requirements:
.1 Store materials in a manner, which will prevent deterioration and contamination. Deteriorated or contaminated materials will be rejected and shall be removed from site.
.2 Replace defective or damaged materials with new.

.3 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
.1 Divert steel materials from landfill to a recycling facility.

PART 2 - PRODUCTS

2.1 MATERIALS

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

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.

.3 Cold-drawn annealed steel wire ties: to CSA G30.3-M or to ASTM A82/A82M.

.4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

2.1 MATERIALS (Cont'd)

.5 Bar Supports and Spacers:
- .1 Adequate for accurate placing and as required for construction loads.
- .2 Provide non-conductive bar supports in contact with exposed surfaces that has geometry and bond characteristics that prevents moisture movement from the surface to the reinforcement.
- .3 In walls and slabs exposed to view after form removal: Small concrete blocks made up of same colour and strength as concrete being placed around them.
- .4 Do not use plastic or stainless steel bar supports or side form spacers.
- .5 Design and fabricate special bar supports for top reinforcing bars in slabs where standard bar supports are not high or strong enough.

.6 Mechanical splices: subject to approval of Consultant.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

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

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

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

PART 3 - EXECUTION

3.1 FIELD BENDING

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

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

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

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

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

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section specifies requirements for the work Cast-In-Place Concrete.

.2 Heating, cooling, hot and cold weather protection, curing, formwork and falsework, finishing, and jointing materials are considered as included in the price of the concrete.

.3 Blended hydraulic cement type LHb for cast-in-place concrete is specified for use at all mass concrete pours at all reinforced concrete structure.

1.2 RELATED SECTIONS

.1 Section 01 22 01 - Measurement and Payment.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 45 00 - Quality Control.

.4 Section 02 41 16 - Structure Demolition.

.5 Section 03 10 00 - Concrete Forming and Accessories.

.6 Section 03 20 00 - Concrete Reinforcing.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measurement Procedures: in accordance with Section 01 22 01 - Measurement and Payment.

.2 The work will be measured and paid for under payment item included in the Unit Price Table:
.1 Item No. 2 - Cast-in-Place Concrete: This item covers the work described in section 1.1.

.3 Measure cast-in-place concrete in cubic meters (m^3) of concrete placed within the new concrete dam, as set out in Section 01 22 01.

.4 All labour, equipment and materials for cast-in-place concrete including incidentals, complete as specified, shall be included in the applicable price for concrete work.

1.3 MEASUREMENT AND PAYMENT PROCEDURES (Cont'd)

.5 Include in the price of concrete the heating or cooling of water and aggregates, and the provision of hot or cold weather protection, including provision for pre-heating of existing substrate.

.6 Include in the price of concrete the bonding agent.

.7 Include in the price of concrete curing.

.8 Include in the price of concrete the installation of all items embedded therein.

.9 Include in the price of concrete supply and installation of waterstops.

.10 Supply and installation of anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to work.

.11 Include in the price of concrete work described in Section 03 10 00 - Concrete Forming and Accessories.

.12 Include in the price of concrete any foundation preparation of the receiving surface including mud slab at existing bedrock.

1.4 REFERENCES

.1 Abbreviations and Acronyms:
- .1 Portland Cement: hydraulic cement or blended hydraulic cement (XXb - b denotes blended).
- .2 Type GU or GUb - General use hydraulic cement.
- .3 Type MS or MSb - Moderate sulphate-resistant hydraulic cement.
- .4 Type MH or MHb - Moderate heat of hydration hydraulic cement.
- .5 Type HE or HEb - High early-strength hydraulic cement.
- .6 Type LH or LHb - Low heat of hydration hydraulic cement.
- .7 Type HS or HSb - High sulphate-resistant hydraulic cement.
- .8 Fly ash:
- .9 Type F - with CaO content less than 8%.
- .10 Type CI - with CaO content ranging from 8 to 20%.
- .11 Type CH - with CaO greater than 20%.
- .12 GGBFS - Ground, granulated blast-furnace slag.

.2 Reference Standards:
- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM C260/C260M-10a, Standard Standard Specification for Air-Entraining Admixtures for Concrete.

1.4 REFERENCES (Cont'd)

.2 (Cont'd)
.1 (Cont'd)
.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.3 ASTM C494/C494M-15a, Standard Specification for Chemical Admixtures for Concrete.
.4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
.5 ASTM C1059/C1059M-13, Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
.6 ASTM D412-15a, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
.7 ASTM D624-00 (2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
.2 CSA International
.1 CAN/CSA-A5, Portland Cement.
.2 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
.3 CAN/CSA-A23.5, Supplementary Cementing Materials.
.4 CAN/CSA-A362, Blended Hydraulic Cements.
.5 CAN/CSA-A363, Cementitious Hydraulic Slag.
.6 CAN/CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
.7 CAN/CSA-A3001-08, Cementitious Materials for Use in Concrete.
.8 CAN/CSA G40.21-13, Structural Quality Steels.
.9 CAN/CSA G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.
.10 CSA A283-06 (R2016), Qualification Code for Concrete Testing Laboratories.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart, convene pre-installation meeting one (1) week prior to beginning concrete works.

1.5 ADMINISTRATIVE REQUIREMENTS (Cont'd)

.2 Ensure Departmental Representative, Consultant, speciality contractor - finishing, forming and other key personnel attend.
.1 Verify project requirements.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 At least two (2) weeks prior to commencing the work, provide the Consultant a concrete design that meets the specifications.

.3 At least two (2) weeks prior to commencing concrete work submit to the Consultant manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements and are compatible:
.1 Portland cement.
.2 Supplementary cementing materials.
.3 Shrinkage compensating grout for concrete.
.4 Admixtures.
.5 Aggregates.
.6 Water.

.4 At least two (2) weeks prior to beginning Work, provide Consultant a cold weather protection plan for concrete.

.5 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken.

.6 Concrete hauling time: maximum allowable time limit for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
.1 Modifications/deviations to maximum time limit must be submitted to Consultant for review.
.2 Any changes to maximum time limit must be agreed by Consultant and concrete producer as described in CSA A23.1/A23.2 before permission is granted.

.7 Provide two copies of WHMIS MSDS in accordance with Sections 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Archaeological, Cultural and Environmental Procedures.

1.7 QUALITY ASSURANCE

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

1.7 QUALITY ASSURANCE (Cont'd)

.2 Provide Consultant, minimum four (4) weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
- .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.3 Minimum two (2) weeks prior to starting concrete work, provide proposed quality control procedures for review by Consultant on following items:
- .1 Temperature control.
- .2 Cold weather concrete.
- .3 Curing.
- .4 Finishes.
- .5 Formwork removal.
- .6 Joints.
- .7 Maintaining an environment for concrete curing.
- .8 Preparing works to receive concrete including achieving an acceptable environment and substrate temperature.

.4 Ensure that mix design is adjusted suitably to prevent alkali aggregate reactivity problems.

.5 Manufacturer's qualifications:
- .1 Ready mix concrete supplier: Member in good standing of Ready Mix Concrete Association of Ontario (RMCAO). Batching plant facilities are required to maintain RMCAO Special Seal of Quality.
- .2 Batching and delivery facilities: Facilities capable of producing minimum of 50 m3/h, conforming to requirements of CAN/CSA A23.1/A23.2.

.6 Inspection and tests:
- .1 Materials: CAN/CSA A23.1/A23.2: Inspected and tested for conformance to requirements of this standard and to contract specifications.
- .2 Tests will be conducted in accordance with CAN/CSA A23.2.
- .3 Cooperate with and assist the Consultant during inspections and tests.
- .4 Inspection or testing by the Consultant will not augment or replace Contractor's quality control nor relieve from contractual responsibility.

.7 Defective concrete:
- .1 Strength acceptance criteria from cylinder tests will be in accordance with CAN/CSA A23.1/A23.2 except as follows:

1.7 QUALITY ASSURANCE (Cont'd)

.7 (Cont'd)
.1 (Cont'd)
.1 Concrete shall be considered defective for concrete placements less than 200 m3 when a cylinder test fails to meet specified strength. In such cases concrete in that section may be checked by Consultant by core specimens drilled and tested in accordance with CAN/CSA A23.2. All concrete core extraction and testing shall be conducted by a third party inspection company with a CSA certified testing laboratory with Category I certification.
.2 Strength acceptance criteria from core specimens will be in accordance with CAN/CSA A23.1/A23.2.
.3 Consider concrete defective if it is structurally unsound, lacks moisture resistance, honeycombed or improperly finished, as determined by the Consultant.
.4 The Consultant has the right to require replacement, strengthening or correction of impacted portions of defective concrete structure to acceptance of the Consultant.
.1 Bear all cost of rectifying defective concrete including inspections, design, coring, testing, strengthening, demolishing, and replacement. Bear investigation and evaluation cost even if further evaluation of design allows unit to be classed as acceptable concrete.

.8 Records:
.1 Before unloading at Site, have concrete producer submit to the Consultant a delivery ticket (with each batch of concrete) on which is printed, stamped or written the following information:
.1 Name and location of batching plant.
.2 Date and serial number of ticket.
.3 Name of Contractor.
.4 Specific designation of job (name and location).
.5 Approved mix code, specified strength, and specific class or designation of concrete indicated in Concrete Mixes article specified.
.6 Amount of concrete in cubic meters.
.7 Truck number, cumulative total, and/or load number.
.8 Time loaded or time of first mixing of cement and water/aggregate.

1.7 QUALITY ASSURANCE (Cont'd)

.8 (Cont'd)
.1 (Cont'd)
.9 If water added on site, show amount and have this information initialed by the Consultant.
.2 Include the following information, which is to be registered by producer's representative on at least two copies of the delivery ticket, after discharge has been completed:
.1 Time that load arrived on Site.
.2 Time that discharge of load was started.
.3 Time that discharge of load was completed.
.4 Type and amount of admixtures, if added on Site.
.5 Amount of water, if added on Site.
.6 Location of placed concrete and any issues encountered.
.7 Volume of concrete returned.
.3 Maintain accurate records of cast-in-place concrete elements. Include in records the following information:
.1 Date of placing concrete element.
.2 Location of concrete element.
.3 Specified strength of concrete.
.4 Air and form temperature when concrete was placed.
.5 Temperature of concrete when placed in the form.
.6 Test samples taken and results of test samples.
.4 Submit additional information designated by the Consultant and required to verify compliance with Specifications upon request.

1.8 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 Consultant and concrete producer as described in CSA A23.1/A23.2.
.2 Deviations to be submitted for review by Consultant.
.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

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

1.8 DELIVERY, STORAGE AND HANDLING (Cont'd)

.2 (Cont'd)
.1 (Cont'd)
Construction/Demolition Waste Management and Disposal.
.2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
.3 Do not use lake/river water for washing trucks.
.4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.3 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

.1 Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Consultant and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

.1 Blended hydraulic cement: to CAN/CSA A3001, type LHb.

.2 Supplementary cementing materials: to CAN/CSA A3001.

.3 Cementitious hydraulic slag ranging between 20% to 30%: to CAN/CSA-A363.

.4 Pozzolanic mineral admixtures: to CAN/CSA-A23.5.

.5 Water: to CSA A23.1/A23.2.

2.3 MATERIALS (Cont'd)

.6 Aggregates: to CSA A23.1/A23.2.

.7 Admixtures:
- .1 Air entraining admixture: to ASTM C260/C260M and CAN3-266.1.
- .2 Chemical admixture: to ASTM C494/C494M and CAN3-A266.2, Type WN. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .3 Superplasticizers: to ASTM C1017.

.8 Grout (Pourable): Premixed compound of non-metallic aggregate, cement, water and reducing and plasticizing agents, of pouring consistency capable of developing compressive strength of 50 MPa at 28 days.

.9 Curing compound: to CSA A23.1/A23.2 white and to ASTM C309, Type 1-chlorinated rubber.

.10 PVC waterstops:
- .1 To be a flexible PVC (Polyvinyl chloride) extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.
- .2 Construction joints: Ribbed without center bulb (flat ribbed) type with shop welded corners and intersecting pieces with legs not less than 400 mm long having the following dimensions:
  - .1 230 mm (9") wide by 9.5 mm thick for all vertical joints.
  - .2 150 mm (6") wide by 9.5 mm thick for all horizontal joints.
- .3 Expansion joints: Ribbed with center bulb (flat ribbed) type with shop welded corners and intersecting pieces with legs not less than 400 mm long having the following dimensions:
  - .1 230 mm (9") wide by 9.5 mm thick for all vertical joints, φext bulb of 25.4 mm.
  - .2 150 mm (6") wide by 9.5 mm thick for all horizontal joints, φext bulb of 17.5 mm.
- .4 Performance requirements to meet:
  - .1 Tensile strength: to ASTM D638, minimum 13.8 MPa (2000 psi).
  - .2 Ultimate elongation: to ASTM D638, minimum 300%.
  - .3 Tear resistance: to ASTM D624, minimum 43.8 kN/m (225 lb/in).
  - .4 Water absorption: to ASTM D570, 0.005 to 0.02%.
  - .5 Low temperature brittleness: to ASTM D746, passed at -37.2°C/-38.3 (-35°F/-37).

2.3 MATERIALS (Cont'd)

.11 (Cont'd)
.4 (Cont'd)
.6 Cold bent test at -45°C for 2 hours - no cracking.
.7 Stiffness in flexure: to ASTM D747, 4.8 kPa (700 psi).
.5 Specific gravity: to ASTM D792 - 1.4.Hydrophilic type waterstops will not be considered as an alternative to ribbed waterstops.

.11 Bonding adhesive: to ASTM C1059.

.12 Anchor Rods and Cast-in Anchors: to CSA-G40.21, Grade 300W, round bar stock threaded at one or both ends to receive a washer and nut and as shown on the Contract drawings.
.1 All components shall be hot-dip galvanized to ASTM A123/A123M-15.

.13 Cold-Drawn Steel Wire for Concrete Reinforcement: to CSA G30.3.

.14 Chairs, Bolsters, Bar Supports, Spacers: Adequate for strength and support of reinforcing construction conditions. Use non-corrodible materials for all concrete work which will be exposed to view in the finished work. To CAN/CSA-A23.1.

.15 Mechanical Splices: Subject to the approval of the Consultant.

2.4 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet Consultant performance criteria to 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.
.2 Provide concrete mix to meet following plastic state requirements:
.1 Uniformity: no segregation.
Concrete shall be tested for density, air content and slump to methods listed in CSA A23.1/A.23.2 to confirm batch uniformity meets requirements of Table 13 of CSA A23.1/A.23.2.
.2 Placeability: provide the lowest slump compatible with the conditions of placement. Slump shall be measured at the point of discharge into the forms;
.1 75 mm +/- 25 mm.

2.4 MIXES (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

.3 Workability: free of surface blemishes, colour variations and segregation. Finishability: to satisfaction of the Consultant.

.4 Set time: to conditions of pour and to acceptance of the Consultant.

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: C-1.

.2 Compressive strength at 28 days: 35 Mpa minimum.

.3 Maximum nominal size of coarse aggregate: 20 mm for sections having minimum dimension less than 1 meter and 20 to 40 mm for sections having least dimension more than 1 meter.

.4 Maximum water to cementing materials ratio: 0.4.

.5 Test aggregate for alkali reactivity as per CSA-A23.2 and as approved by the Consultant.

.6 Intended application: water retaining structure (dam).

.7 Surface texture: all deformities repaired including tie-rods, bug holes, honey combs etc.; sack rubbed to provide a uniform texture and colour.

.8 Geometrical requirements: provide reveals, rounded nosing at piers, steps and chamfers as indicated on the drawings.

.4 Admixtures: to approval of Consultant. Use admixtures to correct deficiencies in the mix or improve placement of concrete.

.1 Consultant may withdraw prior approval of admixture if conditions encountered during course of work indicate unsatisfactory results.

.2 Do not use calcium chloride or materials containing calcium chloride.

.5 Provide quality management plan to ensure verification of concrete quality to specified performance.

.6 Concrete pumpability characteristic shall be sufficient for the selected equipment and shall be co-ordinated between the Contractor and the concrete supplier.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Obtain Consultant's written approval before placing concrete.
  .1 Provide 24 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 Install all items to be embedded prior to commencement of work.

.4 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.

.5 Pumping of concrete is permitted only after approval of equipment and mix.

.6 Ensure formwork, reinforcement and inserts are not disturbed during concrete placement.

.7 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.8 Protect previous Work from staining.

.9 Clean and remove stains prior to application for concrete finishes.

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

.11 Do not place load upon new concrete until authorized by Consultant.

3.2 FORMWORK

.1 Construct mortar-tight formwork in accordance with reviewed formwork drawings, maintain tolerances of finished concrete work as specified in CAN/CSA-A23.1/A23.2.

3.2 FORMWORK (Cont'd)

.2 Where forms appear to be unsatisfactory stop work until defects are corrected.

.3 Strip forms to CAN/CSA-A23.1/A23.2.

3.3 INSTALLATION/ APPLICATION

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Place concrete continuously from start to finish:
- .1 At such rates as to permit satisfactory placing and consolidation - plan the work and use such methods and performance rates as not to allow cold joints and/or honeycomb;
- .2 During clement weather or with protection;
- .3 During daylight hours;
- .4 Without unscheduled construction joints;

.3 When applicable - pumping concrete:
- .1 Coordinate with concrete supplier in selection of appropriate pumping equipment for determined concrete mix and placement applications. Refer to Item 2.4 - Mixes.
- .2 Arrange equipment so that no vibrations result which might damage freshly placed concrete. Use reversible pumps.
- .3 Operate pump in such way that a continuous stream of concrete without air pockets is produced.
- .4 When pumping is discontinued and concrete remaining in pipe line is to be used, void pipe line in a manner that prevents contamination of concrete or separation of ingredients.

.4 Embedded items:
- .1 Where approved by Consultant, set embedded items as indicated or specified elsewhere.
- .2 Do not eliminate or displace reinforcement to accommodate embedded items. If embedded items cannot be located as specified, obtain written approval of modifications from Consultant before placing of concrete.
- .3 Check locations and sizes of embedded parts shown on drawings.

.5 Anchor rods:
- .1 Set anchor rods to templates under supervision with appropriate trade prior to placing concrete.

.6 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

3.3 INSTALLATION/ APPLICATION (Cont'd)

.7 Finishing and curing:
- .1 Finish concrete to CSA A23.1/A23.2.
- .2 Unformed surface concrete tolerance to conventional classification in accordance with straight edge method, as per Class B in Table 19.
- .3 Use a wood (steel) float finish for unformed surfaces that are buried. Exposed surfaces shall be float finished and sack rubbed to the satisfaction of the Consultant.
- .4 Use smooth-form finish for formed surfaces. Apply a sack rub finish to formed concrete surfaces acceptable to the Consultant.
- .5 Do patching of form-tie holes, cutout areas, and cavities to CAN/CSA-A23.1 Clause 24.2. Use material that matches in colour with concrete surface.
- .6 Use procedures as noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
- .7 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

.8 Waterstops:
- .1 Install waterstops to provide continuous water seal.
- .2 Do not distort or pierce waterstop in way as to hamper performance.
- .3 Do not displace reinforcement when installing waterstops.
- .4 Use equipment to manufacturer's requirements to field splice waterstops.
- .5 Tie waterstops rigidly in place.
- .6 Use only straight heat sealed butt joints in field.
- .7 Use factory welded corners and intersections unless otherwise approved by Consultant.
- .8 Waterstops shall be installed at all structure interfaces.

3.4 COLD WEATHER PROTECTION

.1 For concrete placed when air temperature is at or below 5 degrees Celsius, or when air temperature is at or is likely to fall below 5 degrees Celsius within 96 hours after concrete placement, in addition to cold weather requirements of CAN/CSA-A23.1:
- .1 Protect concrete by a windproof shelter of canvas or other material. At no point let walls of shelter touch formwork. Provide sufficient space for removal of formwork for finishing. Supply approved heating equipment. Vent the products of combustion outside the protective shelter.

3.4 COLD WEATHER PROTECTION (Cont'd)

.2 Maintain concrete or grout at following curing temperatures:
- .1 For an initial 3 days, at a temperature of not less than 15 degrees Celsius nor more than 27 degrees Celsius at concrete surfaces.
- .2 Cure at not less than 10 degrees Celsius for an extra 4 days.
- .3 Keep concrete surfaces moist continuously while protected.
- .4 Reduce temperature at a rate not exceeding 10 degrees Celsius per day until outside temperature has been reached.

.3 Temperature of any surface in contact with fresh concrete shall not be less than 5°C.

.4 Submit Cold Weather Protection Plan and shop drawings for the heating and hoarding in accordance with Section 01 33 00 - Submittal Procedures.

3.5 TEMPERATURE CONTROL PLAN

.1 Submit a Temperature Control Plan to the Consultant a minimum seven (7) days prior to commencement of placing any concrete that requires temperature control, for review of compliance with contract requirements.

.2 The plan shall include methods for monitoring and controlling concrete temperature and the temperature difference before, during and after placement for:
- .1 Any concrete subject to cold weather.
- .2 Large concrete components where the smallest dimension is 1.5 meters.

.3 The temperature control plan shall include, as a minimum, the following:
- .1 Concrete elements for which the plan applies.
- .2 Temperature monitoring system, including the location and depth, number of thermocouples, and frequencies of recordings to be used in each placement.
- .3 Method of ensuring concrete temperature and temperature difference are maintained for the duration of the protection period.
- .4 Any alterations to work schedule, production, delivery schedule, and time of placement for temperature control purposes.
- .5 Any modifications to mix design for temperature control purposes.
- .6 Any other specific measures to be taken.

.4 In addition, for concrete subject to cold weather, the temperature control plan shall include the following:

3.5 TEMPERATURE CONTROL PLAN (Cont'd)

.4 (Cont'd)
.1 Type of insulation, R value and number of layers, including test data verifying the R value. The submission for cold weather protective measures shall be accompanied by samples of insulation, if requested by the Consultant.
.2 Type and layout of heaters and type and extent of housing.

3.6 TEMPERATURE RECORDS

.1 Data logger temperature records and a record of any actions taken to maintain control of temperature and temperature difference shall be forwarded to the Consultant at the end of each working day during the temperature monitoring period. At the end of the temperature monitoring period, the Contractor shall submit to the Consultant a complete temperature record, including graphical plot of temperature versus time.

3.7 CONTROL OF TEMPERATURE AND TEMPERATURE DIFFERENCE

.1 The Contractor shall ensure that during the curing period the concrete temperature does not fall below 10°C or exceed 70°C. The Contractor shall also ensure that the temperature difference between the centre of the concrete component at a location where the concrete is expected to reach the highest temperature and the surface does not exceed 20°C for:
.1 Any concrete subject to cold weather.
.2 Large concrete components where the smallest dimension is 1.5 meters or greater.

3.8 TEMPERATURE MONITORING

.1 The Contractor shall monitor the concrete and ambient temperature for:
.1 Any concrete subject to cold weather.
.2 Large concrete components where the smallest dimension is 1.5 meters or greater.

.2 The Contractor shall supply and install thermocouple wires and associated instrumentation with a combined accuracy of ± 1°C capable of recording and displaying temperature. The instrumentation shall include data loggers capable of recording at hourly intervals or less and shall allow direct reading of temperature.

.3 The thermocouples for concrete temperature measurement shall be installed according to Table 2 of OPSS 904 prior to placing concrete. Thermocouples for monitoring ambient air temperature shall be installed in the shade

3.8 TEMPERATURE MONITORING (Cont'd)

.3 (Cont'd)
close to the surface of the concrete at a frequency of 1 thermocouple per stage.

.4 Recording of concrete temperatures shall begin at the start of placement. The temperature shall be recorded automatically at intervals no greater than 1 hour until the end of the monitoring period. The monitoring period shall be 7 days.

.5 The Contractor shall take necessary action to maintain the temperature within the specified limits.

.6 The Consultant shall be provided access to verify temperature readings. The digital temperature indicators shall be left in place until the end of the monitoring period. If the data logger does not have a digital display that allows the Consultant to verify temperature, the Contractor shall provide the necessary instruments to allow the Consultant to verify thermocouple function and readings.

3.9 HOT WEATHER REQUIREMENTS

.1 During hot weather place concrete to hot weather requirements of CAN/CSA-A23.1/A23.2, Clause 21.2. Ensure concrete temperatures at placing meet the requirements of Table 15. Take suitable control measures when mixing ingredients.

3.10 CURING, GENERAL

.1 Unformed surfaces: cure with non-staining fabric and water. Carefully place two layers of damp fabric on the surface of the concrete. Overlap each strip by at least 75 mm and secure against displacement by wind. Maintain fabric in place and keep thoroughly wet for 14 days after day of placing.

.2 Formed surfaces: formwork shall be left in place for 7 days.

.3 During curing period uncover only such areas as are immediately needed for finish treatment. Recover and continue curing.

3.11 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.].

.1 Ensure testing laboratory is certified to CSA A283.

.2 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Consultant.

.3 Departmental Representative will pay for costs of quality control testing.

.4 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.6 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.12 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

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

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

.2 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Consultant.

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

.4 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

3.13 ENVIRONMENTAL CONTROL

.1 For concrete waste water:

.1 At the discharge point into the watercourse, pH will be maintained between 6.5 and 9.0. Water with pH > 9 cannot be released directly back into the watercourse, but must be treated prior to release. Water with a pH ≥ 12.5 is considered toxic and treated as a hazardous waste under Ontario Regulation 347 of the Environmental Protection Act. wastewater in this condition must be removed from the site.

.2 Departmental Representative shall be notified within 48 hours prior to the commencement of any significant concrete pour operations (e.g., foundations) and for all Tremie pour operations.

.3 Maintain complete isolation of cast-in-place concrete for a minimum of 48 hours if the ambient air temperature is above 0°C (for the entire period) and for a minimum of 72 hours if ambient air temperature is below 0°C.

.4 All water that contacts uncured or partly cured concrete, all leachates or wastewater with high pH (greater than 9) shall be captured in a wastewater containment area.

.5 The waste water containment area shall be designed by a Qualified Professional(s) and sized to hold twice the volume of anticipated water run-off, leachate or wastewater.

.6 Carbon dioxide (CO2) or neutralizing acids shall be used to neutralize waters with high pH (greater than 9).

.7 Sufficiently sized carbon dioxide (CO2) tanks with regulators, hoses and gas diffuser, shall be readily available during normal concrete pour operations. The tank shall be used to release carbon dioxide gas into an affected area to neutralize pH levels should a concrete spill occur. Workers shall be trained in the use of the tank.

.8 Neutralizing acids must be contained in a professionally established system operated by a Qualified Professional.

.9 Any use of carbon dioxide (CO2) or neutralizing acids to modify pH levels shall be reported to Departmental Representative as soon as reasonably possible.

3.14 VERIFICATION

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Consultant and provide verification of compliance as described in PART 1 - Quality Assurance.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This section specifies requirements for the grouting works.

.2 Grouting works shall be performed as generally depicted on the drawings, as outlines in these specifications, and as directed by the Consultant. Changes may be called for in both the exact layout and number of grout holes as conditions encountered during work are evaluated. The purpose of the work is to create a watertight grout curtain within the specified work area.

.3 Work included but are not limited to:
- .1 Drilling of grouting holes.
- .2 Washing of drill holes.
- .3 Water pressure tests.
- .4 Supply of cement, sand, admixtures and water for the grout.
- .5 Supply, placing, dismantling of the movement monitoring systems.
- .6 Supply, placing, dismantling of the temperature monitoring systems.
- .7 Carpet grouting.
- .8 Curtain grouting.
- .9 Backfilling of drill holes.
- .10 Site cleaning.

1.2 RELATED SECTIONS

.1 Section 01 22 01 - Measurement and Payment.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.4 Section 31 22 13 - Rough Grading.

.5 Section 31 23 33 - Excavating and Backfilling.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measurement Procedures: in accordance with Section 01 22 01 - Measurement and Payment.

1.3 MEASUREMENT AND PAYMENT PROCEDURES (Cont'd)

.2 The work will be measured and paid for under payment item included in the Unit Price Table:
- .1 Item No. 3 – Grouting Works: This item covers the work described in section 1.1.

.3 Mobilization and Demobilization:
- .1 Payment will be made for costs for assembling all plant and equipment at the site preparatory to initiating the work and for removing it there from when the drilling and grouting program has been completed. Sixty (60) percent of the contract lump-sum price for mobilization and demobilization will be paid following completion of moving onto the site, including complete assembly, in working order, of all equipment necessary to perform the required drilling and grouting operations. The remaining forty (40) percent of the contract lump sum will be paid when all equipment has been removed from the site.
- .2 Unit of measure: Lump Sum Price.

.4 Drilling Grout Holes:
- .1 Drilling of grout holes will be measured for payment on the basis of the linear meter of holes actually drilled.
- .2 Unit of measure: linear meter.

.5 Portland cement in Grout:
- .1 Payment will be made for costs associated with Portland cement in grout.
- .2 Portland cement in grout will be measured for payment on the basis of the number of cubic meter of dry cement used in the grout satisfactorily placed in grout holes or wasted when such wasting is not due to the Contractor's negligence.
- .3 Unit of measure: cubic meter of dry cement.

.6 Sand in Grout:
- .1 Payment will be made for costs associated with sand in grout.
- .2 Sand in grout will be measured for payment on the basis of the number of cubic meter of sand, dry rodded measurement, used in the grout satisfactorily placed in grout holes or in exploratory holes.
- .3 Unit of measure: cubic meter of dry sand.

.7 Admixes in Grout:
- .1 No payment will be made for costs associated with admixes in grout.

.8 Placing Grout:
- .1 The operation of placing grout will be measured for payment on the basis of the number of grout stages satisfactorily placed and have reached the

1.3 MEASUREMENT AND PAYMENT PROCEDURES (Cont'd)

.8 (Cont'd)
.1 (Cont'd)
refusal criteria.
.2 Unit of measure: number of grout stage.

.9 Pressure testing:
.1 The operation of pressure testing will be measured for payment on the basis of the number of test done satisfactorily.
.2 Unit of measure: number of pressure test.

1.4 REFERENCES

.1 Except otherwise stated, the most recent version of these norms and references must be respected during the work execution.

.2 Canadian Standards Association
.1 CAN/CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
.2 CAN/CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
.3 Can/CSA A283-00 Qualification Code for Concrete Testing Laboratories.

.3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation
.1 OPSS 180 November 2011, Management of Excess Materials.
.2 OPSS 903 November 2009, Deep Foundations.
.3 OPSS 906 November 2012, Structural Steel for bridges.
.4 OPSS 1301 November 2007, Cementing Materials.
.5 OPSS 1302 September 1996, Water.
.6 OPSS 1350 November 2014, Concrete – Materials and Production.

1.5 DEFINITIONS

.1 Movement monitoring system: instruments installed in the rock mass to detect any upward movement of the ground surface or any structure within a radius of 10 m from any hole being grouted.

.2 Rock temperature monitoring system: instruments installed in the rock mass to measure the rock mass temperature in depth prior to grouting.

.3 Grouting: introducing cement grout that solidify within the rock joints and voids.

1.5 DEFINITIONS (Cont'd)

.4 Curtain grouting: grouting the rock along one or several rows of holes of variable depth and spacing along a specific axis.

.5 Carpet grouting: grouting the rock, at shallow depth, on each sides of the grout curtain.

.6 Grouting in ascending stages: grouting a hole from the bottom towards up, using packers displaced on successive stages.

.7 Grouting stage: the section of hole in which grouting is carried.

.8 Split spacing method: the procedure of locating an additional grout hole midway between two previously drilled and grouted holes.

.9 Grouting pressure: the measured pressure at the hole collar level during the pumping of the liquid in the hole.

.10 Effective grouting pressure: the pressure at the packer's level during the pumping. It is calculated from the grouting pressure, the pressure developed by the liquid columns at the packer's level and the natural ground water pressure.

.11 Successful grouting stage: all the operations required to achieve, within a hole, the packer assembly that support the specified pressure within leaks or pressure losses during grouting until refusal is reached.

.12 Redrilling: any drilling of hole or drilling of part of drill hole carried in a portion of hole already drilled during a preceding step.

.13 Frozen rock: for grouting purpose, the rock is considered frozen if its temperature is equal or inferior to 4 degree Celsius.

.14 Lugeon unit: the absorption of a liter of water per minute under an effective pressure of 1000 kPa in a hole section of one meter long.

.15 Primary Holes: primary holes for foundation grouting shall be drilled to their full depth. The depths will be governed by the foundation conditions.

.1 The holes thus drilled shall be washed and pressure tested, and then grouted.

.16 Successive Holes: After the primary holes have been completed in any section as specified above, the second and succeeding series of holes, as determined by the

1.5 DEFINITIONS (Cont'd)

.16 (Cont'd)
"split spacing method," shall be drilled and grouted as directed.
.1 As the drilling and grouting work progresses, it may develop that conditions are such that all or parts of the foundation already grouted require additional grouting. In such event, the equipment shall be returned and additional holes for grouting shall be drilled and grouted as directed and no allowance above contract unit prices will be made for drilling and grouting such holes or for the expense of any movement of equipment necessary to the performance of such work.

.17 Grout Mixes: mixes shall be in the proportions directed by the Consultant who will, from time to time, direct changes to suit the conditions found to exist in the particular grout hole.
.1 Cement Grout shall consist of cement, and water.
.2 Mortar Grout shall consist of cement, sand, and water.

1.6 SUBMITTALS

.1 Prior to the start of work, the Contractor shall submit to the Consultant the following information. No work shall be commenced prior to the Consultant's approval of the various submittals:

.2 Grouting plan:
.1 Description of all grouting equipment proposed for use, including, but not limited to, mixers, grout pumps, delivery lines and appurtenances. Information shall include the make, model, year manufactured, and general condition of each item.
.2 A description of all equipment and instruments to be used for surveys and monitoring of the ground surface and adjacent structures during the work.
.3 Names and qualifications statements for all personnel who will be employed in the drilling, grouting, and monitoring operations. All listed personnel must have a minimum of three years' continuous experience in similar grouting work.
.4 A description of the drilling methods and equipment to be used.
.5 A description of the casing and the casing withdrawal system to be used.
.6 Grout material sources, and the proposed mix design.
.7 Methods and equipment for calibration of the proportioning of the grout constituents.
.8 Methods and equipment for calibration of the grout quantity pumped and pumping rate.
.9 Statement of the proposed sequence of operations.

1.6 SUBMITTALS (Cont'd)

.2 (Cont'd)
- .10 Description of grout injection operations.
- .11 Copies of proposed drilling and grouting record forms.

.3 Monitoring procedures:
- .1 General plan and description of proposed monitoring operations
- .2 Description and specifications of monitoring equipment and instruments.
- .3 Proposed methods to obtain and record monitoring data.
- .4 Copies of proposed monitoring data forms.

1.7 QUALITY ASSURANCE AND CONTROL PLANNING

.1 Drilling and grouting work shall be carried by the Contractor under the technical control and the surveillance of the Consultant. Technical control includes, without being limited to, the detailed design and methods to use, materials, grout mixes, pressures, pressure tests and all required modification during drilling and grouting work.

.2 Drilling with or without sampling may be required by the Consultant in the work area, before, during and after the grouting work, for verification purposes.

.3 The Contractor must clean the foundation as described in section 31 23 33 before carrying grouting works.

.4 The drilling and the grouting must be carried in the sequences defined in this section or as shown on the drawings. Hole must be grouted as soon as possible after been drilled.

.5 All blocked holes must be filled with grout and another must be drilled next by except otherwise stated by the Consultant.

.6 Grouting must be done in ascending stages or as required by the Consultant. Except otherwise stated the length of a grouting stage is 4 m.

.7 No hole can be drilled within a radius of less than 12 m from another hole not grouted or being grouted or that been grouted within the last 24 hours preceding.

.8 No grouting can be done within a radius of 30 m of any fresh concrete younger than 7 days or that have reached 10 MPa.

1.7 QUALITY ASSURANCE AND CONTROL PLANNING (Cont'd)

.9 During the work, the Contractor must take all the means required for managing the washing waters, cleaning concrete and rock surfaces from grout accumulations and all others debris.

.10 No grouting can be done within frozen rock.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Cement: A sufficient quantity of cement shall be stored at or near the site of the work to insure that grouting-operations will not be delayed by shortage of cement. In the event the cement is found to contain lumps or foreign matter of a nature and in amounts which, in the opinion of the Consultant, may be deleterious to the grouting operations, screening through a standard 100 mesh screen may be required. No payment will be made for such screening.

.2 Project / Site Conditions: The program shown and described is based on currently available information. Conditions encountered during construction may require additions or deletions. The grouting program shall not be modified or curtailed as construction expediency. It is a required part of design and shall not become secondary to any time or scheduling restrictions. Grouting mixes, pressures, injection rate and the sequence in which the holes are drilled and grouted will be determined in the field and shall be as directed.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Grout: Grout shall be composed of water and cement, admixtures, and fillers. The grout mixes will be designed by the Consultant and will be varied to meet the characteristics of each hole as determined by conditions encountered. The various materials to be furnished by the Contractor shall conform to the specifications listed in paragraphs below.

.2 Water: The water used in the grout shall be furnished by the Contractor. It shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.

.3 Cement: Portland cement used in grout shall conform to the requirements of ASTM C150, Type I or II. The Contractor shall submit to the contracting Officer of

2.1 MATERIALS (Cont'd)

.3 (Cont'd)
the source of cement, brand name and type.
.1 Fly Ash shall conform to ASTM C618 grade C or grade F. Alternate sources of fly ash may be submitted and will be considered.

.4 Admixture: Admixtures may be added to the grout immediately before or during its mixing and will consist of accelerators, retarders, water reducers, fluidifiers and thixotropic cement grout modifier.

.5 Sand: Sand for grout shall be clean and consist of hard, tough, durable, un-coated particles meeting the requirements and graduation of masonry sand ASTM C33.

.6 Pipe and Pipe Fittings: Pipe and fittings required for constructing grout, drainage and exploratory holes shall be furnished, cut, threaded, and fabricated by the Contractor.

.7 Pipe: Pipe will be PVC of the diameter and in the location indicated. The pipe shall conform to ASTM.

PART 3 - EXECUTION

3.1 EQUIPMENT

.1 General:
.1 All drilling and grouting equipment used shall be of a type, capacity and mechanical condition suitable for performing the work, as determined by the Consultant. The power and equipment and the layout thereof shall meet all applicable requirements of local, Provincial, and Federal regulations and codes, both safety and otherwise.

.2 Drilling Equipment:
.1 Standard drilling equipment of the rotary type shall be used to perform the drilling. Water or air shall be used for removing cuttings from the hole during drilling operations. Supplies shall include all bits, drill rods, tools, casing, piping, pumps water, and power to accomplish the required drilling. All drilling rigs and pumps will be equipped with pressure gages.

.3 Grouting Equipment:
.1 The grout plant shall be capable of supplying, mixing, stirring and pumping the grout and additives, to the satisfaction of the Consultant.

3.1 EQUIPMENT (Cont'd)

.3 (Cont'd)

.1 (Cont'd)

The plant shall have a minimum capacity of 100 l/min of grout injected at a pressure not greater than 1500 kPa. It shall be maintained at all times and any grout hole that lost or damaged due to mechanical failure of equipment or inadequacy of grout supply shall be replaced by another hole, drilled by the Contractor at his expense. The amount of grouting equipment shall be as necessary to perform the work specified herein. The type to be furnished shall include the following :

.1 A progressive cavity pump capable of generating pressures up to 1500 kPa and pumping a maximum of 100 l/min. In no case will the pump be separated by more than 75 m of grout line from the header of a hole being grouted.

.2 A colloidal or paddle type grout mixer having a minimum drum capacity of approximately 260 l. Mixing time shall be approximately 60 seconds per batch.

.3 A mechanically agitated sump having a minimum capacity 260 l.

.4 A circulating grout header with control valves and a pressure gage with protector. Control valves shall be connected to the return line and header. The header shall be joined directly to the riser pipe at the hole by means of a quick connector union.

.5 A water meter graduated in 1/10 of liter having a direct reading totalizer.

.6 Such valves, packers, pressure gages, pressure hose, supply lines, and small tools as may be necessary to provide a continuous supply of grout at accurately controlled pressures as specified. The inside diameter of the pressure hose and grout supply line shall be not less than 25 mm. An accurately calibrated, high precision pressure gage shall be used to check the accuracy of all gages used in the grouting. Gages shall be checked at least every 24 hours, or more frequently if the Consultant so determines. When defects are found, grouting operations will be stopped until calibration of gages has been obtained.

3.2 GROUTING WORKS

.1 Grout Hole Drilling:

.1 Grout holes shall be drilled with standard rotary or percussion drilling equipment. No core recovery will be required and the type bit used shall be optional with the Contractor.

.2 The hole shall be of sufficient diameter to allow use of an expansion plug or packer with an effective inside diameter of not less than 25 mm. The minimum diameter of hole shall be 50 mm at the point of maximum penetration.

.3 Drilling will be done in accordance with the applicable grouting method hereinafter described. Whenever artesian flow is encountered, the drilling operations shall be stopped, the hole washed, pressure tested and grouted before drilling operations are resumed in such hole. The grout so injected remaining in a partially completed hole shall be removed therefrom by washing or other methods before it has set sufficiently to require redrilling.

.4 Redrilling required because of the Contractor's failure to clean out a hole before the grout has set shall be performed at the Contractor's expense. Except that where the grout has been allowed to set by direction of the Consultant, the redrilling will be paid for at the contract price for drilling the grout hole.

.2 Grout:

.1 All holes for grouting, shall be drilled at the locations, in the direction, angle, and to the depths indicated or as directed by the Consultant.

.2 The first series of holes to be drilled and grouted shall be at 6 m intervals and hereinafter are referred to as primary holes. All the primary holes must be grouted by before starting drill of the succeeding holes.

.3 The location of secondary and succeeding series (intermediate) holes shall be determined by the split spacing method as defined in paragraph SPLIT SPACING.

.4 Grouting of primary and secondary holes shall be done with a thixotropic cement grout modifier used according with the manufacturer recommendations.

.5 The number of grout holes shall be increased, progressively, by the split spacing method as defined in paragraph SPLIT SPACING. The number grout holes shall be increased progressively, by the split spacing method as deemed necessary by the Consultant until the amount of grout used indicates that the foundation is tight. Each hole drilled shall be protected from becoming clogged or obstructed by means of a cap or other suitable

3.2 GROUTING WORKS (Cont'd)

.2 (Cont'd)

.5 (Cont'd)

device on the collar and any hole that becomes clogged or obstructed due to fault of the Contractor before completion of operations shall be cleaned out in a manner satisfactory to the Consultant or another hole provided by and at the expense of the Contractor.

.6 Except otherwise stated, the pressure must not exceed 25 kPa per meter of vertical downward hole.

.3 Hole washing and Pressure testing:

.1 Just before carrying a grout stage or a pressure test, the hole must be thoroughly washed with water using a hose that reach the bottom of the hole in order to remove all mud, dirt and debris. The hole is considered clean when the water return is clean.

.2 Water used for the washing and pressure testing must have a temperature between 7°C and 20°C.

.3 The Consultant may ask the Contractor to carry pressure test in some drill holes. Pressure tests are carried with several pressure stages as described in the following:

.1 The tested length must be set to 3 m, or as requested by the Consultant;

.2 A simple or double packer assembly must be used to isolate the hole section to test;

.3 Except otherwise stated the test pressure must 15 kPa per meter of depth;

.4 Water must be pumped at the test stage following five pressure steps with continuous pressure and flow volume recording. Each pressure step last 5 minutes with constant flow. The five steps are the following:

1 the first step at 1/3 the test pressure;
2 the second step at 2/3 the test pressure;
3 the third step at test pressure;
4 the fourth step at 2/3 the test pressure;
5 the fifth step at 1/3 the test pressure;

.5 During the test, the absorption volume reading must be taken at each minute. Initial water level must be measured. Absorption test result must be interpreted in Lugeon units.

.4 Grout Injection:

.1 The primary and secondary holes must be grouted using CELBEX 643 admixture or approved equivalent, mixed and used as recommended by the manufacturer.

3.2 GROUTING WORKS (Cont'd)

.4 (Cont'd)

.2 Carpet grouting must be completed within a radius of 50 m before beginning the curtain grouting, and the spilt spacing method must be used for both grouting types.

.3 Grouting works must proceed from the lower hole toward the highest hole, and from downstream to upstream.

.4 Grouting work must be carry in a continuous way, under the required pressure, until refusal, and as specified in this chapter.

.5 For the tertiary and successive holes, if pressure tests indicate a tight hole, grouting shall be started with a thin mix. If an open hole condition exists, as determined by loss of drill water or inability to build up pressure during washing operations, then grouting shall be started with a thicker mix and with a grout pump operating as nearly as practicable at constant speed at all times; the ratio will be decreased, if necessary, until the required pressure has been reached, as directed by the Consultant. If this procedure does not produce the desired pressure, mortar grout shall be used and the mix varied as necessary to produce the desired results.

.6 When the pressure tends to rise too high, the water/cement ratio shall be increased and/or the mix of mortar, grout changed or discontinued as may be required to produce the desired results. If necessary to relieve premature stoppage, periodic applications of water under pressure shall be made, as directed by the Consultant. Under no conditions shall the pressure or rate of pumping be increased suddenly as either may produce a water-hammer effect, which may promote stoppage.

.7 The grouting of any hole shall not be considered complete until that hole takes grout at the rate of 5 L/m/10 min. measured at the pressure required for that portion of the hole being grouted.

.8 Should grout leaks develop, the Contractor shall caulk such leaks when and as directed, the cost thereof being included in the contract price for unit price pay item "Placing Grout", in accordance with MEASUREMENT AND PAYMENT.

.9 If, due to size and continuity of fracture, it is found impossible to reach the required pressure after pumping a reasonable volume of grout at the minimum workable water/cement ratio or mortar grout materials ratio the speed of the pumping shall be reduced or pumping shall be stopped temporarily and intermittent grouting shall be performed, allowing sufficient time between grout injections for the grout to stiffen.

3.2 GROUTING WORKS (Cont'd)

.4 (Cont'd)

.9 (Cont'd)

Following such reduction in pumping speed, if the desired result is not obtained, grouting in the hole shall be discontinued when directed. In such event, the hole shall be cleaned, the grout allowed to set, and additional drilling and grouting shall then be done in this hole or in the adjacent areas as directed, until the desired resistance is built up.

.10 The water-cement ratio in volume varied from 5 : 1 to 0.5 : 1. The grout must be mixed and used according with Manufacturer recommendations.

.11 If during grouting a hole, the grout leaks by adjacent holes and that the leaks volume excess 5 liters over a 10 minute period, adjacent leaking holes must be immediately blocked with a packer placed at the top of the interconnecting zone and installed with a manometers for pressure monitoring. The Contractor must be able to connect up to 3 of those connecting holes at the same time in order to be able to grout them all simultaneously at specified pressure to reach refusal as specified in this chapter.

.12 Grout that cannot be placed, for any reason, within two hours after mixing shall be wasted. If such grout is mixed at the direction of the Consultant or with his knowledge and consent, such wasted grout, except as specified in MEASUREMENT AND PAYMENT, shall be paid for at the contract unit prices for the materials contained therein.

.5 Backfilling of Holes:

.1 Holes shall be backfilled with grout proportioned as directed by the Consultant and generally having a water/cement ratio less than 1.0. The backfilling shall be accomplished by injection of grout through a tremie pipe or hose inserted to full depth of hole. When grout vents at the surface, the tremie shall be gradually withdrawn, maintaining grout in pipe or hose until completely removed. Holes containing freshly injected grout shall not be backfilled until the injected grout has set, grout will be paid for at the contract unit price for the Portland cement therein.

.6 Equipment Arrangement and Operation:

.1 The arrangement of the grouting equipment shall be such as to provide a continuous circulation of grout throughout the system and to permit accurate pressure control by operation of a valve on the grout return line, regardless of how small the grout take may be. The equipment and lines shall be prevented from becoming fouled by the

3.2 GROUTING WORKS (Cont'd)

.6 (Cont'd)

.1 (Cont'd)

constant circulation of grout and by the periodic flushing out of the system with water. Flushing shall be done with the grout intake valve closed, the water supply valve open, and the pump running at full speed.

.7 Records:

.1 The Consultant will keep records of all grouting operations, such as a log of the grout holes, results of washing and pressure testing operations, time of each change of grouting operation, pressure, rate of pumping, amount of cement for each change in water/cement ratio, and other data deemed by him to be necessary. The Contractor shall furnish all necessary assistance and cooperation to this end.

3.3 ENVIRONMENTAL CONTROL

.1 For concrete waste water:

.1 At the discharge point into the watercourse, pH will be maintained between 6.5 and 9.0. Water with pH > 9 cannot be released directly back into the watercourse, but must be treated prior to release. Water with a pH ≥ 12.5 is considered toxic and treated as a hazardous waste under Ontario Regulation 347 of the Environmental Protection Act. Wastewater in this condition must be removed from the site.

.2 Departmental Representative shall be notified within 48 hours prior to the commencement of any significant concrete pour operations (e.g., foundations) and for all Tremie pour operations.

.3 Maintain complete isolation of cast-in-place concrete for a minimum of 48 hours if the ambient air temperature is above 0°C (for the entire period) and for a minimum of 72 hours if ambient air temperature is below 0°C.

.4 All water that contacts uncured or partly cured concrete, all leachates or wastewater with high pH (greater than 9) shall be captured in a wastewater containment area.

.5 The waste water containment area shall be designed by a Qualified Professional(s) and sized to hold twice the volume of anticipated water run-off, leachate or wastewater.

.6 Carbon dioxide (CO2) or neutralizing acids shall be used to neutralize waters with high pH (greater than 9).

3.3 ENVIRONMENTAL CONTROL (Cont'd)

.1 (Cont'd)

.7 Sufficiently sized carbon dioxide (CO_2) tanks with regulators, hoses and gas diffuser, shall be readily available during normal concrete pour operations. The tank shall be used to release carbon dioxide gas into an affected area to neutralize pH levels should a concrete spill occur. Workers shall be trained in the use of the tank.

.8 Neutralizing acids must be contained in a professionally established system operated by a Qualified Professional.

.9 Any use of carbon dioxide (CO_2) or neutralizing acids to modify pH levels shall be reported to Departmental Representative as soon as reasonably possible.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Material specification, finishes and erection of structural steel members described on the Contract drawings.

1.2 RELATED SECTIONS

.1 Section 05 52 16 - Guardrails.

.2 Section 05 50 00 - Metal Fabrication.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No separate measurement for payment shall be made for structural steel work. Include cost in Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.4 REFERENCES

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

- .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A276-16, Standard Specification for Stainless Steel Bars and Shapes.
- .3 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .4 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
- .5 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- .6 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.

1.4 REFERENCES (Cont'd)

.3 Canadian Standards Association (CSA International)
- .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CAN/CSA-S16-14, Design of Steel Structures.
- .3 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel. CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
- .4 CSA W55.3-08 (R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.
- .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.5 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with requirements of CSA S16 to resist forces, moments, shears and allow for movements indicated.

.2 Shear Connections:
- .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
- .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam or the design shears are not indicated. Design for factored loads acting on members where indicated.

.3 Submit drawings, details, and design calculations stamped and signed by qualified professional engineer licensed in the Province of Ontario, Canada, for all structural steel connections.

1.6 SHOP DRAWINGS

.1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 - Submittal Procedures.

.2 Ensure Fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Ontario, Canada.

.3 Indicate all welds on shop drawing by CSA W59 welding symbols.

1.6 SHOP DRAWINGS (Cont'd)

.4 Proposed welding procedures shall be stamped and approved by Canadian Welding Bureau.

1.7 QUALITY ASSURANCE

.1 Submit two (2) copies of mill test reports 4 weeks prior to fabrication of structural steel.
- .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
- .2 Provide mill test reports certified by metallurgists qualified to practice in Province of Ontario, Canada.

.2 Provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and product standards as specified and indicated.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 Structural steel: to CAN/CSA G40.20/G40.21 Grade 350W for all steel shapes including HSS and W sections, channel sections, angles and plates.

.2 Bolts, nuts and washers: to ASTM A325M, Type 1.

.3 Welding materials: to CSA W59, type required for materials being welded and certified by Canadian Welding Bureau.

.4 Hot dip galvanizing: galvanize steel to ASTM A123/A123M, minimum zinc coating of 600 g/m2, Coating Grade 85.
- .1 Touch-Up Primer for Galvanized coating. SPCC 20 Type I Inorganic zinc rich.

.5 Gain opening angles: 304 or 316 stainless steel as specified in ASTM A276.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CSA-S16 and in accordance with reviewed shop drawings.

.2 Provide holes in plates and angles as part of the handrail mounting assembly as indicated on contract drawings.

PART 3 - EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CSA-S16.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 MARKING

.1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.3 ERECTION

.1 Erect structural steel, as indicated and in accordance with CSA-S16.

.2 Field cutting or altering structural members: to approval of Consultant.

.3 Clean with mechanical brush and touch up galvanized finish to bolts, welds and burned or scratched surfaces at completion of erection.

.4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.4 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Consultant.

.3 Departmental Representative will pay costs of tests as specified in Section 01 45 00 - Quality Control.

3.5 FIELD TOUCH-UP

.1 Touch-up galvanized surfaces, field welds, bolts and burnt or scratched surfaces with zinc rich primer where burned by field welding.

.1 Pre-treat damaged surfaces to manufacturer's instructions for zinc rich paint.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Specification requirements for the supply, delivery and installation of miscellaneous steel components required, including attachments, welds, studs, stiffeners, anchors, fasteners or other fixtures and hardware as indicated.

.2 Work under this section covers the fabrication of dam gain liners, gain covers, sill beam, stop log slides hoist frames and other miscellaneous steel fabrication items as indicated on the drawings.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 No separate measurement for payment shall be made for metal fabrication. Include cost in the Contract Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.3 REFERENCES

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

- .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-16, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A276-16, Standard Specification for Stainless Steel Bars and Shapes.
- .4 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- .5 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .6 ASTM A780/A780M-09 (2015), Standard Practice for Repair of Damaged and uncoated Areas of Hot-Dip Galvanized Coatings.
- .7 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

1.3 REFERENCES (Cont'd)

.1 (Cont'd)
.1 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.2 American National Standards Institute (ANSI):
.1 ANSI/NAAMM MBG531-00, Metal Bar grating Manual.

.3 CSA International
.1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA S16-14, Design of Steel Structures.
.3 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
.4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
.5 CSA W48.1-M91 (R1998), Carbon Steel Covered Electrodes for Shielded Metal Arc Welding.
.6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

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

1.4 STRUCTURAL DESIGN

.1 Design of connections shall be performed by a structural engineer licensed to practice in the Province of Ontario, Canada.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.6 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements upon request by the Consultant.

.3 Subcontractor Qualifications: provide metal fabrications specified in this specification section only by a fabricator who has adequate plant, equipment, and skilled tradesmen to fabricate and install metal fabrications expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past 5 years.

.4 Welder Qualifications: weld structural component: in steel, in accordance with CSA W59, and by a fabricator fully certified by the CWB to conditions of CSA W47.1 and W55.3 as applicable.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Storage and Handling Requirements:
- .1 Store materials off ground and in accordance with manufacturer's recommendations in clean and dry area.
- .2 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Unless detailed or specified otherwise, standard products will be acceptable if construction details and installation meet intent of Contract Documents.

.2 Include all materials, products, accessories, and supplementary parts necessary to complete the assembly and installation of metal fabrications specified in this specification section.

.3 Incorporate only metals that are free from defects which impair strength or durability, or which are visible. Install only new metals of best quality, and free from rust or waves and buckles and that are clean, straight, and with sharply defined profiles.

2.1 MATERIALS (Cont'd)

.4 Steel sections, channels, angles and plates: to CSA G40.20/G40.21, Grade 350W.Bolts: to ASTM A325M Type 1, unless otherwise specified.

.5 Gain opening angles: 304 or 316 stainless steel as specified in ASTM A276.

.6 Bolts: to ASTM A325M Type 1, unless otherwise specified.

.7 Welding materials: to CSA W59.

.8 Welding electrodes: to CSA W48 Series.

.9 Grating (aluminum):

.1 Main and service gain covers: to ANSI/NAAMM MBG 531, Type 30-51M, aluminum 6061-T6 to ASTM B221, serrated bearing bars 25.4x4.8 mm @ 30 mm o.c., twisted cross bars @ 51 mm o.c., complete with 32x32x6.4 mm aluminum structural angle frame as shown on drawings.

.10 Weld joints unless otherwise indicated and unless details of construction do not permit welding. Make exposed welds continuous and grind smooth.

.11 Make allowance for thermal expansion and contraction when fabricating exterior work.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Where possible, fit and shop assemble work, ready for erection.

.3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.4 Fabricate gratings within limits given in Metal Bar Grating Manual.

.5 Fabricate to reviewed Shop Drawings and in general to details indicated on drawings and specified herein.

2.3 FINISHES

.1 Galvanizing: all components, except aluminum grating covers, stainless components and guardrails, fabricated under this section are to have hot-dip galvanized finish with zinc coating 600 g/m2, Coating

2.3 FINISHES (Cont'd)

.1 (Cont'd)
Grade 85, to ASTM A123/A123M.
.1 Touch-Up Primer for Galvanized coating. SPCC 20 Type I Inorganic zinc rich.

.2 Bolts and anchor bolts are to be hot-dip galvanized to ASTM A153/A153M, unless otherwise specified.

.3 Hot-Dip galvanize assemblies following their fabrication except where impossible.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Consultant.
.2 Inform Consultant of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 ERECTION

.1 Field welding is not allowed.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Exposed fastening devices to match finish and be compatible with material through which they pass.

.4 Supply components for work by other trades in accordance with shop drawings and schedule.

.5 Make field connections with bolts to CSA S16.

.6 Deliver items over for casting into concrete together with setting templates.

3.2 ERECTION (Cont'd)

.7 Touch-up galvanized surfaces with zinc rich primer where scratched.

3.3 STEEL GRATING FASTENING

.1 Fasten steel grating to all supporting steel using fixing clips adequate to grating type consisting of a top saddle clip, lower clamp, hex head cap screw, nut and washer, and is designed for use with HD Type 30 series grating.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 The work of this Section includes but is not limited to:
- .1 Fabrication and installation of steel HSS guardrails complete with base plates, supporting brackets, including bolts, epoxy anchors, nuts and washers, as shown on Contract drawings.

1.2 RELATED SECTIONS

.1 Section 05 12 23 - Structural Steel.

.2 Section 05 50 00 - Metal Fabrication.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the work under this Section. Include cost in Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work.

1.4 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-16, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .4 ASTM A501/A501M-14, Specification for Hot-Formed Welded and Seamless carbon Steel Structural Tubing.
- .5 ASTM A780/A780M-09 (2015), Standard Practice for Repair of Damaged and uncoated Areas of Hot-Dip Galvanized Coatings.
- .6 ASTM D522/D522M-13, Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.

1.4 REFERENCES (Cont'd)

.1 (Cont'd)
- .7 ASTM D2794-93 (2010), Standard Test Method for Resistance of Organic Coatings to the Effect of Rapid Deformation (Impact).
- .8 ASTM D3359-09e2, Standard Test Methods for Measuring Adhesion by Tape Test.
- .9 ASTM D3363-05 (2011)e2, Standard test Method for Film Hardness by Pencil Test.
- .10 ASTM D7803-12, Standard Practice For Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.

.2 CSA International
- .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA S16-14, Design of Steel Structures.
- .3 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
- .4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 CSA W55.3-08 (R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.
- .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual – current edition.

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 sections pipe, tubing, bolts and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS MSDS.
  - .1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L prior to use.

1.5 SUBMITTALS (Cont'd)

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by Professional Engineer registered or licensed in Province of Ontario, Canada.
  - .1 Shop drawings to show profiles, sizes, core thickness, connection details, attachments, size, type and number of fasteners, method of anchoring and accessories.

1.6 QUALITY ASSURANCE

.1 Perform welding to CSA W59.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Storage and Handling Requirements:
- .1 Store materials off ground and in accordance with manufacturer's recommendations.
- .2 Store and protect railings from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 STEEL RAILING

.1 Rails and Posts: square HSS steel tubing to CAN/CSA G40.20-13/G40.21-13, Grade 350W, as detailed on contract drawings.

.2 Mounting: brackets and steel plates for mounting to steel members and concrete.

.3 Anchor Bolts (to concrete): to ISO 898 Class 5.8, to be powder coated the same colour as the steel railing system. Installed with epoxy adhesive. Polyester resin will not be accepted.

.4 Bolts (to steel): to ASTM A325M Type 1, unless otherwise specified.

.5 Splice Connectors: steel welding collars.

2.2 PAINT SYSTEM

.1 All handrail system components shall be powder coated.

.2 Surface preparation: 5 stage iron phosphate with DI rinse pre-treatment.

.3 Minimum two coats of powder coating. Base coat shall be thermosetting epoxy powder coating with a minimum thickness of 2 mils. Top-coat shall be factory powder coated using Polyester/TGIC, dry film thickness 2-3 mils.

- .1 Acceptable material: POWDURA Polyester TGIC, P-2042-5 Velvet Black, by Sherwin-Williams or equal.
- .2 Material properties to meet or exceed the following:
  - .1 Impact Resistance to ASTM D2794 (dir/rev): 80/80.
  - .2 Flexibility to ASTM D522-B: no cracking.
  - .3 Pencil Hardness to ASTM D3363: H to 2H.
  - .4 Adhesion to ASTM D3359: 0 detachment.
  - .5 Colour: custom colour black to be chosen by Departmental Representative, semi-gloss finish.

2.3 FABRICATION

.1 Fabricate guardrails in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.

.2 Fit and shop assemble components in largest practical sizes for delivery to site.

.3 Verify dimensions and guardrail layout on site prior to fabrication.

.4 Fabricate work square, true, straight and accurate to required size. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

.5 Form all changes in rail direction by mitering or uniform radius bending within tolerance of HSS tubing size. Fit joints in true planes and securely fasten weld to CSA W59-03. File or grind welds smooth and flush with adjoining surfaces.

.6 Provide anchors bolts, plates and angles brackets required for connecting railings to structure.

.7 Ensure exposed welds are continuous for full length of each joint.

2.3 FABRICATION (Cont'd)

.8 Exposed Mechanical Fastenings: flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- .1 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- .2 Continuously seal joined pieces by intermittent welds and plastic filler continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
- .3 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- .4 Accurately assemble components to each other and to dam structure.
- .5 Accommodate for expansion and contraction of members and structure movement without damage to connections or members.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for handrail installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Consultant.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 PREPARATION

.1 Supply items required to be cast into concrete with setting templates, to appropriate locations.

3.3 INSTALLATION

.1 Install guardrails in accordance with contract drawings and manufacturer's instructions.

.2 Install components plumb and level.
- .1 On inclined surfaces, posts are to be vertical.

.3 Anchor railings to structure with anchors bolts at concrete and structural bolts at steel members including all plates and angle brackets.

.4 Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

.5 Drill, clean and install base plates using anchor bolts with epoxy injection adhesive anchoring systems approved by Consultant in accordance to manufacturer's recommendations.

.6 Align posts so that the maximum deviation of any post from a straight line drawn between end posts is less than 4 mm.

.7 Use metal shims as required to install handrail posts plumb and true. Metal shims are to be minimum 38 mm wide and the full length of the support plate wherever possible. Shims are to be painted with cold galvanizing repair compound.

.8 At locations where metal shims are used, fill all voids between concrete and base plates with epoxy adhesive to eliminate any gaps.

3.4 TOUCH UP

.1 Touch up scratched surfaces of guardrail system with compound using approved methods recommended by manufacturer.
- .1 Powder coated surfaces compatible touch up paint shall be used.

3.5 ERECTION TOLERANCES

.1 Maximum Variation from Plumb: 6 mm.

.2 Maximum Out-of-Position: 6 mm.

3.6 CLEANING

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

3.6 CLEANING (Cont'd)

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.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.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by handrail installation.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section specifies requirements for safety signage both permanent and temporary at the Bobs Dam Lake for public safety and navigation.

.2 The work includes but is not limited to the following:
- .1 Supply and installation of all temporary signs including supporting hardware.
- .2 Supply of all hardware as indicated on Contract drawings and installation of all permanent signs supplied by Parks Canada Agency (PCA will supply permanent signs only).

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for temporary and permanent signs. Include cost in Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be included in the applicable item of work for signage.

1.4 REFERENCES

.1 Canadian Dam Association
- .1 Signage for Public Safety Around Dams 2012.

.2 American Society for Testing and Materials International, (ASTM)
- .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM B209-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- .3 ASTM B210-12, Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.

1.4 REFERENCES (Cont'd)

.2 (Cont'd)
.4 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
.5 ASTM A276-16, Standard Specification for Stainless Steel Bars and Shapes.

.3 CSA International
.1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

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 safety signage hardware, including product characteristics, performance criteria, physical size, finish and limitations.

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 off ground and in accordance with manufacturer's recommendations.
.2 Store and protect railings from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Permanent sign supports:
.1 Post Base: to CAN/CSA G40.20/G40.21, Grade 300W.
.2 Aluminum Channels (Extruded): to ASTM B221 (Type T-6063-T6).

2.1 MATERIALS (Cont'd)

.1 (Cont'd)

.3 Fasteners: u-clamps, bolts, nuts, washers and other miscellaneous hardware for signs: 304 or 316 stainless steel as specified in ASTM A276 and ASTM F1554-A36.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Sign support:

.1 Erect supports as indicated on Contract drawings. Permissible tolerance: 10 mm maximum departure from vertical.

.2 Erect posts plumb and square to details as indicated on shop drawings and to requirements of sign manufacturer.

.2 Signboard:

.1 Fasten signboards to supporting posts and brackets as indicated on Contract drawings.

.2 Use strapping with bolted connections where signs fastened to handrail assembly.

3.2 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by signage installation.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies requirements for clearing, close cut clearing, grubbing and clearing isolated trees as indicated by the Consultant and on Contract Drawings.

.1 Clearing to be limited to allow proper access and ease of work completion on site, this includes clearing of staging areas and construction areas near existing structure of low lying brush and vegetation to provide level and clear terrain for work and equipment access.

.2 Tree clearing shall be limited as much as reasonably possible.

.2 Identified trees to be removed are to be tagged by the Consultant prior to removal.

.3 Contractor to follow environmental mitigating measures as set out in ESG, in Contractors EMP and in the Environmental Impact Assessment for the Bobs Lake Dam Replacement report. Report to be provided by Departmental Representative with Contract documents. Also refer to Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29 - Health and Safety Requirements.

.3 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.4 Section 01 71 00 - Examination and Preparation.

.5 Section 01 74 11 - Cleaning.

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

.7 Section 31 23 33 - Excavating and Backfilling.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There will be no separate measurement of Work described in this Section.

.2 Payment of this Section shall be included in the applicable Lump Sum Price item as set out in Section 01 22 01.

1.4 REFERENCES

.1 Ontario Provincial Standard Specifications (OPSS).
- .1 OPSS 201 Construction Specifications for Cleaning, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders, November 2007.
- .2 OPSS 805 Temporary Erosion and Sediment Control Measures, November 2010.

1.5 DEFINITIONS

.1 "Clearing" consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 "Close-cut clearing" consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.

.3 "Clearing isolated trees" consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.

.4 "Underbrush clearing" consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.

.5 "Grubbing" consists of excavation and disposal of stumps and roots to not less than specified depth below existing ground surface.

.6 "Pruning" consist of the removal of tree limbs and branches by qualified arborist to maintain a healthy tree.

1.6 QUALITY ASSURANCE

.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.6 QUALITY ASSURANCE (Cont'd)

.2 Safety Requirements: worker protection.
.1 Workers must wear gloves, respirators dust masks, long sleeved clothing, eye protection protective clothing.

1.7 STORAGE AND PROTECTION

.1 Prevent damage to trees, landscaping, existing buildings, earth embankments, water courses and root systems of trees which are to remain.
.1 Repair damaged items to approval of Consultant.
.2 Replace any trees designated to remain, if damaged, as directed by Consultant.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 All slash left from felling and clearing is to be chipped and chipped material to be used as erosion protection on site. Excess material to be removed off site by the contractor to a disposal/recycling/composting facility approved by the Departmental Representative.

.2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as sellable timber.
.1 Trim limbs and tops, and saw into sellable lengths of 2.4 m for fuel wood.
.2 Selling on site is not allowed.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Herbicide: is not permitted on this project.

.2 Soil Material for Fill:
.1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
.2 Remove and store soil material for reused.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

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

3.2 PREPARATION

.1 Inspect site and verify with Consultant trees to be cut and designated to remain.

.2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.

.3 Notify utility authorities before starting clearing and grubbing.

3.3 ISOLATED TREES

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

.2 Grub out isolated tree stumps.

.3 Prune individual trees as indicated.

.4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.

.5 Cut limbs and branches to be trimmed close to bole of tree or main branches.

.6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

3.4 UNDERBRUSH CLEARING

.1 Clear underbrush from areas as indicated at ground level.

3.5 GRUBBING

.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps as approved by the Consultant.

.2 Grub out stumps and roots to not less than 200 mm below ground surface.

.3 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.6 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site to disposal area as approved by Consultant.

.2 Cut timber greater than 150 mm diameter to 2400 mm lengths and stockpile as indicated. Stockpiled timber becomes property of the Contractor.

.3 Burning and burial of cleared and grubbed materials are not allowed.

3.7 FINISHED SURFACE

.1 Leave ground surface in condition suitable for immediate grading operations to approval of Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUSES

.1 All related work for rough grading including subgrade preparation.

1.2 RELATED SECTIONS

.1 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.2 Section 01 35 29 - Health and Safety Requirements.

.3 Section 01 45 00 - Quality Control.

.4 Section 02 41 16 - Structure Demolition.

.5 Section 31 11 00 - Clearing and Grubbing.

.6 Section 31 23 33 - Excavating and Backfilling.

.7 Section 31 37 10 - Rip-Rap.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for rough grading including preparation of subgrade. Include cost in Contract Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be incidental to all work related to rough grading.

1.4 REFERENCES

.1 American Society for Testing and Materials (ASTM)
- .1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

.2 Ontario Provincial Standard Specifications (OPSS)
- .1 OPSS 206 Grading
- .2 OPSS 212 Borrow
- .3 OPSS 1010 Aggregates - Base, Sub-base, Select Subgrade and Backfill Materials
- .4 OPSS 1860 Geotextiles

1.4 REFERENCES (Cont'd)

.2 (Cont'd)
.5 OPSS 182 Environmental Protection for Construction in Waterbodies and on Waterbody banks, November 2010
.6 OPSS 501, November 2010, Construction specification for Compacting
.7 OPSS 805 Temporary Erosion and Sediment Control Measures, November 2010
.8 OPSS 902, November 2010, Construction Specification, Excavation and Backfilling - Structures

1.5 EXISTING CONDITIONS

.1 Examine subsurface investigation reports which are bound into specification.

.2 Known underground and surface utility lines and services are as indicated on site plan.

.3 Refer to dewatering in Section 35 20 22 - Dewatering, Diversion and Temporary Construction Access Roads.

1.6 PROTECTION

.1 Identify all above-ground and below-ground works including utilities and services prior to commencement of construction.

.2 Protect existing fencing trees, landscaping, natural features, bench marks, buildings, water control structures; roads, driveways and parking areas, surface or underground utility lines which are to remain as directed by Consultant. If damaged, restore to original or better condition unless directed otherwise.

.3 Maintain access roads to prevent accumulation of construction related debris on roads. Clean regularly and as directed by Consultant.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Granular fill material in accordance with Section 31 23 33 - Excavating and Backfilling.

2.1 MATERIALS (Cont'd)

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Consultant.

PART 3 - EXECUTION

3.1 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:
.1 200 mm for grassed areas.
.2 To requirements as identified on contract drawings at other areas.

.3 Do not disturb soil within branch spread of trees or shrubs to remain.

3.2 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site as directed by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies requirements for rock removal and rock surface preparation to complete Work as indicated by Contract Drawings and Specifications.

1.2 RELATED SECTIONS

.1 Section 01 22 01 - Measurement and Payment.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.4 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.

.5 Section 31 22 13 - Rough Grading.

.6 Section 31 23 33 - Excavating and Backfilling.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measurement Procedures: in accordance with Section 01 22 01 - Measurement and Payment.

.2 The work will be measured and paid for under payment item included in the Unit Price Table:

.1 Item No. 4 - Rock Removal: This item covers the work described in subsection 1.1.1.

.3 Measure rock removal in m^3 of material removed as set out in Section 01 22 01.

.1 Quantities will be taken from cross section showing original rock surface and actual grade line set by Consultant, except that minimum depth of rock required to be excavated to be considered as 300 mm.

.4 Include in the price of rock removal the rock surface preparation requirements and other requirements at subsection 3.1 Rock Removal.

1.4 DEFINITIONS

.1 Definitions:
.1 Rock: any solid material in excess of 0.5 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with a minimum operating weight of 26,500 kg and a bucket capacity of 1.0 m^3. Frozen material not classified as rock.
.2 PPV: peak particle velocity.

1.5 SUBMITTALS

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

1.6 QUALITY ASSURANCE

.1 Vibration Control:
.1 Reduce ground vibrations to avoid damage to structures or remaining rock mass.
.2 In vicinity of structure, PPV not to exceed 50 mm/s.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 Not used.

PART 3 – EXECUTION

3.1 ROCK REMOVAL

.1 Perform excavation in accordance with Erosion and Sedimentation Control Plan.

.2 Co-ordinate this Section with Section 01 35 29 – Health and Safety Requirements.

.3 Remove rock to alignments, profiles, and cross sections as indicated.

.4 Remove bedrock until acceptable bedrock surface is reached, that is all weak rock elements or blocks that can be easily detached mechanically with an excavator

3.1 ROCK REMOVAL (Cont'd)

.4 (Cont'd)
from the substrate surface. All foundation excavations done by a mechanical excavation must be done under the supervision of the Consultant.

.5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.

.6 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
.1 Manually clean the bedrock surface roughness.
.2 Excavate potholes and other cavities including detachable rock fragments from fault or shear zones.
.3 Clean completely the foundation surface of any loose rock using water or compressed air jets.

.7 Remove boulders and fragments which may slide or roll into excavated areas.

.8 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating and Backfilling.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Rock Disposal:
.1 Dispose of surplus removed rock off site in accordance with Section 01 74 21 - Construction/demolition Waste Management and Disposal.
.2 Do not dispose removed rock into landfill. Send material to appropriate quarry.

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

3.3 PROTECTION

.1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies requirements for excavating and backfilling to complete Work as indicated by Contract Drawings and Specifications.

.2 Work includes but is not limited to:

- .1 Excavation required for the demolition of the existing dam and for the construction of the new dam, stream bed rehabilitation and associated works (permanent and temporary) including identification and protection of underground and above ground utilities.
- .2 Stability of temporary and permanent works.
- .3 Backfilling with approved granular material to patch and repair existing earth embankment slopes to the appropriate grades as indicated on the Contract Drawings. This includes the grading on the downstream face of the earth embankment on both sides of the new concrete structure to match new grade elevation and blend into adjacent embankment slope and grade.
- .4 Disposal of surplus material.

1.2 RELATED SECTIONS

.1 Section 01 14 00 - Work Restrictions.

.2 Section 01 22 01 - Measurement and Payment.

.3 Section 01 35 29 - Health and Safety Requirements.

.4 Section 01 35 45 - Environmental Procedures.

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

.6 Section 02 41 16 - Structure Demolition.

.7 Section 31 11 00 - Clearing and Grubbing.

.8 Section 35 20 22 - Dewatering and Diversion.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Excavation required for the demolition of the existing dam and for the construction of the new dam, stream bed rehabilitation and associated works (permanent and temporary), and disposal of excavated material shall not be measured separately and shall be paid as part of the Contract Lump Sum Price for the applicable item of work as set out in Section 01 22 01.

.2 Temporary access roads, stream bed rehabilitation, diversion system, cofferdams and dewatering of excavation will not be measured separately for payment and is to be included in other respective items of works.

.3 Backfilling will not be measured separately and shall be paid as part of the Contract Lump Sum Price for the applicable item of work as set out in Section 01 22 01.

.4 Backfilling to authorized limits with rip rap and rockfill will be measured for payment in tonne (1 000 kg) for the supply, placement and consolidation of materials as set out in Section 01 22 01 and Section 31 37 10, for each of the three zones of rockfill:

.1 Zone 1 – Rip rap ϕ200-500 mm;

.2 Zone 2 – River rockfill ϕ200-500 mm;

.3 Zone 3 – River rockfill ϕ30-300 mm.

.5 Backfilling to authorized limits with organic soil will be measured for payment in tonne (1 000 kg) for supply, placement and consolidation as set out in Section 01 22 01 and Section 35 42 25.

.6 Backfilling to authorized limits with clean sand will be measured for payment in tonne (1 000 kg) for supply, placement and consolidation as set out in Section 01 22 01 and Section 35 42 25.

.7 No separate measurement for payment will be made for over-building and trimming of embankments to bring to final and/or subgrade.

.8 Payment shall be made as set out in Section 01 22 01 and shall be incidental to or included in the applicable item of work.

1.4 REFERENCES

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

.1 ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM D422-63 (2007)e2, Standard Test Method for Particle-Size Analysis of Soils.

1.4 REFERENCES (Cont'd)

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

.3 Ontario Provincial Standard Specifications / Drawings (OPSS/OPSD), Ontario Ministry of Transportation
.1 OPSS 421, April 2008, Construction Specification for Pipe Culvert Installation.
.2 OPSS 501, November 2010, Construction Specification for Compacting.
.3 OPSS 902, November 2010, Construction Specification for Excavating and Backfilling of Structures.
.4 OPSS 1004 November 2006, Ontario Provincial Standard Specification, Material Specification for Aggregates - Miscellaneous.
.5 OPSS 1010 April 2004, Ontario Provincial Standard Specification, Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

1.5 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
.1 Rock: solid material in excess of 0.5 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with a minimum operating weight of 26,500 kg and a bucket capacity of 1.0 m^3 bucket. Frozen material not classified as rock.
.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 Topsoil: All uncontaminated soil having a high organic content, without debris that promotes the growth of vegetation that may be used for landscaping, planting and/or seeding.

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

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

1.6 SUBMITTALS

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

.2 Preconstruction Submittals:
- .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
- .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field/clearance record from utility authority and location plan of relocated and abandoned services, as required.

1.7 QUALITY ASSURANCE

.1 Submit design and supporting data at least 6 weeks prior to beginning Work.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.

.3 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams and diversion structures required for Work as set out in Section 35 20 22 and Section 01 48 00 and acceptable to the Consultant and authorities having jurisdiction.

.4 Engage services of qualified Professional Engineer who is registered or licensed in the Province of Ontario, Canada to develop the erosion and sediment control plan and to design and inspect sediment and erosion control measures. Erosion and sediment control measures are to comply with Section 01 48 00 and be acceptable to the Consultant and authorities having jurisdiction.

.5 Keep design, temporary works construction plans, details and supporting data on site.

.6 Do not use soil material until written report of soil test results are reviewed by Consultant.

.7 Health and Safety Requirements:
- .1 Occupational health and safety during construction in accordance with Section 01 35 29 - Health and Safety Requirements.

.8 Regulatory Requirements:
- .1 Adhere to Provincial and National Environmental requirements when potentially toxic materials are involved. Soil, Ground Water and Sediment

1.7 QUALITY ASSURANCE (Cont'd)

.8 (Cont'd)
1. (Cont'd)
Standards for use under Ontario Regulation 153/04, as amended Ontario Regulation 511/09, Part XV.1 of the Environmental Protection Act.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

.2 Divert excess aggregate materials from landfill to local quarry for reuse.

1.9 EXISTING CONDITIONS

.1 Examine all geotechnical reports.

.2 Buried services:
.1 Before commencing work establish location of buried services on and adjacent to site.

.3 Existing surface features:
.1 Conduct, with Consultant, condition survey of existing trees and other plants, shoreline landscaping, lawns, service poles, wires, domestic water wells, survey bench marks and monuments which may be affected by Work.
.2 Protect existing buildings and surface features from damage while Work is in progress to the requirement of the Condition Survey. Undertake monitoring to the requirements of Section 01 48 00. In event of damage, immediately make repair as directed by Consultant.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Common fill: selected material from excavation or clean fill graded from earth embankment slope adjacent to structure to be replaced, approved by Consultant for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.2 Granular material: to Ontario Provincial Standard Specification 1010 for:
.1 Granular A, maximum size 19.0 mm.

2.1 MATERIAL (Cont'd)

.2 (Cont'd)
.2 Granular B, Type II, maximum size 150 mm.

.3 Sand: clean, washed, minimum 100% passing 4.75 mm sieve, maximum 5% passing 0.075 mm sieve to OPSS 1004.05.04, November 2006.

.4 Rip-rap and rockfill: to Section 31 37 10.
Organic soil: to Section 35 42 25.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

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

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

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

3.2 PREPARATION/ PROTECTION

.1 Protect existing features in accordance with Section 01 48 00 – Construction Control and Monitoring, Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.

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

.3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.4 Protect adjacent properties and structures including landscaping features.

3.3 STOCKPILING

.1 Stockpile fill materials in areas approved by Consultant.
- .1 Stockpile granular materials in manner to prevent segregation.
- .2 Stockpile site (excavated) material by type for re-use as backfill.

.2 Protect fill materials from contamination.

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

3.4 COFFERDAMS, SHORING AND BRACING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29 - Health and Safety Requirements and Health and Safety Act for the Province of Ontario.

.2 Construct temporary Works for dewatering, diversion and other work to depths, heights and locations as approved by Consultant. Cofferdam and diversion work are to be in accordance with Section 35 20 22 – Dewatering, Diversion and Temporary Construction Access Roads.

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

3.5 DEWATERING AND HEAVE PREVENTION

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

.2 Provide for Consultant's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

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

3.5 DEWATERING AND HEAVE PREVENTION (Cont'd)

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

.5 Dispose of water in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures to approved collection and in manner not detrimental to public and private property, or portion of Work completed or under construction.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to watercourses or drainage areas.

3.6 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated and approved by Consultant.

.2 Remove concrete, wood, miscellaneous metal, rubble and other obstructions encountered during excavation in accordance with Section 02 41 16 – Structure Demolition.

.3 For excavation of embankments, undertake the Work to maintain slope stability. Sub-cut the slope to create steps of a minimum 1.0 m high and 1.0 m deep, and to meet safety codes.

.4 Keep excavated and stockpiled materials safe distance away from edge of trench as approved by Consultant.

.5 Restrict vehicle operations directly adjacent to open trenches.

.6 Dispose of surplus and unsuitable excavated material in approved location off site.

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

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

.9 Notify Consultant when bottom of excavation is reached.

.10 Obtain Consultant approval of completed excavation.

.11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as approved by Consultant.

3.6 EXCAVATION (Cont'd)

.12 Undertake excavation in a manner to protect temporary works.

.13 Correct unauthorized over-excavation as follows:
- .1 Fill under foundation bearing surfaces: with concrete specified for foundation.
- .2 Fill under other areas with Granular "B" compacted to not less than 95% of Standard Proctor maximum dry density.

3.7 FILL TYPES AND COMPACTION

.1 Use types of fill with compaction as indicated.

.2 Compaction shall be undertaken to the following requirements, unless otherwise specified on the Contract drawings and specifications:
- .1 Common (native) materials (unless otherwise specified): Compact 95% Standard Proctor Maximum Dry Density.
- .2 Backfill with common fill acceptable to the Consultant at landscape areas disturbed by the diversion system and other works. Compact 95% Standard Proctor Maximum Dry Density.
- .3 Rip-rap: consolidate with hydraulic excavator bucket in a manner acceptable to the Consultant.

3.8 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:
- .1 Consultant has inspected and approved installations.
- .2 Inspection, testing, approval, and recording location of underground utilities.
- .3 Removal of concrete formwork.
- .4 Removal of shoring and bracing.

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

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

.4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to subgrades unless specified elsewhere and as approved by the Consultant. Compact each layer before placing succeeding layer.

.5 Place rip-rap to Section 31 37 10.

3.9 RESTORATION

.1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Consultant.

.2 Reinstate landscapes to elevations which existed before excavation.

.3 Clean and reinstate areas affected by Work as approved by Consultant.

.4 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies requirements for the treatment of the foundations to complete Work as indicated by Contract Drawings and Specifications.

1.2 RELATED SECTIONS

.1 Section 01 22 01 - Measurement and Payment.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 43 – Archaeological, Cultural and Environmental Procedures.

.4 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.

.5 Section 31 22 13 - Rough Grading.

.6 Section 31 23 33 - Excavating and Backfilling.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measurement Procedures: in accordance with Section 01 22 01 - Measurement and Payment.

.2 The work will be measured and paid for under payment item included in the Unit Price Table:
- .1 Item No. 5 – Foundation Treatment: This item covers the work described in subsection 1.1.1.

.3 Shotcrete:
- .1 Payment will be made for costs associated with shotcrete used on foundation surface.
- .2 Shotcrete will be measured for payment on the basis of the number of cubic meter of shotcrete used on the foundation surface and satisfactorily placed to resurface the foundation.
- .3 Unit of measure: cubic meter of shotcrete.

.4 Concrete Backfill:
- .1 Payment will be made for costs associated with concrete backfill used in cavities of the foundation.
- .2 Concrete backfill will be measured for payment on the basis of the number of cubic meter of concrete

1.3 MEASUREMENT AND PAYMENT PROCEDURES (Cont'd)

.4 (Cont'd)
.2 (Cont'd)
backfill used to fill cavities and open joints of the foundation surface.
.3 Unit of measure: cubic meter of concrete backfill.

.5 Liquid Mortar:
.1 Payment will be made for costs associated with liquid mortar used in open joints of the foundation.
.2 Liquid mortar will be measured for payment on the basis of the number of liter used to fill open joints of the foundation surface.
.3 Unit of measure: liter of liquid mortar.

.6 Rock Dowel:
.1 Payment will be made for costs associated with rock dowels fixed in the foundation.
.2 Rock dowel will be measured for payment on the basis of the number of dowels used in the foundation surface.
.3 All labour, equipment and materials for rock dowels, including the drilling and cleaning of the hole, and the filling with a grout, shall be included in the applicable price for rock dowels.
.4 Unit of measure: liter of liquid mortar.

1.4 REFERENCES

.1 Except otherwise stated, the most recent version of these norms and references must be respected during the work execution.

.2 Canadian Standards Association
.1 CAN/CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
.2 CAN/CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
.3 Can/CSA A283-00 Qualification Code for Concrete Testing Laboratories.

.3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation
.1 OPSS 906 November 2012, Structural Steel for bridges.
.2 OPSS 1301 November 2007, Cementing Materials.
.3 OPSS 1302 September 1996, Water.
.4 OPSS 1350 November 2014, Concrete - Materials and Production.

1.5 SUBMITTALS

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

1.6 QUALITY ASSURANCE

.1 The Contractor must clean the foundation as described in sections 31 23 16.26 and 31 23 33 before carrying foundation treatment works.

.2 During the work, the Contractor must take all the means required for managing the washing waters, cleaning concrete and rock surfaces from shotcrete or concrete accumulations and all others debris.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Shotcrete: to CSA A23.1/A23.2. Premixed compound of non-metallic aggregate, cement, water and reducing and plasticizing agents, of pouring consistency capable of developing compressive strength of 30 MPa at 28 days.

.2 Concrete backfill: to CSA A23.1/A23.2. Concrete which the characteristics, once cured and in service, of a minimal compressive strength of 30 MPa at 28 days with a maximal weight ratio water/cement of 0.50.

.3 Liquid Mortar: to CSA A179 and as indicated by Contract Drawings

.4 Rock dowel: Billet steel, grade 400, deformed bars to CSA-G30.18, as indicated by Contract Drawings.

PART 3 - EXECUTION

3.1 CLEANING

.1 Prepare and clean rock surfaces, including potholes, cavities, fault, shear zones and open joints, as required by the Consultant and in accordance with Section 31 23 16.26 – Rock Removal.

3.2 FOUNDATION TREATMENT

.1 Co-ordinate this Section with Section 01 35 29 - Health and Safety Requirements.

.2 Resurface steep faces and overhang with concrete backfill and contact grouting, as indicated on drawings and to the Consultant approval.

.3 Fill the open joints with liquid mortar and trough or cavities with concrete backfill, as indicated on drawings and to the Consultant approval.

.4 Rock Disposal:

.1 Dispose of surplus removed rock off site in accordance with Section 01 74 21 - Construction/demolition Waste Management and Disposal.

.2 Do not dispose removed rock into landfill. Send material to appropriate quarry.

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

3.3 PROTECTION

.1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies geotextile for erosion protection including supply, installation, and labour required during the implementation of the Work according to the Contract Drawings.

1.2 RELATED SECTIONS

.1 Section 01 22 01 - Measurement and Payment.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 43 – Archaeological, Cultural and Environmental Procedures.

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

.5 Section 31 22 13 - Rough Grading.

.6 Section 31 23 33 - Excavating and Backfilling.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for rough grading including preparation of subgrade. Include cost in Contract Lump sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be incidental to all work related to rough grading.

1.4 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM D4491-15, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- .2 ASTM D4595-11, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- .3 ASTM D4716-14, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

1.4 REFERENCES (Cont'd)

.1 (Cont'd)
.4 ASTM D4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.

.3 Ontario Provincial Standard Specifications (OPSS)
.1 OPSS 1860, Material Specification for Geotextiles.

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 geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Storage and Handling Requirements:
.1 Store materials off ground and in accordance with manufacturer's recommendations.
.2 Store and protect geotextiles from direct sunlight and UV rays.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.
.1 Width: approved by the Consultant.
.2 Length: as specified on contract Drawings.
.3 Composed of: minimum 85% by mass of polypropylene or polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.

2.1 MATERIAL (Cont'd)

.2 Physical properties:
.1 Tensile strength and elongation (in any principal direction): to ASTM D 4595.
.1 Tensile strength: minimum 1000 N, wet condition.
.2 Elongation at break: minimum 15%.

.3 Hydraulic properties:
.1 Filtration opening size (FOS): to CAN/CGSB-148.1 No.10.

.4 Factory seams: sewn in accordance with manufacturer's recommendations.

.5 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

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 geotextile material installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Consultant.
.2 Inform Consultant of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

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

3.2 INSTALLATION (Cont'd)

.4 Overlap each successive strip of geotextile 600 mm over previously laid strip.

.5 Join successive strips of geotextile by sewing.

.6 Pin successive strips of geotextile with securing pins at 300 mm interval at mid point of lap.

.7 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.8 After installation, cover with overlying layer within 4 hours of placement.

.9 Replace damaged or deteriorated geotextile to approval of Consultant.

.10 Place and compact soil layers in accordance with Section 31 23 33 – Excavating and Backfilling.

3.3 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse 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.

3.4 PROTECTION

.1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies stone, for heavy rip-rap and rockfill for erosion protection and stream bed environmental rehabilitation including supply, installation, and labour required during the implementation of the Work according to the lines, elevations and dimensions within this Section, on the Contract Drawings and or determined by the Consultant.

1.2 RELATED SECTIONS

.1 Section 01 22 01 - Measurement and Payment.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.4 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.

.5 Section 31 22 13 - Rough Grading.

.6 Section 31 23 33 - Excavating and Backfilling.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measurement Procedures: in accordance with Section 01 22 01 - Measurement and Payment.

.2 The work will be measured and paid for under payment item included in the Unit Price Table:

.1 Item No. 6 - Rip-Rap and rockfill: This item covers the work described in subsection 1.1.1.

.3 Measure rip-rap and rockfill in tonne of material placed as set out in Section 01 22 01, for each of the three zones of rockfill:

.1 Zone 1 – Rip rap ϕ300-500 mm;

.2 Zone 2 – River rockfill ϕ300-500 mm;

.3 Zone 3 – River rockfill ϕ50-300 mm.

.4 Infilling of rip-rap and rockfill will be measured for payment in tonne for supply and placement in lifts as set out in Section 01 22 01, for each of the three zones of rockfill.

1.4 REFERENCES

.1 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation
- .1 OPSS 1004 November 2006, Ontario Provincial Standard Specification, Material Specification for Aggregates - Miscellaneous.
- .2 OPSS 511, April 2011, Construction Specifications for Rip-Rap Rock Protection and Granular Sheeting.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Divert left over aggregate materials from landfill to local quarry for reuse as approved by Consultant.

PART 2 - PRODUCTS

2.1 STONE

.1 Hard, with relative density not less than 2.65, durable quarry (shot-rock) stone, free from seams, cracks or other structural defects, clean with deleterious materials, durable and resistant to weathering by air and water, non-acid generating, acceptable to the Consultant. The Consultant may reject any material at the stockpile, based on visual inspection, which contains excessive fines, dust or other deleterious products. The rip-rap or rockfill shall meet following size distribution for the use intended:
- .1 Zone 1 – Rip Rap ϕ300-500 mm:
  - .1 Stones are to have angular faces and be spherical. No one dimension shall be greater than 30% of the mean dimension.
  - .2 Stones shall be free of sand, silt and clay fraction. The Contractor should consider washing of the stone to provide material free of rock fines and dust at the source.
- .2 Zone 2 – River Rockfill ϕ300-500 mm:
  - .1 Stones are to have no sharp edges and be spherical. No one dimension shall be greater than 30% of the mean dimension.
- .3 Zone 3 – River Rockfill ϕ50-300 mm:
  - .1 Stones are to have no sharp edges and be spherical. No one dimension shall be greater than 30% of the mean dimension

PART 3 - EXECUTION

3.1 PLACING

.1 Fine grade area to be rip-rapped and rockfilled to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.2 Where rip-rap or rockfill is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.

.3 Place rip-rap or rockfill to thickness and details as indicated.
- .1 Placement shall be controlled to ensure that a uniform and continuous cover results.

.4 For Zone 1 – Rip Rap ϕ300-500 mm, place stones in manner approved by Consultant to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .1 Placement of rip rap so that it forms dense, well-graded mass of stone with minimum voids.
- .2 Place rip-rap to its full thickness in one operation.
- .3 Do not place rip-rap by dumping through chutes or other methods that can cause segregation of stone sizes.
- .4 The finished slope should be free of pockets of small stone or clusters of large stones.
- .5 Finished grade to blend with the surrounding area.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section specifies the requirements for reinstating all damaged and landscaped areas within the work and staging areas, access route and areas disturbed by the work and consisting of:
- .1 Restoring North shore residential property disturbed by the Work.
- .2 Restoring existing access road and municipal grounds to their original state.
- .3 Supplying and placing of approved native vegetation, including but not limited to:
- .1 maintenance for plant material during both establishment and warranty periods.

.2 All disturbed riparian areas (interface zone between land and lake/river), inside the construction limits, as shown on the Contract Drawings, to be re-vegetated with approved local native plans and vegetation as directed by Consultant.

1.2 RELATED SECTIONS

.1 Section 01 11 00 -Summary of Work.

.2 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There will be no separate measurement of Work described in this Section.

.2 Payment of this Section shall be included in the applicable Lump Sum Price item as set out in Section 01 22 01.

1.4 PRELIMINARY INSPECTION

.1 Establish the condition of all areas affected by Work in conjunction with Consultant before commencement of work.

1.5 REFERENCES

.1 Agriculture and Agri-Food Canada (AAFC).
  .1 Plant Hardiness Zones in Canada-2000.

.2 Canadian Nursery Landscape Association (CNLA)
  .1 Canadian Standards for Nursery Stock, 8th Edition, 2006.

1.6 SUBMITTALS

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

.2 Product Data: Plant material for re-vegetation
  .1 Submit source of:
  .2 Fertilizer
  .3 Anti Dessicant
  .4 Guying and staking assembly including collar, guying rope and anchors
  .5 Mulch.

1.7 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling: obtain approval from Consultant of schedule 7 days in advance of shipment of plant material.

.2 Schedule to include:
  .1 Date for selection of plant material or representative sample at source by Consultant.
  .2 Quantity and type of plant material.
  .3 Shipping dates.
  .4 Arrival dates on site.
  .5 Planting Dates.

1.8 SOURCE QUALITY CONTROL

.1 Provide name of plant material supplier and obtain approval from Consultant of plant material at source prior to shipping to site.

.2 Arrange for inspection of plant stock upon arrival to site. All rejected plant material shall be removed from the project site immediately upon rejection by the Consultant.

1.9 DELIVERY, STORAGE AND PROTECTION

.1 Schedule deliveries in order to keep storage at the job site to a minimum without causing delays.

.2 Plant Material:

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

.1 Protect plant material from frost, excessive heat, wind and sun during delivery.

.2 Protect plant material from damage during transportation.

.2 Storage and Handling Requirements:

.1 Immediately store and protect plant material which will not be installed within one day in accordance with supplier's written recommendations and after arrival at site in storage location approved by Consultant.

.2 Protect stored plant material from frost, wind and sun and as follows:

.1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil and watering to full depth of root zone.

.2 For pots and containers, maintain moisture level in containers. Heel-in fibre pots.

.3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

1.10 WARRANTY

.1 For plant material as itemized in subsection 2.3.6 the 12 months warranty period prescribed in General Conditions is extended to 24 months.

.2 End-of-warranty inspection will be conducted by Consultant.

.3 Consultant reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

PART 2 - PRODUCTS

2.1 TOPSOIL

.1 New topsoil (organic soil) to be a friable sandy-clayish loam of good humus content, suitable for supporting intended plant and sod growth:
- .1 Soil texture based on The Canadian System of Soil Classification, to consist of 4% organic matter for clay loams and 2% for sandy loams to a maximum of 20%.
- .2 Contains no toxic elements or growth inhibiting materials.
- .3 Soil to be free from:
  - .1 Debris and stones over 50 mm diameter.
  - .2 Coarse vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.2 Approval of topsoil material subject to soil testing and analysis. Testing of topsoil will be carried out by testing laboratory designated by Consultant. Consultant will pay for cost of tests.

2.2 SEEDS

.1 Mixture composition for low lying areas along waterbody edges where light seasonal flooding is a possibility - MTO Lowland Mix:
- .1 35% Creeping Red Fescue,
- .2 25% Brome Grass,
- .3 10% Kentucky Blue Grass Mixture,
- .4 5% Birdsfoot Trefoil "Leo",
- .5 5% White Clover,
- .6 20% Perennial Ryegrass Mixture.

.2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.

2.3 PLANT MATERIAL

.1 Type of root preparation, sizing, grading and quality: to Canadian Standards for Nursery Stock.
- .1 Source of plant material: grown in Zone 5 in accordance with Plant Hardiness Zones in Canada.
- .2 Plant material must be planted in zone specified as appropriate for its species.
- .3 Plant material in location appropriate for its species.

2.3 PLANT MATERIAL (Cont'd)

.2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.

.3 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.

.4 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

.5 Collected stock: maximum 40 mm in caliper, minimum 2 meters high, with well developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.

.6 The Contractor to allow for a total of 15 trees to be planted including ten (10) white spruce trees and five (5) mixed trees, including three (3) cedars and two (2) maples.

2.4 WATER

.1 Free of impurities that would inhibit plant growth.

2.5 STAKES

.1 T-bar, steel, 40 mm by 40 mm by 5 mm by 2440 mm and wood, pointed one end, 38 mm by 38 mm by 2300 mm in location close to utilities/services.

2.6 WIRE TIGHTENER

.1 Type 1: galvanized] steel.

.2 Type 2: turnbuckle, galvanized steel, 9.5 mm diameter with 270 mm open length.

2.7 GUYING WIRE

.1 Type 1: steel, 3 mm wire.

.2 Type 2: 1.5 mm diameter multi-wire steel cable.

.3 Type 3: 3 mm diameter multi-wire steel cable.

2.8 CLAMPS

.1 U-bolt: galvanized, 13 mm diameter, c/w curved retaining bar and hex nuts.

.2 Crimp type.

2.9 ANCHORS

.1 Wood:
.1 Type 1: 38 mm by 38 mm by 460 mm.
.2 Type 2: 38 mm by 67 mm by 600 mm.

.2 Drive-in type.
.1 Type 1: 13 mm diameter by 75 mm long, aluminum.
.2 Type 2: 18 mm diameter x 120 mm long, aluminum.

.3 Screw-in type:
.1 Type 1: 100 mm diameter steel dis].

2.10 GUYING COLLAR

.1 Tube: plastic, 12 mm diameter, nylon reinforced.

2.11 TRUNK PROTECTION

.1 Wire mesh: galvanized, electrically welded 1.4 mm wire with 25 mm by 25 mm mesh and fastener.

.2 Plastic: perforated spiraled strip.

.3 Burlap: clean 2.5 kg/m^2 minimum mass and 150 mm minimum wide, and twine fastener.

.4 Tar impregnated crepe paper and twine fastener.

2.12 MULCH

.1 Shredded bark: varying in size from 25 mm to 50 mm in diameter, from bark to coniferous trees.

2.13 FERTILIZER

.1 Organic commercial type as recommended by soil test report.

2.14 ANTI-DESICCANT

.1 Wax-like emulsion.

2.15 SOURCE QUALITY

.1 Obtain approval from Consultant of plant material prior to planting.

PART 3 - EXECUTION

3.1 PREPARATION OF TOPSOIL SUB-GRADE

.1 Verify that grades are correct. If discrepancies occur, notify Consultant and do not start other landscaping work in that area until instructed to do so in writing by Consultant.

.2 Grade soil, eliminating uneven areas and low spots, ensuring that new surface will be faired-off to the existing areas with no sharp transition.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 .1 Remove debris which protrudes more than 75 mm above surface.
 .2 Dispose of removed material off site.

3.2 SUBGRADE COMPACTION

.1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.

3.3 FINISHING

.1 Hand finish slopes that cannot be finished satisfactorily by machine.

3.4 ACCEPTANCE OF TOPSOIL GRADING

.1 Consultant will inspect topsoil in place and determine acceptance of depth of topsoil and finish grading.

3.5 RE-VEGETATION

.1 Re-establish vegetated riparian buffer zones with suitable vegetation to minimum 3 m along edge of watercourse banks as determined by Consultant.

3.5 RE-VEGETATION (Cont'd)

.2 Plant vegetation natural to area, suitable for application without requirement for fertilizers, pesticides and other chemicals.

.3 Protect new planting material from disturbance by final construction activities.

3.6 PRE-PLANTING PREPARATION

.1 Ensure plant material acceptable to Consultant.

.2 Remove damaged roots and branches from plant material.

.3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.7 EXCAVATION AND PREPARATION OF PLANTING BEDS

.1 Prepare of sub-grade for planting beds in accordance with Section 31 22 13 - Rough Grading.

.2 For individual planting holes:
- .1 Stake out location and obtain approval from Consultant prior to excavating.
- .2 Excavate to depth and width as indicated.
- .3 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.
- .4 Scarify sides of planting hole.
- .5 Remove water which enters excavations prior to planting. Notify Consultant if water source is ground water.

3.8 PLANTING

.1 For bare root stock, place 50 mm backfill soil in bottom of hole. Plant trees and shrubs with roots placed straight out in hole.

.2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.

.3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.

.4 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.

3.8 PLANTING (Cont'd)

.5 For trees and shrubs:
- .1 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.
- .2 Form watering saucer as indicated.

.6 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.7 Water plant material thoroughly.

.8 After soil settlement has occurred, fill with soil to finish grade.

.9 Dispose of burlap, wire, and container.

3.9 TRUNK PROTECTION

.1 Install trunk protection on deciduous trees as indicated.

.2 Install trunk protection prior to installation of tree supports when used.

3.10 TREE SUPPORTS

.1 Install tree supports as indicated.

.2 Use single stake tree support for deciduous trees less than 3 m in height and evergreens less than 2 m in height.
- .1 Place stake on prevailing wind side and 150 mm minimum from trunk.
- .2 Drive stake minimum 150 mm into undisturbed soil beneath roots. Ensure stake is secure, vertical and unsplit.
- .3 Install 150 mm long guying collar 1500 mm above grade.
- .4 Thread Type 1 guying wire through guying collar tube. Twist wire to form collar and secure firmly to stake. Cut off excess wire.

.3 Use 3 guy wires and anchors for deciduous trees greater than 3 m in height and evergreens greater than 2 m in height.
- .1 Use Type 2 guying wire for trees less than 75 mm in diameter and Type 3 guying wire with clamps for trees greater than 75 mm in diameter.
- .2 Use Type 1 anchors for trees less than 75 mm in diameter and Type 2 anchors for trees greater than 75 mm in diameter.

3.10 TREE SUPPORTS (Cont'd)

.3 (Cont'd)
- .3 Install guying collars above branch to prevent slipping at approximately 2/3 height for evergreens and 1/2 height for deciduous trees. Collar mounting height not to exceed 2.5 m above grade.
- .4 Guying collars to be of sufficient length to encircle tree plus 50 mm space for trunk clearance. Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi-wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120 degrees.
- .5 Install anchors at equal intervals about tree and away from trunk so guy wire will form 30 degree angle with ground. Install anchor at angle to achieve maximum resistance for guy wire.
- .6 Attach guy wire to anchors. Tension wire and secure by multi-wraps.
- .7 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree.
- .8 Saw tops off wooden anchors which extend in excess of 100 mm above grade or as directed by Consultant.
- .9 Install flagging tape to guys as indicated.
- .10 After tree supports have been installed, remove broken branches.

3.11 MULCHING

.1 Ensure soil settlement has been corrected prior to mulching.

.2 Spread mulch as indicated.

3.12 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following maintenance operations from time of planting to acceptance by Consultant.
- .1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
  - .1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
  - .2 Remove weeds monthly during establishment period.
  - .3 Replace or respread damaged, missing or disturbed mulch.

3.12 MAINTENANCE DURING ESTABLISHMENT PERIOD (Cont'd)

.1 (Cont'd)
.1 (Cont'd)
.4 For non-mulched areas, cultivate as required to keep top layer of soil friable.
.5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Consultant prior to application.
.6 Remove dead or broken branches from plant material.
.7 Keep trunk protection and guy wires in proper repair and adjustment.
.8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.13 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of acceptance by Consultant to end of warranty period, perform following maintenance operations.
.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
.2 Reform damaged watering saucers.
.3 Remove weeds monthly.
.4 Replace or respread damaged, missing or disturbed mulch.
.5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.
.6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Consultant prior to application.
.7 Apply fertilizer in early spring as indicated by soil test.
.8 Remove dead, broken or hazardous branches from plant material.
.9 Keep trunk protection and tree supports in proper repair and adjustment.
.10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.
.11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
.12 Submit monthly written reports to Consultant identifying:
.1 Maintenance work carried out.
.2 Development and condition of plant material.

3.13 MAINTENANCE DURING WARRANTY PERIOD (Cont'd)

.1 (Cont'd)

.12 (Cont'd)

.3 Preventative or corrective measures required which are outside Contractor's responsibility.

3.14 CLEANING

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

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

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This section specifies requirements for Cofferdams Dewatering, Water Diversion Works and Temporary Construction Access Roads described by drawings and specifications.

.2 These temporary measures shall be designed to accommodate:
- .1 Seasonal flows and winter conditions;
- .2 Lake operating levels and required discharges;

.3 Work includes but is not limited to:
- .1 Engaging a Professional Engineer licensed in the Province of Ontario to design and oversee the implementation of the following:
  - .1 a cofferdam system to permit construction, taking account of the protection of historic rock crib dam located downstream of the upstream cofferdam;
  - .2 a flow diversion system and related structures;
  - .3 design, construction and commissioning of bypass system to pass a minimum of 1.5 cms up to 2.5 cms through stream bed rehabilitation and demolition area;
  - .4 methodology and related structures to control flows and balance water levels upstream and downstream of the Work in response to varying seasonal conditions and water flow requirements;
  - .5 the systems used to remove the water at the Work space (site);
  - .6 methodology for maintaining the work spaces in a dry state (task area);
  - .7 methodology for removal of temporary works and for maintaining stability of new and existing Works during the recharging (filling) of the waterway;
  - .8 upstream and downstream temporary construction access road;
- .2 Implementation of cofferdams dewatering and diversion works, taking account of the protection of historic rock crib dam located downstream of the upstream cofferdam, and implementation of temporary construction access roads according to the Professional Engineer's design.

1.1 SECTION INCLUDES (Cont'd)

.3 (Cont'd)

.3 Constructing and maintaining cofferdams dewatering and diversion structures and temporary construction roads for the duration of the Work.

.4 Providing and maintaining all dewatering equipment for the duration of the Work.

.5 Removing water from Work spaces and maintaining these spaces in the dry state for the duration of the Work.

.6 Supply of standby equipment to replace dewatering equipment which malfunctions.

.7 Removing temporary cofferdams, dewatering and diversion structures, taking account of the protection of historic rock crib dam, and removing temporary construction access roads at the end of the Work.

.8 Complying with the provisions of Section 01 35 43 - Archaeological, Cultural and Environmental Procedures with respect to turbidity and pollution control at all times.

1.2 RELATED SECTIONS

.1 Section 01 11 00 -Summary of Work.

.2 Section 01 14 00 - Work Restriction.

.3 Section 01 33 00 - Submittals Procedures.

.4 Section 01 35 29 - Health and Safety Requirements.

.5 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.6 Section 01 48 00 - Construction Control and Monitoring.

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

.8 Section 02 41 16 - Structure Demolition.

.9 Section 31 23 33 - Excavating and Backfilling.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There will be no separate measurement of Work described in this Section.

.2 Payment of this Section shall be included in the applicable Lump Sum Price item as set out in Section 01 22 01.

1.4 REGULATORY REQUIREMENTS

.1 Adhere to local, provincial and federal requirements relating to:
- .1 Protection of environment;
- .2 Safety of construction; and
- .3 Protection of workers.

.2 Pumping water out of cofferdams enclosure: to Section 01 35 43.

.3 Obtain and pay costs of all required permits.

.4 Sediment and erosion control measures must be in conformance with related contract plans as a minimum, MOE, MNR, PCA and DFO permit approval requirements and be acceptable to the Consultant.

.5 Maintain minimum river flow during fish spawning period at Bobs River Dam as per Section 01 14 00 - Work Restrictions and the Consultant directives.

1.5 SUBMITTALS

.1 Shop drawings of cofferdams, flow diversion, and dewatering systems, including seepage control within the work area to Section 01 33 00 - Submittal Procedures.
- .1 Shop drawings shall be complete with Professional Engineer's seal and signature.
- .2 Submit design criteria and calculations of (for each stage of construction):
  - .1 flow capacity of diversion works to include 1/20 year return flood and to maintain seasonal operating levels and balance lake water levels upstream and downstream of the construction site;
  - .2 flow characteristics at intake, conveyance and outlet of diversion works to mitigate scouring and erosion, and to address environmental and public boating safety concerns;
  - .3 flow diverters and related structures; Provide methodology, details (including sequencing) and shop drawings for the removal of diversion system and for site restorations at areas disturbed by the removal of these temporary works.
  - .4 measures to control seepage, and surface drainage into the Work area, to keep the Work area in a dry state.

.2 Shop drawings of temporary construction access roads complete with Professional Engineer's seal and signature.

1.5 SUBMITTALS (Cont'd)

.3 Submit detail drawings to Regulatory Agencies, as required to satisfy conditions for granting of permits.
- .1 Modify detail drawings to meet Regulatory Agency Requirements.
- .2 Revise details to address site conditions encountered during construction.

1.6 TEMPORARY WORKS ENGINEERING SERVICES

.1 Designer of flow diversion and other related dewatering structures, including seepage control, treatment and cofferdams, must be a Professional Engineer, licensed to practice in the Province of Ontario, with considerable expertise and experience in design of similar structures and systems, and be acceptable to the Consultant.

.2 Design Engineer must: make, check and sign all calculations; check, seal and sign all drawings; inspect cofferdams dewatering and diversion structures and systems on site; verify their adequacy and safety; provide a written notice to the Consultant stating that the temporary works have been constructed as per design requirements and that they are ready for safe operation.

.3 Design and install cofferdams so that turbidity levels specified in Section 01 35 43 Archaeological, Cultural and Environmental Procedures are not exceeded.

1.7 DESIGN CRITERIA

.1 Design flow diversion to pass river flow around the work area.
- .1 Flow capacity of diversion works to include 1/20 year return flood with corresponding flow of 36 m^3/s.
- .2 Minimum environmental flows of 1.5 up to 2.5 m^3/s must be maintained at all times in the Tay River at the worksite.
- .3 Cofferdam crest elevations must be a minimum of 163.5 m.
- .4 Diversion system shall have capability of maintaining water levels within the regulated range and general practice, as described in Section 01 14 00 Work Restrictions.

1.7 DESIGN CRITERIA (Cont'd)

.1 (Cont'd)

.5 Parks Canada will operate the existing dam to control the water levels on Bobs Lake. Diversion system to have capability to maintain balanced water levels upstream and downstream of the new dam construction site.

.6 The Contract drawings show three proposed different locations for the Diversion Works. Only one need to be selected and approved by the Consultant.

.7 The Contractor shall undertake their own evaluation as to the adequacy of this location to undertake the Works.

.8 The Contractor may choose an alternative location for the water diversion to be able to undertake Work, subject to Consultant approval.

.2 Ensure that the Diversion Works interfere with the passage of river flow past the construction site without causing flooding either upstream or downstream which would not have occurred without the dewatering structures at the site.

.1 Upstream water levels which exceed an elevation of 162.8 m are regarded as flooding.

.2 Historical operating water elevations are given in Section 01 14 00 Work Restrictions.

.3 At all times, provide Diversion Works with adequate capacity to discharge the river flows for each stage of dewatering, to ensure the achievement of all water control requirement.

.1 Provide safe access for operation.

.2 Provide training for operating staff.

.3 Provide measures to protect Parks Canada Agency employees and public from temporary works (inlet and outlet), including warning and advisory signage, safety boom and buoys, and fencing.

.4 Provide erosion control measures at the inlet, conveyance and outlet works as necessary.

.5 Provide measures to prevent blockage by debris at inlet works.

.4 Design temporary construction access roads to facilitate dam demolition/construction and Contractor's requirements for access.

.5 At all times, maintain environmental quality of water, permits and approval stipulation to Section 01 35 43.

1.7 DESIGN CRITERIA (Cont'd)

.6 Ensure that no phase of Work threatens safe performance of cofferdams.

.7 Provide operating rule curves for the diversion control structure. Records of control structure settings are to be maintained throughout the duration of the project.

1.8 WATER LEVELS AND FLOW RECORDS

.1 Seasonal operating levels are identified in Section 01 14 00.

.2 Contractor must be able to pass flow safely through the construction site during the course of the work.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Dispose of water so it does not create a safety or health hazard; or cause damage to environment, to adjacent property or to any portion of Work, or cause erosion of river banks or channel banks.

.2 Prior to dewatering the work area, remove any aquatic species (fish and turtles) according to approved environmental plan. Work to be supervised by a knowledgeable and competent fishery expert.

.3 Turbidity limit: to Section 01 35 43 and Section 35 49 25.

.4 During the installation of temporary construction access roads, cofferdams, and construction of diversion system, provide measures to mitigate sediment transport.

.5 Do not release any silt or other materials into watercourse during construction, including demolition, excavation, haulage and grading or removal of diversion system and temporary construction access roads.

1.10 PROTECTION

.1 Protect dewatered work spaces from damage due to floods, rain, ice, snow or other adverse climatic conditions.

.2 Protect existing adjacent structures and properties. Protect historic rock crib dam located downstream of the upstream cofferdam.

1.10 PROTECTION (Cont'd)

.3 Providing and maintaining all dewatering equipment for the duration of the Work.

.4 Diversion works shall be constructed to safely pass flows without causing damage to adjacent works.

.5 Train staff for safe operation of diversion works.

.6 Provide back-up equipment as necessary to maintain a dry working area. Provide measures to monitor dewatering equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Only use material in good condition, accepted by Consultant and suitable for their use in Work.

.2 Do not use materials which may cause environmental damage to waterway or to land at or near site. This includes materials which would cause turbidity in excess of limits specified in Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.3 Materials and methods proposed for use in Dewatering of the Site and Diversion are to be approved by all of the following:

.1 Ontario Ministry of Natural Resources and Forestry.

.2 Ontario Ministry of the Environment and Climate Change.

.3 Federal Department of Fisheries and Oceans.

The Plan (shop drawings) shall clearly demonstrate the materials to be employed and the methodology of installation, operation, maintenance, and removal along with restoration where applicable.

.4 The placement of loose or unconfined rockfill, earth or granular materials is not acceptable for cofferdam construction.

.5 If using sand bags for an interim measure, sand must be washed of fines before placing in the water. Bags are to be made of a synthetic reinforced material suitable for the purpose intended. The Consultant may request a demonstration to confirm the filled bags can be installed and removed without any resulting turbidity. Sand bags are not to be used for long term solution for water diversion works.

2.1 MATERIAL (Cont'd)

.6 Note that Fisheries and Oceans prefers sheet pile systems, caissons, sand bags, bulk bags, or other types of in water works which do not generate turbidity. Cofferdams must meet these criteria.

PART 3 - EXECUTION

3.1 GENERAL

.1 Evaluate, plan and execute Work to the design criteria, in a professional and prudent manner giving due consideration to:

.1 Climatic conditions which may occur at work location during period of doing work in its entirety.
.2 Safety of personnel and of general public including boating traffic.
.3 Safety of Work and of adjacent property and structures.
.4 Safety of removals.
.5 Safe operation (including training of staff) of operation of diverters and other equipment to maintain navigation and seasonal water levels.
.6 Environmental requirements.
.7 Clearance requirements for Work.
.8 Irregularities of adjacent surfaces.
.9 Changes in water levels.
.10 Minimize and manage risk associated with temporary Works including, monitoring and recording site conditions on a daily basis.
.11 Resolving site issues in a timely manner.

3.2 WATER MANAGEMENT AND DIVERSION CONTROL OPERATIONS

.1 Provide a communication protocol with Parks Canada Agency acceptable to all parties including the Departmental Representative and the Consultant.

.2 Do not make adjustments in flow diversion without notifying Agency. Provide estimated quantity of flow for diversion to Agency. Wait for confirmation and instructions from Agency.

.3 Maintain a record of date/ time/ setting/ calculated flow/ river stage and submit to Agency and Consultant weekly.

.4 Operator of diversion system is to be on call at all times during construction period commencing when the diversion works are functional until project assumption.

3.2 WATER MANAGEMENT AND DIVERSION CONTROL OPERATIONS (Cont'd)

.5 Maintain a record of date/ time/ setting/ calculated flow/ river stage and submit to Agency and Consultant weekly.

.6 Operator of diversion system is to be on call at all times during construction period commencing when the diversion works are functional until project assumption.

.7 Operate diversion structure to maintain water levels within the operating range as given in Section 01 14 00 and as directed by Parks Canada Agency. The water diversion system through the stream bed rehabilitation area must be designed so flow capacity can be adjusted.

3.3 DEWATERING

.1 Dewater work spaces for the various tasks involved with the Work and maintain them in a fully dewatered state until Work is finished. Dewatering may require 24 hour maintenance and supervision.

.2 Continue dewatering operations to enable Work to proceed in the dry for duration of Work.

.3 Repeat entire dewatering procedure as often as may be necessary if flooding or other damage occurs before completion of Work.

.4 Maintain the dewatered state by pumping from well-points and/or sumps.

.5 Protect existing adjacent structures and properties. Protect historic rock crib dam located downstream of the upstream cofferdam.

3.4 WATCHKEEPER

.1 Ensure continuity of dewatering by designating a Watchkeeper to make periodic checks both during the work and at times when Work is not in progress. Watchkeeper's qualifications under this Section are to be sufficient to perform on dewatering equipment, such duties as:

.1 Preventive maintenance and refueling of generators normally performed during any shift.

.2 Emergency repairs of minor complexity.

.3 Placing standby items in service.

3.5 EQUIPMENT

.1 General:
- .1 Provide equipment in safe operating condition and maintain it in a safe operating condition for entire period of use and/or standby for use on Work.
- .2 Provide skilled operators for equipment.
- .3 Undertake service and maintenance of equipment according to approved environmental procedures.

.2 Standards and performance:
- .1 Provide equipment of such quality and in such quantity as to provide sufficient capability to perform essential functions of Work to the approved schedule.
- .2 Equipment that is working in channel / river shall meet all environmental requirements.
- .3 Equipment shall be inspected and serviced regularly. Provide copies of equipment inspection and service records when requested by the Consultant.
- .4 Provide emergency equipment for spills of deleterious substances.
- .5 Provide standby replacement for pumps and other essential dewatering equipment which may break down during Work.
- .6 Keep this replacement equipment available on site for immediate use.
- .7 Ensure pumps in areas not defished are compliant with DFO screen guidelines

3.6 REMOVAL OF TEMPORARY WORKS AND FLOW DIVERSION

.1 At approved stages in Work, remove all temporary construction access roads and diversion system to original bottom level, taking account of the protection of historic rock crib dam.

.2 Remove all construction access road materials to the founding soils to the satisfaction of the Consultant.

.3 Remove entirely all flow diversion and restore the site to the original condition or better.

.4 Dispose of all unwanted materials off-site as approved by the Consultant.

.5 Do not dispose of any materials in river.

.6 Undertake removals to the requirements of the regulatory permits and approvals, and to Section 01 35 43.

3.7 CLEANING

.1 In accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies requirements for the upstream safety boom installation as part of the safety requirements for navigation as set out by Transport Canada Navigable Waters and the Canadian Dam Association Guidelines.

- .1 Safety boom and warning buoys will be supplied by the Contractor. The Contractor is also responsible for installation.
- .2 The work under this section also includes supply and installation in-water anchors along with all new connecting cable/chain link and hardware components as described on the Contract drawings.

1.2 RELATED SECTIONS

.1 Section 01 22 01 - Measurement and Payment.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 56 00 - Temporary Barriers and Enclosures.

.4 Section 05 50 00 - Metal Fabrications.

.5 Section 35 49 25 - Turbidity Curtain.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There will be no separate measurement of Work described in this Section.

.2 Payment of this Section shall be included in the applicable Lump Sum Price item as set out in Section 01 22 01.

1.4 REFERENCES

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

- .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-16, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.4 REFERENCES (Cont'd)

.1 (Cont'd)

.3 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.4 ASTM A572/A572M-15, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

1.5 SUBMITTALS

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

.2 Submit manufacturer's printed product literature and data sheets for the associated hardware including product characteristics, performance criteria, physical size, finish and limitations.

1.6 DELIVERY

.1 Contractor is responsible for supplying, storing and handling in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 DAM SAFETY BOOMS

.1 Dam safety boom consists of flotation units and connector assemblies. The assembled boom will consist of interconnected floatation units that must provide a continuous demarcation boundary. Connection assembly is to be as prescribed.

.2 Floatation units and connector assemblies must be new and not previously used.

.3 Flotation unit with connectors attached must have a minimum freeboard of 30 cm.

.4 Assembled boom must have a minimum tensile load capacity of 190 kN.

.5 Flotation units must be commercially available in order to readily purchase additional components as required.

2.2 FLOATATION UNITS

.1 Flotation units must consist of an external encasement, internal foam fill and internal structural steel channel through which all external inter flotation unit connections are attached.

.2 Foam fill core must be polystyrene or polyurethane foam meeting requirements of ASTM C-578 and must have an in-place density in range of 14.4 kg/m^3 and 19.2 kg/m^3. Water absorption of foam must not exceed 3% by volume. Foam fill must take up a minimum of 95% of the interior volume of the floatation unit.

.3 Each flotation unit must be approximately cylindrical in shape.

.4 The nominal length must be 3 m. The nominal diameter must be 40 cm.

.5 Each flotation unit to have a minimum buoyancy of 300 kg. Each floatation unit must maintain its original buoyancy if it is structurally damaged or punctured.

.6 The flotation unit must be encased with a durable polyethylene encasement shell with antioxidants and UV inhibitors. Nominal wall thickness of polyethylene encasement must be a minimum of 4 mm. Polyethylene encasement must have minimum density of 0.926 g/m^3.

.7 The encasement colour must be yellow (FS-13655) per Transport Canada requirements.

.8 Each flotation unit must be reinforced and ballasted with a steel channel. The channel must be located on the interior of each flotation unit, and positioned on the bottom to provide anti-rolling. Channel must be fixed to and integral with the flotation unit.

.9 All flotation unit metal hardware must be stainless steel or hot dip galvanized.

2.3 INTER BOOM AND ANCHOR CONNECTION HARDWARE

.1 All connecting hardware between flotation units and anchors shall conform to the Contract drawings.

.2 Connector assembly at each floatation unit spacing is to consist of a length of chain along with a bolt and cotter pin style shackle at each end to attach floatation units. Floatation units must have integral connector assembly to receive shackle. Chain must be 19 mm size and grade 30 hot dipped galvanized steel. Shackles must be stainless steel or hot dipped galvanized sized to suit connection and rated for

2.3 INTER BOOM AND ANCHOR CONNECTION HARDWARE (Cont'd)

.2 (Cont'd)
loading requirements. Cotter pins for shackles must be stainless steel (type 304 or 316).

.3 The complete connector assembly shall result in a spacing between floatation units of 1000 mm. Acceptable tolerance is +/-50 mm.

.4 All components must be corrosion resistant. Steel components to be hot dip galvanized or stainless steel type 304 or 316.

.5 Connection assemblies must permit minimum rotation of 90 degrees between floatation units (horizontal plane) and must allow movement to account for wave action.

2.4 IN-WATER ANCHOR NAVIGATION WARNING MARKINGS

.1 In-water anchor: shall conform to the Contract drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Safety Boom:
- .1 Contractor is to only remove existing safety boom after completing works related to new safety boom anchorage and only immediately before placing new safety boom across channel.
- .2 Install in accordance with manufacturer's instructions and as indicated on the Contract drawings.
- .3 Do not make alteration to system components without written permission of Consultant.
- .4 Individual section of boom shall be connected to shoreline anchor or in-water anchor with separate clevis (shackle), unless otherwise indicated.
- .5 Ensure that all warning messages are facing upstream. Alternate boom units with English and French warning messages.

.2 Safety Boom Anchors:
- .1 The Contractor shall be responsible to supply, transport and install and align all field placed cast-in and in water anchors.
- .2 Contractor to install in accordance with anchor design and manufacturer's instructions and as indicated on Contract drawings.

3.2 CONSTRUCTION

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

.2 For installation of anchors, provide sediment control measures acceptable to Consultant. Do not spill concrete into open waterways.

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspections:
- .1 Provide Consultant with minimum 10 days notice prior to beginning any Work on safety boom assembly and provide access to Work for inspection.
- .2 Safety boom constructed in whole or in part without inspection will not be accepted.
- .3 Final inspection of safety boom will be made in place. Contractor to assist with access for inspection.
  - .1 Individual units are to be inspected by Consultant prior to installation.
- .4 Evidence of units having a lack of buoyancy, or damaged, as determined by the Consultant will be cause for rejection and shall be returned to PCA.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies requirements for the preservation of watercourses and related environments during construction activities and their restoration.

1.2 RELATED SECTIONS

.1 Section 01 14 00 - Work Restrictions.

.2 Section 01 22 01 - Measurement and Payment.

.3 Section 01 33 00 - Submittal Procedures.

.4 Section 01 35 43 – Archaeological, Cultural and Environmental Procedures.

.5 Section 01 78 00 - Closeout Submittals.

.6 Section 31 11 00 - Clearing and Grubbing.

.7 Section 35 20 22 - Dewatering and Diversion.

.8 Section 35 49 25 - Turbidity Curtain (Silt Curtain).

1.3 ENVIRONMENTAL REQUIREMENTS

.1 Operation of construction equipment in water is prohibited.

.2 Use borrow material from watercourse beds only after receipt of written approval from Consultant or governing authority having jurisdiction.

.3 Design and construct temporary construction access roads to minimize environmental impact to watercourse.

.4 Ensure construction activities do not impact downstream spawning beds.

.5 Dumping excavated fill, waste material, or debris in watercourse is prohibited.

.6 Underwater blasting is prohibited.

1.3 ENVIRONMENTAL REQUIREMENTS (Cont'd)

.7 Carry out work to requirements of work permits.

.8 Install turbidity curtain to prevent sediment from construction activities from entering the watercourse and being transported beyond the approved work area to Section 35 49 29.

.9 Construction of sediment and erosion control measures and in particular the sediment trap within the dewatered area of the construction limit shall be considered by the Consultant.

.1 The Contractor shall demonstrate that other alternative locations outside the dewatered area have been explored and have been found to be impractical or not acceptable to the regulatory and local authorities.

.2 The Contractor shall demonstrate to the satisfaction of the Consultant that there will be no short term and long term environmental impacts to the watercourse.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Obtain work permits from governing Federal, Provincial, Municipal and/or Conservation Authority.

3.2 EXISTING CONDITIONS

.1 Maintain existing flow pattern in natural watercourse systems.

3.3 SITE CLEARING AND PLANT PROTECTION

.1 Undertake site clearing to Section 31 11 00.

.2 Conduct work to provide minimal disturbance to vegetated buffer zones. Protect trees and plants on site and adjacent properties where indicated.

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

3.4 DRAINAGE

.1 Pumping water containing suspended materials into watercourse is prohibited.

.2 Establish rock chute spillways and energy dissipater at outlet of diversion works to accommodate safe surface water entry to watercourse as approved by the Consultant.

.3 Maintain existing drainage patterns on adjacent lands to the water course to the greatest extent possible.

.4 Undertake channel diversion system to requirements of Section 35 20 22.

3.5 SITE RESTORATION

.1 Remove sediment and erosion control measures with approval of Departmental Representative.

.2 Protect new planting material from disturbance by construction activities.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section specifies the requirements for the rehabilitation of a channel between the proposed new Bobs Lake Dam and the to-be-removed existing Bobs Lake Dam.

.2 The work includes the construction of the stream channel over a distance of approximately 50 meters and of a diverse and stable aquatic habitat. The newly dry lake bed riparian habitat downstream of the new dam must be stabilized and re-vegetated.

1.2 RELATED SECTIONS

.1 Section 01 11 00 -Summary of Work.

.2 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.3 Section 31 23 33 - Excavating and Backfilling.

.4 Section 31 32 19.01 - Geotextiles.

.5 Section 32 94 00 - General Landscaping.

.6 Section 35 20 22 - Dewatering, diversion and temporary construction access roads.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Measurement Procedures: in accordance with Section 01 22 01 - Measurement and Payment.

.2 Backfilling to authorized limits with rip rap and rockfill will be measured for payment in tonne (1 000 kg) for the supply, placement and consolidation of materials as set out in Section 01 22 01 and Section 31 37 10, for each of the three zones of rockfill:

.1 Zone 1 - Rip rap ϕ300-500 mm;

.2 Zone 2 - River rockfill ϕ300-500 mm;

.3 Zone 3 - River rockfill ϕ50-300 mm.

.3 Backfilling to authorized limits with organic soil will be measured for payment in tonne (1 000 kg) for supply, placement and consolidation as set out in Section 01 22 01 and Section 35 42 25.

1.3 MEASUREMENT AND PAYMENT PROCEDURES (Cont'd)

.4 Backfilling to authorized limits with clean sand to be measured for payment in tonne (1 000 kg) for supply, placement and consolidation as set out in Section 01 22 01 and Section 35 42 25.

.5 All Work other than riprap and rockfill and organic soil shall be included in the applicable Lump Sum Price item as set out in Section 01 22 01. Items of work to be considered in the applicable Lump Sum Price are, but not limited to:
.1 excavation grading and backfilling of the area and associated works as required;
.2 riparian planting and maintenance;
.3 boulder clusters and large wood debris.

1.4 REFERENCES

.1 Agriculture and Agri-Food Canada (AAFC).
.1 Plant Hardiness Zones in Canada-2000.

.2 Canadian Nursery Landscape Association (CNLA)
.1 Canadian Standards for Nursery Stock, 8th Edition, 2006.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Trees, shrubs and ground cover: species shown on the Contract Drawings.

.2 Organic soil: see top soil, to Section 32 94 00.

.3 Large wooded debris:
.1 Included material from the following tree species : Thuja Occidentalis (Cedar) and/or Quercus Rubra (Red Oak) and/or Tsuga Canadensis (Eastern Hemlock);
.2 Maximum length wood debris will be 2.0 m;
.3 Diameter will range between 200 mm and 400 mm;

.4 Rip-rap and rockfill: to Section 31 37 10.

.5 Sand fill: to Section 31 23 33.01.

2.2 BOULDER CLUSTERS

.1 Hard, with relative density not less than 2.65, durable quarry (shot-rock) stone, free from seams, cracks or other structural defects, clean with deleterious

2.3 BOULDER CLUSTERS (Cont'd)

.1 (Cont'd)
materials, durable and resistant to weathering by air and water, non-acid generating, acceptable to the Consultant. The Consultant may reject any material at the stockpile, based on visual inspection, which contains excessive fines, dust or other deleterious products. The boulder cluster shall meet following size distribution for the use intended:

.1 Boulder Cluster ϕ1 000 mm:
  .1 Stones are to have no sharp edges and be spherical. No one dimension shall be greater than 30% of the mean dimension.
  .2 Stones shall be free of sand, silt and clay fraction.
  .3 Partially embed boulders (30 cm) to prevent movement.

PART 3 - EXECUTION

3.1 DIVERSION

.1 Stream bed environmental rehabilitation and dam demolition must be substantially complete within a three-week period to allow for passage of water through the new stream channel. Scheduling of this work is dependent on in water work restriction and flow conditions requirements at Bobs Lake. Process would entail:

.1 Partial draw down of area between new dam and old dam in a manner to prevent erosion and turbidity;
.2 Remove stranded fish as per Section 01 35 43;
.3 Construction and commissioning of bypass system to pass minimum 1.5 cms through stream bed rehabilitation and demolition area;
.4 Full draw down of area between old and new dam;
.5 Measures to control seepage from new dam, divert seepage to sediment treatment, and release in order to facilitate stream bed rehabilitation work in the dry;
.6 Construction of stream bed rehabilitation and old dam demolition;
.7 Substantial completion of stream bed rehabilitation and old dam demolition within three-week period to allow for commissioning of new dam and flows through new stream channel.

3.2 EXCAVATION

.1 Excavate the sediments as indicated on the Contract Drawings and in accordance with Section 31 23 33.01 - Excavating and Backfilling.

3.3 LARGE WOODED DEBRIS (LWD)

.1 Cut side branches, if any are present on the trunk, at 600 mm from the trunk, allowing for more shelter area.

.2 Orient wooded debris alignment downstream, angled at 20 to 40 degrees to the streambank.

.3 Anchor securely the trunk of the tree to the bank with no possibility of movement. Anchor the individual large wooded debris components at three points.

.4 Anchors will be composed either of stainless steel cables secured with cable crimp links or wire rope clips (U-bolt and a saddle) or of hot-dip galvanized chain and secured by bolting links.

.5 Anchor the large wooded debris into the streambank with stainless steel or hot-dip galvanized metal rods.

.6 Place washers for all anchors at the head of the nut end.

.7 To enhance anchoring, bury large wooded debris 600 mm in length, under the river rocks.

.8 Place river rocks and riprap along the streambank to prevent erosion.

3.4 RE-VEGETATION

.1 Re-establish vegetated riparian zone as indicated on the Contract Drawings and in accordance with Section 32 94 00 - General Landscaping.

3.5 CLEANING

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

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

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies requirements for the installation of a turbidity curtain as part of the preservation of the watercourses.

1.2 RELATED SECTIONS

.1 Section 01 14 00 - Work Restrictions.

.2 Section 01 22 01 - Measurement and Payment.

.3 Section 01 33 00 - Submittal Procedures.

.4 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.5 Section 35 20 22 - Dewatering and Diversion.

.6 Section 35 42 19 - Preservation of Watercourses.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 There shall be no separate measurement for payment for the supply, installation and maintenance of a Turbidity Curtain within a watercourse. Include cost in Contract Lump Sum Price.

.2 Payment shall be made as set out in Section 01 22 01 and shall be incidental to applicable item of work for environmental controls and dewatering and diversion work.

.3 There shall be no further compensation for modifications to the sediment and erosion control plan including the turbidity curtain should this plan need to be modified to meet the permitting requirements and/or the monitoring specifications.

1.4 REFERENCES

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

.1 ASTM D4491-15, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

.2 ASTM D4595-11, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

1.4 REFERENCES (Cont'd)

.1 (Cont'd)
.3 ASTM D4716-14, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
.4 ASTM D4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-4.2, Textile Test Methods.
.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
.1 No. 2-M85, Mass per Unit Area.
.2 No. 3-M85, Thickness of Geotextiles.
.3 No. 6.1-93, Bursting Strength of Geotextiles Under No Compressive Load.
.4 No. 7.3-92, Grab Tensile Test for Geotextiles.

.3 Canadian Standards Association (CSA)
.1 CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.
.2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.4 Ontario Provincial Standard Drawings (OPSD)
.1 OPSD 219.260 November 2006, Turbidity Curtain.
.2 OPSD 219.261 November 2015, Turbidity Curtain, Seam Detail.

.5 Ontario Provincial Standard Specifications (OPSS)
.1 OPSS 577 November 2006, Construction Specification for Temporary Erosion and Sediment Control Measures.

1.5 SUBMITTALS

.1 Submit details of the temporary turbidity curtain system to the Consultant prior to the start of the Work.

.2 Submit to Consultant details of geotextile material and seam at least 2 weeks prior to commencing work.

.3 Complete the submission of a Sediment Control Plan as described in the Ministry of Natural Resources Technical Note, TN-20, Sediment Control Plans: Reducing Sediment Concerns at Water Crossings, dated 1992, to the Consultant to meet the requirements of all review agencies. Ensure compliance of the sediment control plan throughout the project.

1.6 DELIVERY AND STORAGE

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

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Geotextile: woven synthetic fibre fabric, supplied in rolls.
- .1 Width: approved by the Consultant.
- .2 Length: as specified on contract Drawings.
- .3 Composed of: minimum 85% by mass of polypropylene or polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.

.2 Physical properties:
- .1 Thickness: to CAN/CGSB-148.1, No. 3, minimum 0.8 mm.
- .2 Mass per unit area: to CAN/CGSB-148.1, No. 2, minimum 220 g/m2.
- .3 Tensile strength and elongation (in any principal direction): to ASTM D 4595.
  - .1 Tensile strength: minimum 1350 N, wet condition.
  - .2 Elongation at break: minimum maximum 25%.
  - .3 Seam strength: minimum 1350N equal to or greater than tensile strength of fabric.
  - .4 Mullen burst strength: to CAN/CGSB-4.2, method 11.2, minimum 4000 N, equal to or greater than tensile strength of fabric.

.3 Hydraulic properties:
- .1 Apparent opening size (AOS): to ASTM D4751.

.4 Seams: sewn in accordance with manufacturer's recommendations.

.5 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

PART 3 - EXECUTION

3.1 GENERAL

.1 Complete the submission of a Sediment Control Plan as described in the Ministry of Natural Resources Technical Note, TN-20, Sediment Control Plans; Reducing Sediment concerns at Water Crossings, dated 1992, to the Consultant. Where directed by the Consultant, submit to the review agencies as part of any permit requirements. Modify the sediment and erosion control plan to address the review agency comments. Ensure compliance of the sediment control plan throughout the project.

.2 Supply, install, maintain, replace and remove silt curtains when instructed by the Consultant.

.3 Monitoring of water turbidity outside the silt curtain will be carried out by the Contractor as set out in Section 01 48 00 and Section 01 35 43. Maximum allowable increase of turbidity above background levels in NTU (Nephelometric Turbidity Units) as specified in Section 01 35 43.

3.2 INSTALLATION

.1 Turbidity curtains shall consist of turbidity curtain geosynthetic, load line, flotation, ballast, anchors, mooring buoys, mooring lines, adjustment lines, and tie-downs.

.2 Design to conform to Ontario Provincial Standard Specification, OPSS 577 and Ontario Provincial Standard Drawings: OPSD 219.260 and OPSD 219.261 as a minimum. Design for a 0.61 m wave height and a 0.51 m/s current.

.3 Turbidity curtains shall be constructed as follows:

- .1 The floatation shall provide support along the length of the turbidity curtain.
- .2 A sleeve shall be formed and heat-sealed or sewn along the entire bottom edge of the turbidity curtain geosynthetic, to contain the ballast in the sleeve. Breaks may be made in the sleeve to facilitate pulling, provided they are a minimum 100 mm in size and spaced at minimum 3 m intervals.
- .3 Where turbidity curtain geosynthetic is joined to provide a continuous run, the sections shall be connected to provide a continuous seal and prevent the escape of turbid water between the sections.

3.2 INSTALLATION (Cont'd)

.3 (Cont'd)

.4 The turbidity curtain, as prepared for installation, shall be of sufficient width to account for water depth and wave action.

.5 Adjustment lines shall be placed at maximum intervals of 10 m, and are to encircle the turbidity curtain from top to bottom.

.6 The turbidity curtain shall be prepared for installation by furling and tying with furling ties every 1.5 m for the entire length of the curtain.

.7 Anchor locations shall be established as is necessary to maintain the turbidity curtain in place and functioning.

.8 Provide buoys or other navigation markers to identify the location of the turbidity curtain to boaters.

.9 Place turbidity curtain to maintain a clear navigation channel as set out in the contract drawings and approved by the Consultant.

.10 Turbidity curtains shall be in place prior to any in-water work such as cofferdam construction.

3.3 OPERATION AND MAINTENANCE

.1 Turbidity curtains shall be installed to prevent sediment passage, from the area enclosed by the curtain, to the remaining water body. Turbidity curtains shall be installed and maintained in a manner that avoids entry of equipment, other than hand-held equipment or boats, to the remaining water body.

.2 Equipment is permitted in the work area enclosed by the turbidity curtain.

.3 Turbidity curtains shall be operated and maintained in the specified location, with the entire top edge above the water surface.

.4 The curtain shall be free of tears and gaps, and the bottom edge of the curtain is to be continuously in contact with the water course bed so that sediment passage from the area enclosed is prevented.

.5 Any folds in the turbidity curtain which form next to the flotation collar shall be regularly monitored and freed of collected sediment.

.6 Monitor and maintain the turbidity curtain booms both during and outside normal working shifts as required. Provide all personnel, materials and equipment necessary to maintain, repair or relocate the silt curtain system.

3.3 OPERATION AND MAINTENANCE (Cont'd)

.7 Carry out construction operations to minimize impact on fish habitat from both disturbed sediments and fill materials.

.8 Replace sediment and damaged or deteriorated geotextile to approval of Consultant.

.9 Remove debris trapped by the turbidity curtain regularly and dispose at an approved location.

.10 Remove turbidity curtain when authorized by the Consultant after completion of the work.

END OF SECTION

SPECIFICATIONS

APPENDICES

GEOPHYSICS GPR INTERNATIONAL INC.

100 – 2545 Delorimier Street
Longueuil (Québec)
Canada J4K 3P7

Tel. : (450) 679-2400
Fax : (514) 521-4128
info@gprmtl.com
www.geophysicsgpr.com

August 3rd, 2015

Transmitted by email: John.Konczynski@cima.ca

Our Ref.: M-15069

Mr. John Konczynski, P.Eng.
CIMA+
3400, boul. du Souvenir, Suite 600
Laval (QC) H7V 3Z2

Subject: **Seismic Refraction Surveys at Bob's Lake Dam Site, Bolingbroke (ON)**

Dear Sir,

Geophysics GPR International Inc. has been mandated by CIMA+ to carry out seismic refraction surveys on three lines across the Bob's Lake North end, in Bolingbroke. The geophysical investigations aimed a general rock quality assessment with depth from surface recognisance for the optimization of the location of the new dam/weir.

The surveys were carried out from July 21st to 23rd 2015, by Mr. Charles Trottier, M.A.Sc., phys., Mr. Nicolas Beaulieu, Eng., and Mr. Jérémie Dufour, train. Figure 1 shows the regional location of the site, and Figure 2 illustrates the location of the seismic lines. Both figures are presented in the appendix.

The following paragraphs briefly describe the survey design, the principles of the test methods, and the results in graphic format.

Method Principle

The seismic refraction method relies on measuring the transit time of the wave that takes the shortest time to travel from the shot-point to each geophone/hydrophone. The fastest seismic waves are the compression (P) or acoustic waves, where displaced particles oscillate in the direction of wave propagation. The energy that follows this first arrival, such as reflected waves and transverse (S) waves, is not considered under routine seismic refraction interpretation.

The calculations of the seismic data were done using the Hawkins method. It allows the computation of rock depth and rock mechanical quality for every geophone/hydrophone. The method is based on the closure times of the inner shots. It allows the calculation of the true velocities of the upper portion of the bedrock, using the apparent seismic velocities, with the information provided by the outer shots.

Figure 3 illustrates the basic operating principle for refraction surveys. A more detailed description of the theory and processing steps can be found in *Technical Report E-73-4 Seismic Refraction Exploration* for Engineering Site Investigation, B.B. Redpath, NTIS, 1973 and, *Shear wave velocity measurement guidelines for Canadian seismic site characterization in soil and rock*, Hunter, J.A., Crow, H.L., et al., Commission géologique du Canada, Dossier public 7078, 2012.

Survey Design

As no stakes and/ or obvious marks were present on the site, the seismic lines were located from theoretical coordinates and hand-held GPS, considering existing land constrains.

On land, geophones were installed along the topography 3 meters apart, while across Bob's Lake, hydrophones were installed 3 meters apart, horizontally (cf. Figure 4) from a hanging cable across the lake.

On shores, the seismic source used was a 20 lb sledge hammer, striking a steel plate for electrical close contact triggering, with stacking for S/N ratio enhancement. Over the river, the seismic source was a buffalo-gun (blank black powder 12 gauge shells).

RESULTS

The surface topographic references were made with the A000492B-AR001.DWG drawing and the correlated field observations. The planimetric coordinates system is UTM, zone 18. The bathymetric measurements were realized with a fathometer GARMIN ECHO 101, and localized over each installed hydrophone.

The seismic refraction profiles results are presented in Annex. The integration of these results was realized to figure the general trends of the rock elevation (figure 8), and the rock mechanical quality, related to V_P (figure 9).

After a geotechnical report of 1984, the rock mechanical quality became an important concern for the new location of the dam. As illustrated by the Figure 9, the rock seismic velocity appears to be lower, closer to the actual dam. From the left shore (NW), the rock seismic velocity increases SW (upstream). It is also maximal in the center of the river, especially upstream. From the right shore (East), the rock seismic velocities are very low for the three seismic lines, possibly due to a shear zone and/or a chemically weathered rock. Considering an excellent rock at 4500 m/s, the Poor to Fair limit could be around 3090 m/s [dashed line]. Similarly, considering an excellent rock at 5000 m/s, the Poor to Fair rock quality limit could be around 3430 m/s [bold line] (cf. ASTM STP 447, pp.154-173, for MRQD evaluation).

From a topographic point of view, the rock elevation seems to be lower on the left side (SW) portion of the river (cf. Figure 8). From the left shore, the rock topography seems to present a trend for a slight dip SW. The right shore presents a steady raise SE, according with the surface topography.

The downstream portion of the area investigated appears more attractive for the new dam axis, as the rock is less weathered than on the other upstream investigated seismic lines. The rock elevation on the left shore (NW) appears to be potentially lower.

In any case, the right shore would have to be investigated by boreholes, as the geophysical results suggest a poor rock quality.

The SL-2-15 (downstream) shows a rock depth under the riverbed around 6.5 meters on the left side, almost outcropping on the right portion of the river center-line, and 2.6 meters on the right side. On the SL-1-15 (middle line), the rock depth under the river could be around 5.9 meters on the left side, 1.7 meter on the right portion of the riverbed center-line, and 3.9 meters on the right side. The SL-3-15 (upstream) suggests a rock depth under the riverbed around 2.2 meters on the left side, almost outcropping on center portion of the river, and 3.5 meters on the right side.

From the shores sides, SL-2-15 suggests 0.5 to 6.2 meters of overburden on the right side, and 1.2 to 3.7 meters on the left side. SL-1-15 results show 0.9 to 5.4 meters of overburden on the right side, and 2.5 to 4.5 meters on the left side. The SL-3-15 suggests 1.3 to 3.0 meters of overburden on the right side, and 1.1 to 2.2 meters on the left side.

All these depths/thicknesses should be considered accurate to around 1 to 2 meters, as long as no geotechnical calibrations are available.

CONCLUSION

CIMA+ mandated Geophysics GPR International inc. to realize seismic refraction surveys over Bob's Lake, upstream of the existing concrete dam, to assess the rock mechanical quality and evaluates its depth from the surface.

As per the seismic refraction results, the rock quality increases from downstream to upstream the actual dam/weir site, especially from the left (NW) shore. The right (SE) shore presented a steady low V_P velocity range. The center-SE of the river had shown a fair rock almost everywhere, especially upstream.

From the shores, the rock elevation seems dipping SW on left shore, away from existing dam. The overburden could be as thick as 0.5 to 6.2 meters on the right shore, and 1.1 to 4.5 meters on the left shore.

Geotechnical assessments are recommended for the rock quality and elevation on the left shore, and especially for the rock quality on the right shore.

This report has been written by Jean-Luc Arsenault, M.A.Sc., P.Eng.

Jean-Luc Arsenault, M.A.Sc., P.Eng.
Project Manager

Figure 1: Regional location of the Site
(source : *Google Maps*™)

Figure 2: Location of the seismic spread
(source : *Google Earth*™)

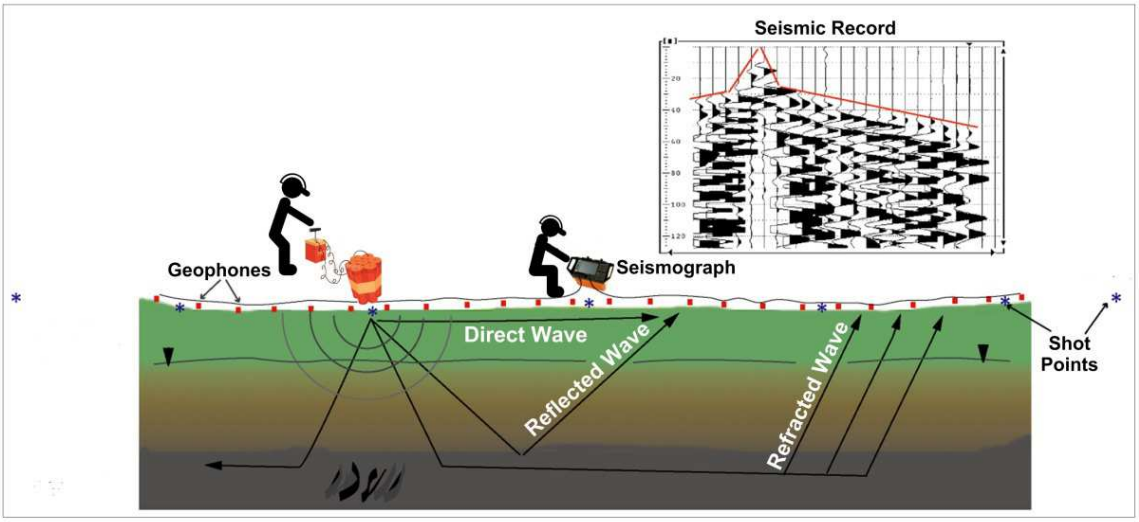
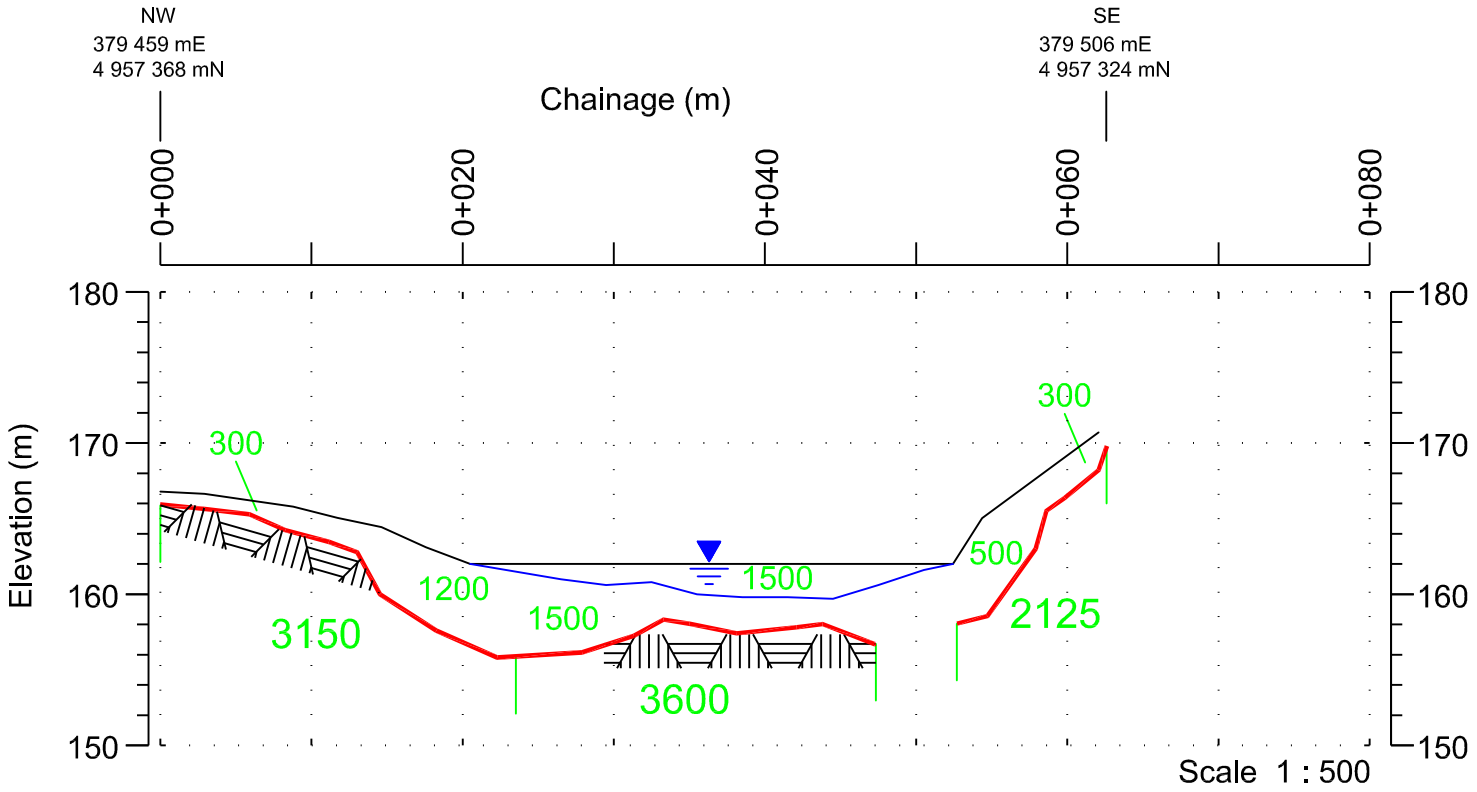
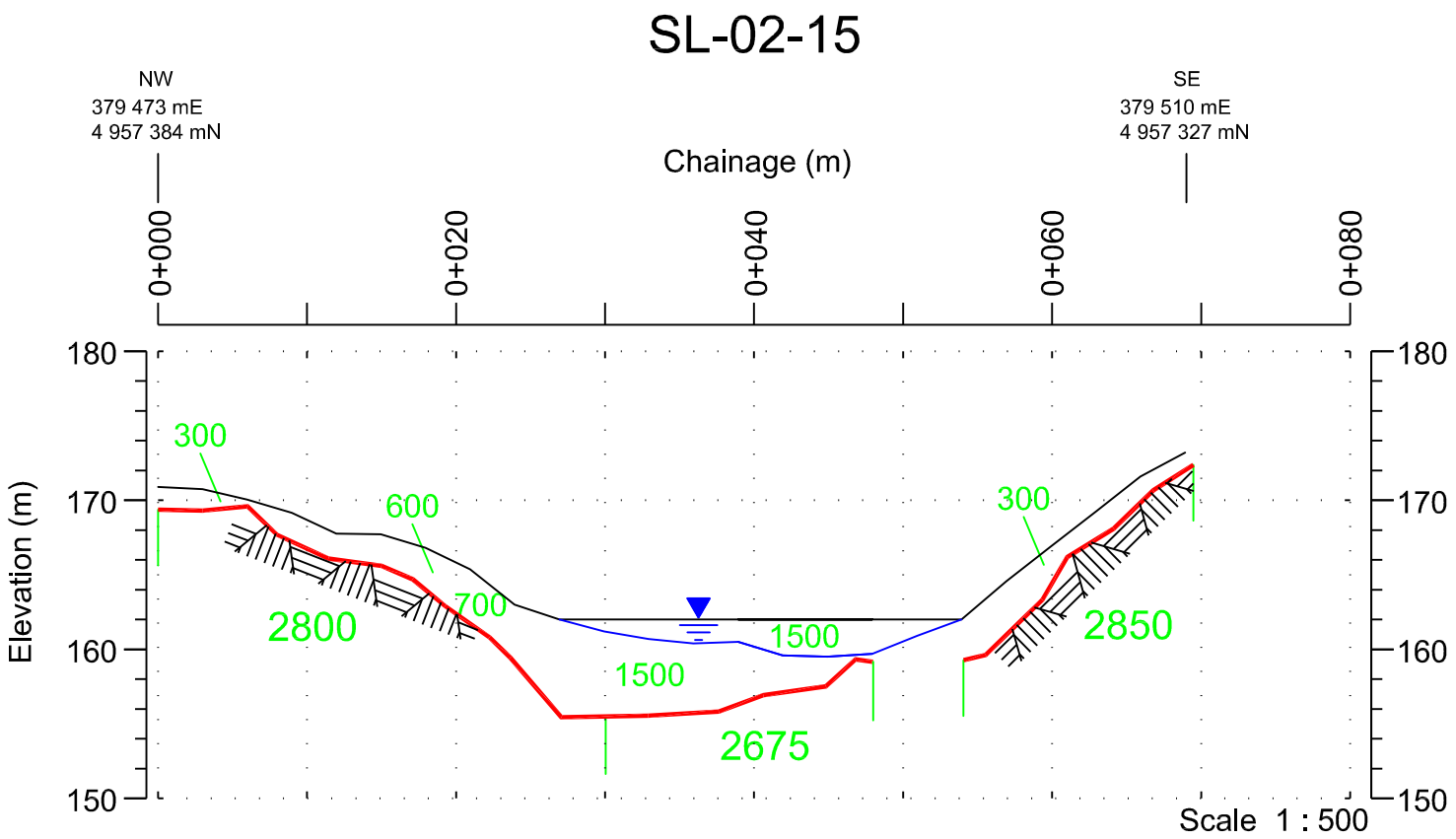


Figure 3: Seismic Refraction Operating Principle

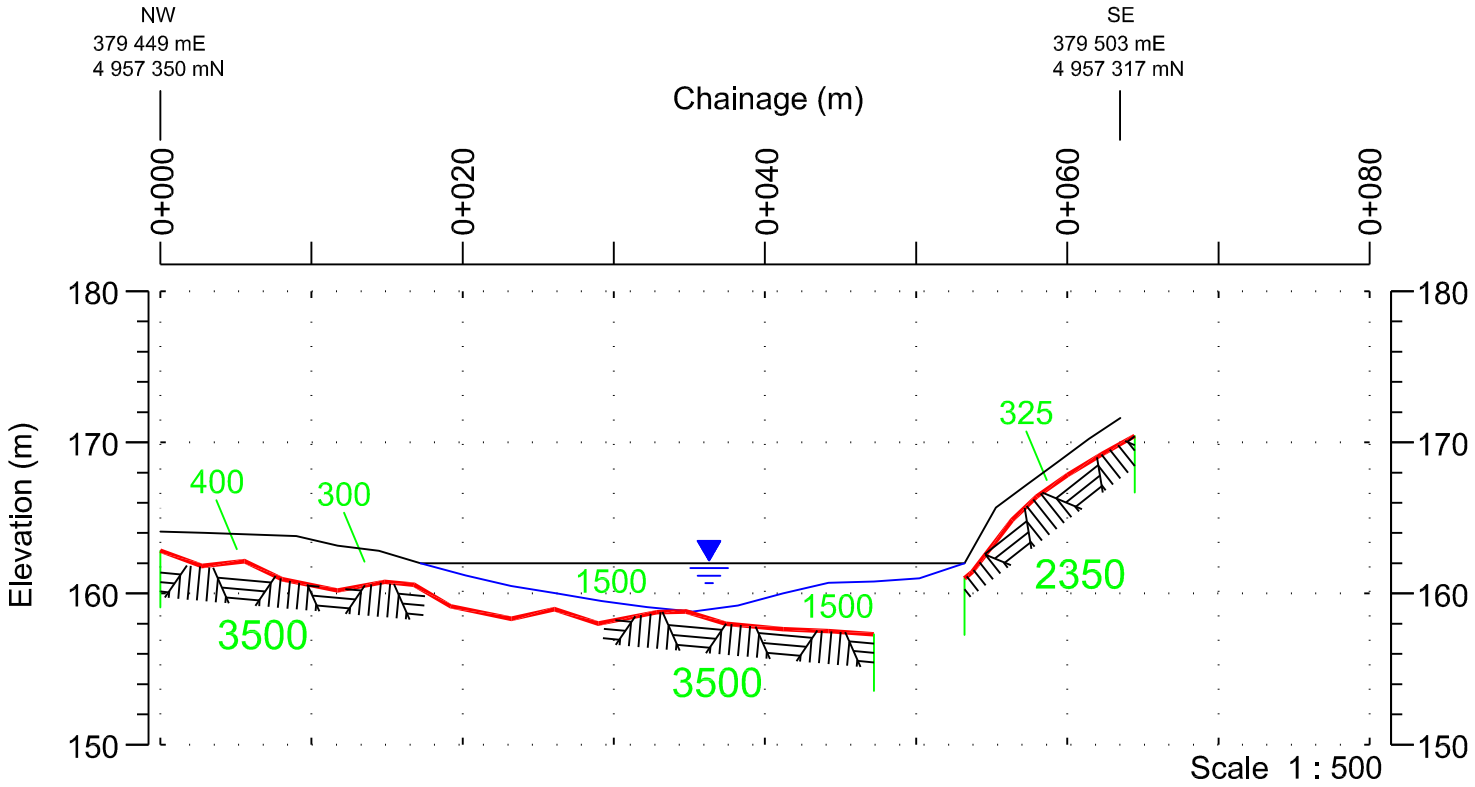
Figure 4: River Crossing Seismic Line with Geophones & Hydrophones

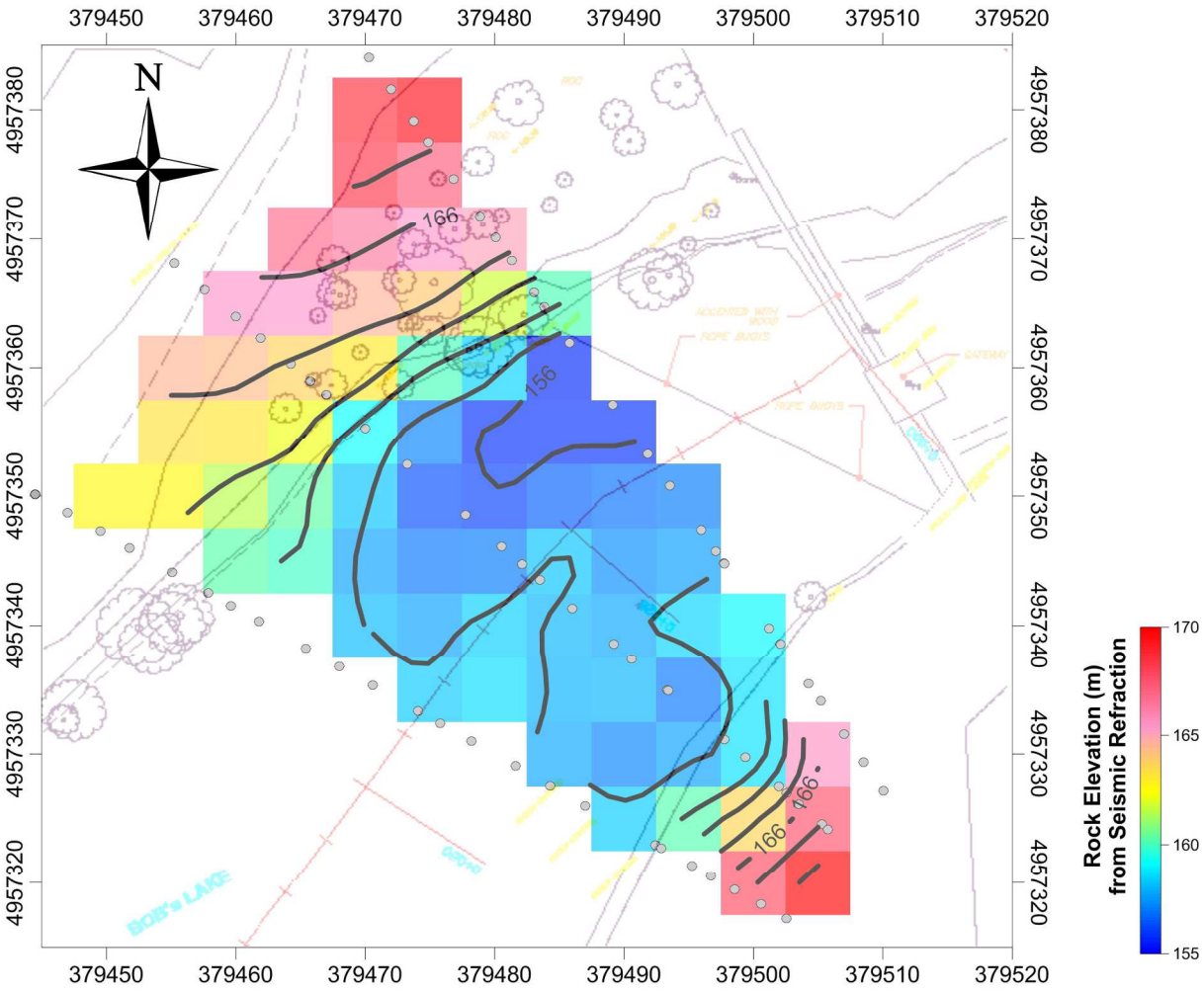
SL-01-15


NW
379 459 mE
4 957 368 mN
SE
379 506 mE
4 957 324 mN
Chainage (m)
0+000
0+020
0+040
0+060
0+080
Elevation (m)
180
170
160
150
300
300
1200
1500
1500
500
3150
3600
2125
Scale 1 : 500


SL-02-15
NW
379 473 mE
4 957 384 mN
SE
379 510 mE
4 957 327 mN
Chainage (m)
0+000
0+020
0+040
0+060
0+080
180
170
160
150
Elevation (m)
300
600
700
2800
1500
1500
2675
300
2850
Scale 1 : 500

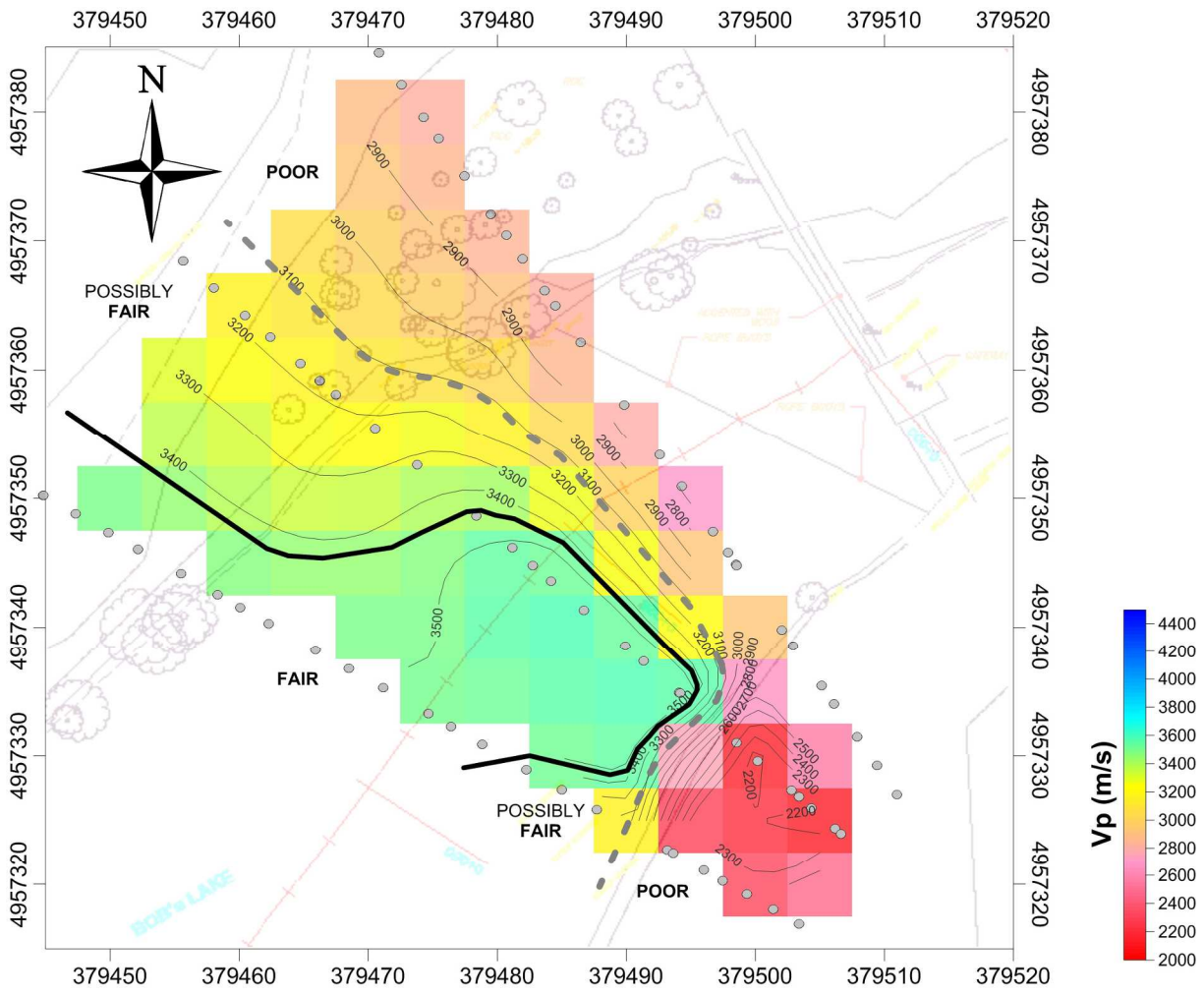
SL-03-15


NW
379 449 mE
4 957 350 mN
SE
379 503 mE
4 957 317 mN
Chainage (m)
0+000
0+020
0+040
0+060
0+080
Elevation (m)
180
170
160
150
400
300
325
1500
1500
2350
3500
3500
Scale 1 : 500



Rock Elevation Model from Seismic Refraction Surveys

Figure 8



Rock Seismic Velocity (Vp) from Seismic Refraction Surveys

Figure 9

Geotechnical Investigation-Preliminary Design Stage
Relocation/Reconstruction Bolingbroke Dam

Crow Lake Road, Maberly, Ontario

CIMA + c/o Parks Canada

179 Colonnade Road South, Suite 400 Ottawa Ontario K2E 7J4

11103700 | A1 | Report No 1 | February 09 2016

Table of Contents

Figure Index

Table Index

Appendices

1. Introduction

GHD Limited (GHD) was retained by Mr. John Konczynski of CIMA+ who have a mandate on behalf of Parks Canada to undertake a Geotechnical Investigation for the proposed relocation/reconstruction of Bolingbroke Dam located on Crow Lake Road in the Township of Tay Valley, Ontario.

The purpose of the investigation was to evaluate the subsoil and bedrock conditions by drilling boreholes at several locations. Five vertical boreholes and two boreholes at a 45° inclination were drilled at the proposed dam alignments as per CIMA's instructions. Five boreholes and probe locations were also drilled in order to assess the soil and bedrock contact depths along the proposed access road. Based upon the data, we have provided descriptions and recommendations concerning foundation and associated bearing pressures, access road pavement design, as well as comments on excavation, and construction field review.

This report has been prepared with the understanding that the design will be as described in Section 2.0 and will be carried out in accordance with all applicable codes and standards. Any changes to the project described herein will require that GHD be retained to assess the impact of the changes on the recommendations provided herein.

The scope of work for GHD consisted of the following activities:

- Drilling Fieldwork | The proposed scope included advancement of a total of seven boreholes including two 45° inclined boreholes plus an additional five probes. Boreholes were drilled on the shorelines, and within the upstream lake at the alternative dam locations, as directed by CIMA. Probes consisted of driving a dynamic cone and were performed along the proposed access roads.
- Packer Testing | Packer testing was performed in all deep boreholes at different depths to estimate the hydraulic conductivity of the bedrock.
- Acoustic TeleViewer (ATV) Logging | Based on the poor rock quality data collected from the boreholes drilled within the upstream lake ATV logging was performed to provide detailed 3D logging of the bedrock to assist in logging the subsurface rock condition.
- Lab Testing | Compression and tension test on a total of eight rock core samples; were carried out.
- Reporting | Preparation of this Geotechnical Report which summarizes the findings of the fieldwork programs and presents recommendations for the design and construction of the structure.

2. Site and Project Description

The Bolingbroke Dam is located near Crow Lake Road near the community of Bolingbroke in geographic Tay Valley Township, in Lanark County, Ontario. Existing Bolingbroke Dam was built on the Tay River and Bobs Lake. The Site is accessible from an abandoned farm located on 169 Crow Lake Road, in Maberly community, Ontario.

There are two options for proposed new location for relocation/reconstruction of the dam as per CIMA's instructions, both located upstream of the existing dam. The site topography is such that there are slopes on the north and south shores, with the south shore being very steep but densely wooded. The north slope is gradual with steep sections and vegetated with grass, shrubs and sporadic mature trees. North shore slopes are covered with overgrown vegetation and few trees.

It is our understanding that the proposed development will consist of relocation and reconstruction of the existing Bolingbroke Dam. It is our understanding that the project is at the preliminary stage and concept or design drawings are not available.

The location of the Site is shown on the Site Location Map attached as, Figure 1.

3. Field Investigation

3.1 Fieldwork Investigation

3.1.1 Borehole Drilling Program

The fieldwork component of this Geotechnical Investigation consisted of the advancement of a total of seven boreholes (F1 to F7) and five rock probes (P1 to P5). Two of the boreholes (F1 and F2) were drilled within the water at the two proposed alignments. The two boreholes (F3 and F6) drilled with 45° inclination; were drilled from Bobs Lake toward the south shore and borehole F6 drilled from the north shore toward Bobs Lake; boreholes F1, F2 and F3 were drilled from a barge. Boreholes F4 and F5 were drilled on the north shore. Borehole F7 and probes P1 to P5 were drilled on the proposed access road. It is noted that the boreholes locations were selected by the client.

Boreholes F1 and F2 were advanced to a depth of about 10 m below the bottom of the lake, boreholes F3 and F6 were advanced 21 m at the 45° inclination. Boreholes F4 and F5 were advanced to depths of about 18.2 m and 16.9 m, respectively. Two attempts were taken to drill the borehole F7; in first attempt refusal to auger advancement was encountered at a depth of about 0.8 m which was believed to be over a boulder therefore second attempt was carried out approximately 1.0 m away from the original location with Dynamic Cone Penetration Test (DCPT), and refusal to DCPT was encountered at a depth of about 2 m. A DCPT drives a 50 m diameter cone tip using an energy of approximately 470 joules by using a hammer. The blows of the hammer are recorded for each 0.3 m of penetration, and plotted on the logs. Probes encountered refusal to DCPT at depths varying between 1.2 m to 2.7 m below the existing surface grade. The location of the boreholes is shown in the Borehole Location Plan attached as Figure 2. A graphical representation of each borehole is presented on the Borehole Logs, Appendix A. Notes on Boreholes and Test Pit Logs are also provided as Appendix A, to assist in the interpretation of the information.

The fieldwork program was undertaken throughout August 10 to 26, 2015 with specialized diamond drilling rig adapted for soil sampling and rock coring, under the supervision of GHD field staff. Boreholes were advanced into the overburden using NW casing. Standard Penetration Tests (SPTs ASTM D1586) were performed at regular intervals using a 50 mm diameter split-spoon sampler and a 63.5 kg hammer free falling from a distance of 760 mm, to collect soil samples in boreholes F1, F2, F4, F5 and F7. The number of drops required to drive the sampler 0.3 m is recorded on the borehole logs as "N" value. Boreholes F1 to F6 were advanced into bedrock using diamond coring

equipment, in order to provide rock characterization (ASTM D2113). Boreholes were sealed with cement upon drilling completion.

3.1.2 In-Situ Lugeon Test

In order to assess the permeability of the rock mass, Lugeon Tests (Packer Test) were performed at different depths in all deep boreholes.

The Lugeon Test consists of isolating a section of the borehole within the rock mass and injecting water under pressure. The investigated section of the borehole was isolated using inflatable packers. For this site double packer test was performed with one packer located at the bottom and one packer at the top of the investigated section.

Following the installation of the packers at the selected depths, water injection for five successive periods of ten minutes will be carried out. The water injection pressure was increased for the first three periods and reduced to the same pressures as the second and first periods for the two final periods respectively. The pressures were determined based on the depth of the test, the overburden pressure and the quality of the rock.

The water absorption within the selected vertical section is directly estimated from the fracturing degree of the rock mass. Based on the measured absorptions at each of the five periods the coefficient of hydraulic conductivity of the rock was determined.

The results of the Lugeon tests are provided in Appendix B and are discussed in the following sections.

3.1.3 Acoustic TeleViewer (ATV) Logging

Acoustic TeleViewer equipment was used to scan the borehole wall in boreholes F4 and F5. This method allows collecting detailed description of the joints within the massive rock, their quantity, orientation, dip, and their opening as well as detail information regarding foliations if any.

The ATV tool generates an image of the borehole wall using transmitted ultrasound pulses from a rotating sensor and records the amplitude and travel time of the reflected signals at the interface between the water and the borehole wall. This method needs the water level within the borehole to be sufficiently elevated to allow for the scanning.

The fieldwork consists of inserting the ATV tool in the centre of the borehole while controlling the descending speed. This method permits applying different parameters and filters and therefore changing the resolution of the collected data. The treatment and interpretation of the data will be completed by a geophysicist using WellCad software.

The data collected from the ATV scanning was used in bedrock description provided in Section 4.4 of this report. Graphical representations of the ATV loggings are presented on the ATV Logs, in Appendix C.

3.2 Laboratory Testing

Laboratory testing on recovered rock samples included compression (ASTM D5731), and tension strength Analysis (ASTM D3967). In total, four compression and four tension tests were performed. It is noted that none of the soil samples collected from the boreholes were of the required quantity

for grain size analysis and generally consist of broken cobbles or gravels and therefore no unit weight or moisture content analyses could be performed. The results of the compression and tension testing will be discussed in Section 4.0 and on the borehole logs.

Analytical testing was carried out on a water sample collected from Bobs Lake to provide an initial assessment of corrosion potential of the water at the site at this Preliminary Design Stage. The results of the chemical analyses are discussed in Section 6.4.

The results of the compression and tension analysis are attached as Appendix D.

4. Subsurface Conditions

Detailed descriptions of the subsurface conditions are summarized in the following sections, with a graphical representation of each borehole location presented on the Borehole Logs, Appendix A. Notes on Boreholes and Test Pit Logs are also provided as Appendix A to assist in the interpretation of the information.

4.1 Lake Sediments

Lake sediments were collected from three boreholes F1, F2, and F3. The thickness of the sediments was found to be about 2 m at F1 location and 1 m at F2 location. Sediments were found to consist of silty sand with cobbles and boulders. The majority of the sediments were found to consist of large boulders.

4.2 Topsoil

A surficial covering of topsoil was observed in boreholes F4 to F7. The topsoil was observed to range in thickness from approximately 125 mm to approximately 150 mm at borehole locations. The topsoil layer was found to be a mix of organic matter within a sandy matrix. It was dark brown to black in color, and recovered in a damp condition. The topsoil descriptions, and thicknesses within this report are for planning purposes only and should not be used for quality assessments or quantity take-offs.

4.3 Silty Sand

A layer of native silty sand with cobbles and boulders were encountered from the surface in boreholes F4 and F5. The silt and sand content varies across the site and changes from silty sand to sandy silt. This material was found to be brown in colour, loose to compact in compactness condition, and was recovered in a moist condition. Large boulders are expected within this deposit.

4.4 Bedrock

Practical refusal to SPT or DCPT advancement was encountered over assumed bedrock in all boreholes probe locations at depths varying from 1.2 m in P2 to 5.4 m in F6. The type of bedrock and its quality was confirmed by retrieving bedrock core samples from boreholes F1 to F6 locations by diamond coring techniques.

Highly weathered, intensely fractured coarse grained calcite marble was encountered at the borehole locations. The colour of the marble was found to be white to pale grey becoming grey with depth. Gneiss beddings were observed in borehole F2. The Rock Quality Designation (RQD) values

indicated the quality of this rock to be very poor to fair in the upper portion of the bedrock. The rock quality was found to become good to excellent at depth in F4 and F6 location. Although the rock quality was found to be very poor to fair, the recovery values suggest low probability of cavities within the rock mass.

Lugeon Test (or Packer Test) results carried out in boreholes F1 to F6 show a hydraulic conductivity of between 2 x 10^{-3} to 3.7 x 10^{-3} cm/s in the fractured zones and 1.2 x 10^{-} to 7.2 x 10^{-4} cm/s in fair to good quality bedrock zones. Generally the results show a turbulent flow within the bedrock with wash out or void filling in some of the test locations. It should be noted that the rock closer to these surface may have higher permeability.

ATV logging carried out in boreholes F4 and F5 shows dip and direction of the discontinuities; it can be seen that the upper portion of the bedrock at F4 location is intensely fractured with open/filled joints and bedrock quality increases with depth at F4 location and more close joints were recorded this also confirmed with the visual evaluation of the rock cores; at F5 location however the bedrock quality varies at different depths and the rock quality does not improve with depth; veins or change in lithology (intrusions) were recorded in this borehole as well.

Rock quality also varies at different depths in the inclined boreholes. Although rock quality is very poor in the upper 4 m of the bedrock at F6 location, rock quality improves with depth and becomes fair to good quality. At F3 location bedrock shows an increase in quality between the depths of about 9.0 m to 17 m (45° inclined) below 17 m fractured and poor quality rock is present. The Geophysical study (Seismic Refraction Survey) competed by Geophysics GPR International Inc. also shows low V_p velocities at the south shore at line No. SL-03-15.

Generally the rock quality is very poor to poor in the upper portion of the bedrock and becomes fair quality with depth (around 9 to 10 m below ground surface) at some borehole locations like F4 and F6.

Compression Strength and Tensile Strength of the rock core samples collected from the upper portion of the bedrock from boreholes F1, F2, F4 and F5. In general rock core samples collected from boreholes F2 and F4 show slightly higher strengths than the rock cores collected from F1 and F5 location. The strength analysis results are summarized in the following table.

Table 4.1 Compressive and Tensile Strength of the Rock Samples

Borehole No.	Sample No.	Depth In Meters	Uniaxial Compressive Strength (MPa)	Tensile Strength (MPa)
F1	RC2	4.5 – 6.0	58.4	--
F1	RC3	6.0 – 7.5	--	5.8
F2	RC1	3.5 – 4.5	110.4	10.1
F4	RC2	3.5 – 4.5	125.4	10.2
F5	RC2	2.5 – 3.5	93.7	9.9
Notes: (--) not tested				

5. Groundwater

No monitoring well was installed as part of this scope of work. The shallow groundwater level is considered to be at the same elevation as Lake water level.

It should be noted that groundwater levels are subject to seasonal fluctuations and in response to precipitation and snowmelt events, and are anticipated to be at their highest during the thaw in early spring.

6. Discussion and Recommendations

The recommendations contained within this report are based on GHD's understanding of the proposed development and are for this Preliminary Design phase and should be considered preliminary in nature, which is outlined as follows:

- The project is in preliminary stage and no design drawings are available.
- The proposed development consists of relocation and reconstruction of the existing Bolingbroke Dam.
- It is our understanding that the proposed new structure will be a gravity dam.
- Two locations are proposed as the new dam location.
- As part of this new development access roads will be constructed as well.
- Additional geotechnical investigation may be required in subsequent design stages.

If any of these assumptions are incorrect or these facts change through the design or construction phases, GHD must be retained to assess the impact on our recommendations.

Based on our understanding of the proposed structure, the subsurface conditions encountered in the boreholes, and assuming them to be representative of the subsurface conditions across the Site, the following recommendations are provided. The most important geotechnical considerations for the design of the proposed structure are the following:

- Bedrock Quality | Highly fractured and weathered marble was encountered in the boreholes. The RQD values show very poor to fair quality bedrock within the upper portion of the bedrock. The quality of the bedrock improves by depth however the good to excellent quality bedrock was encountered below a depth of about 9.0 m in F4 and below a depth of about 13 m in F5 and F6.
- Bedrock Hydraulic Conductivity | The result of the Lugeon test carried out at different depths show that generally the bedrock is highly permeable. However the permeability may be even higher in the areas, generally above 5 m to 7 m. This will have an impact on the construction of the proposed structure and rock improvement methods like grouting of the bedrock. Several grouting programs should be considered if this rock improvement method will be used. Designers should be aware that determination of the amount of required grout will be very difficult and most likely not accurate for this site.

- Preparation of Rock Subgrade | Depending on the founding depth of the proposed new structure the preparation for the foundation subgrade may consist of various procedures like cleaning and sealing, backfilling solution cavities, etc.
- Rock Improvement | Grouting of the rock foundation will be required in order to reduce the rock permeability; it is however noted that several grouting programs will be required due to high hydraulic conductivity of the bedrock and turbulent water flow to achieve desirable results. The use of fast setting grout or special use grouts may be required to overcome these issues.
- Temporary Shoring | Cofferdam construction will be required in order to provide a dry environment for construction. Contractors should have significant experience with Cofferdam design and installation. However, grouting programs may also be required to reduce water flow through the bedrock into open excavation.

6.1 Site Preparation

6.1.1 Proposed New Dam Location

Site preparation within the footprint of the proposed structure may require the construction of a cofferdam and grouting program for surface water and groundwater control during construction. Once the cofferdam has been constructed contractors may remove all sediments, topsoil, overburden soil and highly fractured and weathered rock to expose a suitable rock subgrade to the satisfaction of the geotechnical engineer and designers. The poor quality bedrock will present very difficult conditions to create adequate grout curtain.

Any exposed surface should be examined by geotechnical personnel to assess the competency. Any identified local anomalies should be excavated and replaced with concrete or be grouted.

It is noted that the bedrock was found to be highly fractured and weathered, therefore weak zones, filled joints, and solution cavities should be expected. The rock surface will require cleaning and grouting. The bedrock is highly permeable therefore contractors should allow for grout loss and multiple grouting events during any grouting and sealing operation.

The construction should ensure control of surface and groundwater; Construction dewatering techniques should be used during construction.

6.1.2 Pavement Subgrade Preparation

The preparation of the pavement subgrade at the proposed access road locations will involve the removal of any vegetation and organic soils, and any other deleterious material to expose a suitable subgrade. The exposed subgrade surface should be compacted following excavation, proof rolled and examined by geotechnical personnel to assess the competency and any identified local anomalies (over size materials) or soft spots should be subsequently excavated, replaced with suitable fill, and compacted. Field verification should be carried out by qualified geotechnical personnel during construction. Detailed recommendations regarding the pavement subgrade preparation is provided in Section 6.6 of this report.

6.2 Excavation and Dewatering

The excavations should be completed and maintained in accordance with the current Occupational Health and Safety Act (OHSA), Regulations for Construction. The following recommendations for

excavations should be considered to be a supplement to, and not a replacement of the OHSA requirements.

The construction of the cofferdam will be required in order to provide a 'dry' environment for construction. Contractors will need to have significant experience with Cofferdam design and installation.

The sediments and native soils were found to consist of large boulders; contractors should be prepared to encounter occasional large boulders.

Surface water and groundwater seepage is expected in the excavated areas. Water quantities will depend on seasonal conditions, depth of excavations, and the duration that excavations are left open. Construction dewatering techniques should be taken during construction.

The groundwater inflow into the excavations was not estimated as it was not part of the mandate for this project. However, based upon permeability and rock quality a grouting program is recommended to reduce or migrate groundwater inflow into open construction excavation. It is noted that as per the Water Taking and Transfer Regulation (O. Reg. 387/04) a regulation under the Ontario Water Resources Act, Section 34, is likely required for this project.

6.3 Foundation

6.3.1 Dam Foundation

Based on the data collected during our fieldwork for this Preliminary Design Stage, it is expected that the dam foundation will be founded on the poor quality bedrock. The recommended bearing pressures for shallow foundation, founded on the poor quality marble will depend on the width of the foundation. For example, for a 5 m wide foundation the design bearing capacity is 1,500 kPa under factored ULS conditions and 750 kPa under SLS condition; the design bearing capacity for a 1 m wide foundation is 500 kPa under factored ULS conditions and 250 kPa under SLS condition. The factored ULS value includes the geotechnical resistance factor (Φ) of 0.5.

It is noted that due to the high hydraulic conductivity of the bedrock key trench combined with other foundation improvement techniques such as cut-off wall or grout curtains should be used.

The total settlement of the footings founded on bedrock using the recommended bearing pressures under SLS conditions, is estimated to be less than 25 mm.

6.3.2 Resistance to Foundation Uplift

It is anticipated that resistance to foundation uplift, would be provided by means of dead weight of footing and soil weight and by drilled and or grouted rock anchors. Dead weights calculated by the structural engineers. Grouted rock anchors may be designed based on a frictional stress between grout and the bedrock. Based upon typical published values and conservative approach, we recommend that a conservative allowable working stress value of 500 kPa be utilized to calculate the length of the required bond zone. The bond zone must be entirely within "sound bedrock" which is below the weathered zone. For this site an allowance for a weathered rock zone of 4.0 m from the surface of the bedrock in each hole should be incorporated.

Designing in accordance with the Limit State Design (LSD) method, designers may take the approach that working stress value is approximately equivalent to the SLS value. The ULS and SLS

must be based upon performance and structural criteria. However, based upon typical published values, the ULS values may be approximately 1.0 MPa to more than 1.5 MPa. As per the Canadian Foundation Engineering Manual (CFEM-2012), a geotechnical resistance factor of $\Phi = 0.3$ should be applied to this empirical ULS. Higher stress values may be available; however as stated, performance load testing in the field will be required to prove the capacities. If performance testing is carried out at the outset of the project, then a resistance factor of $\Phi = 0.4$ can be applied as per CFEM-2012.

In order to mobilize the shear stress in the rock, the load at the top of the anchor zone must be properly transferred through the anchor zone to prevent progressive grout fail and ensure proper performance. Therefore, a "free length" is required through the overburden and the weathered rock zone. This free length should be a minimum of 3 m long.

The mass of rock mobilized by a rock anchor may be assumed to be based upon a 60° cone drawn up from a point located at the lower one-third point of the anchor shaft bond zone and spaced such that the theoretical cones do not overlap. Designers should review the spacing of anchors and take into account of any overlapping cones (i.e., avoid doubling-up on rock mass calculations for overlapping cones). The bulk unit weight of bedrock may be assumed to be approximately 26 kN/m^3. The corresponding buoyant unit weight would be approximately 16 kN/m^3.

GHD recommends that independent monitoring by geotechnical engineer be carried out during the installation of the anchors to monitor depths, diameters, and quality of installation as well as the grouting of the anchors. Proof testing of anchors is recommended to be carried out by the Contractor and monitored by the Geotechnical Engineer following the grouting. The testing should be completed prior to foundation elements being installed.

These types of permanent anchors should be designed with double corrosion protection by the manufacturer/installer.

6.4 Geotechnical Properties

The following soil and rock parameters can be used for designing of the dam.

Table 6.1 Soil and Rock Parameters

Soil	Density 'γ' (kN/m^3)	Angle of Internal Friction 'φ'	Cohesion 'c' (MPa)	Hydraulic Conductivity (cm/s)
Lake Sediments (Mostly boulders)	20	30	00.015	10^{-1}
Native soil(silty sand with cobbles and boulders)	18	32	00.022	10^{-2}
Marble Bedrock	24	50	17.000	10^{-3}

6.5 Corrosion Potential of Water

Analytical testing was carried out on a water sample collected from Bobs Lake borehole to determine corrosion potential of the water at the site. The selected water sample was tested for pH, resistivity, chlorides, sulphides, sulphates, and redox potential. The test results are summarized in the following table.

Table 6.2 Corrosion Potential of Water

Sample ID	Water Sample
pH	8.16
Redox Potential (mV)	190
Resistivity (ohm-cm)	7,143
Sulphide (µg/L)	<0.01
Sulphate (µg/L)	4
Chloride (µg/L)	6

The American Water Works Association (AWWA) publication 'Polyethylene Encasement for Ductile-Iron Pipe Systems' ANSI/AWWA C105/A21.5-10 dated October 1, 2010 assigns points based on the results of the above tests. The water or soil sample that has a total point score of ten or more is considered to be potentially corrosive to ductile iron pipe. Based on the results obtained for the sample submitted, the Site water is not considered to be potentially corrosive to cast iron pipe.

Table 3 of the Canadian Standards Association (CSA) document A23.1 04/A23.2 04 'Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete' divides the degree of exposure into the following three classes:

Table 6.3 Classes of Degree of Exposure

Degree (Class) of Exposure	Water Soluble (SO4) in Soil Sample (%)
Very Severe (S-1)	> 2.0
Severe (S-2)	0.20 – 2.0
Moderate (S-3)	0.10 – 0.20

A review of the analytical test results shows the sulphate content in the tested samples was found to be less than 4 x 10 - 7 percent. Based upon the test results, the degree of exposure of the subsurface concrete structures to sulphate attack is low. Therefore, normal General use (GU) hydraulic cement can be used for the below grade concrete structures.

6.6 Pavements

Access roads are expected to be constructed over the native silty sand material. In order to prepare the site for the pavement area, it is necessary that the area be stripped of any existing cover materials such as surficial topsoil and associated root-mat, or other deleterious materials deemed unsuitable by geotechnical personnel to expose a suitable subgrade. The exposed subgrade should be proof rolled in the presence of a Geotechnical Engineer. Any areas where "soft spots", rutting, local anomalies, or appreciable deflection are noted should be excavated and replaced with suitable fill, and use of geotextiles may be warranted for strength improvement. The fill should be compacted to at least 95 percent of its MPMDD.

The pavement sections described in the table below are recommended for areas subjected to access roads. Pavement materials and workmanship should conform to the appropriate Ontario Provincial Standard Specifications (OPSS).

Table 6.4 Recommended Pavement Structure

Pavement Layer	Access Road

Table 6.4 Recommended Pavement Structure

Pavement Layer	Access Road
Granular 'A' Base Course	200 mm
Granular 'B', Type II Subbase Course	300 mm

In order to accommodate the recommended thicknesses, designers will need to review grades and determine where stripping or filling is necessary.

Drainage of the pavement layers is important. The subgrade surface and each layer of the pavement section should be provided with a suitable cross fall (approximately 2 percent) to prevent water from ponding on the pavement surface and beneath the pavement layers. Surface runoff should be directed to storm sewers, or allowed to flow into ditches.

Annual or regular maintenance will be required to achieve maximum life expectancy. Generally, the asphalt pavement maintenance will involve crack sealing and repair of local distress.

It should be noted that the pavement sections described within this report represent end-use conditions only, which includes light vehicular traffic and occasional service trucks. It may be necessary that these sections be temporarily over-built during the construction phase to withstand larger construction loadings such as loaded dump trucks or concrete trucks.

6.7 Construction Field Review

The recommendations provided in this report are based on an adequate level of construction monitoring being conducted during construction phase of the proposed dam. GHD requests to be retained to review the drawings and specifications, once complete, to verify that the recommendations within this report have been adhered to, and to look for other geotechnical problems. Due to the nature of the proposed development, an adequate level of construction monitoring is considered to be as follows:

- Prior to construction of foundation, the exposed foundation subgrade should be examined by a Geotechnical Engineer or a qualified Technologist acting under the supervision of a Geotechnical Engineer, to assess whether the subgrade conditions correspond to those encountered in the boreholes, and the recommendations provided in this report have been implemented.
- Placement of concrete should be periodically tested to ensure that job specifications are being achieved.
- Rock anchor installation should be monitored by a qualified technologist on a full-time basis to ensure that holes remain clean, and to verify that specified bond lengths are achieved.
- A program of proof and performance testing should be carried out on all anchors to ensure that they achieve the specified design capacity.

7. Limitation of the Investigation

This report is intended solely for CIMA+ or other party explicitly identified in this report, and is prohibited for use by others without GHD's prior written consent. This report is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse,

redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to GHD. Client shall defend, indemnify and hold GHD harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of Geotechnical Engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, GHD will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, GHD is the Geotechnical Engineer of record. It is recommended that GHD be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the seven boreholes and five rock probe locations only. The subsurface conditions confirmed at these test locations may vary at other locations. Soil and groundwater conditions between and beyond the 12 test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction, which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

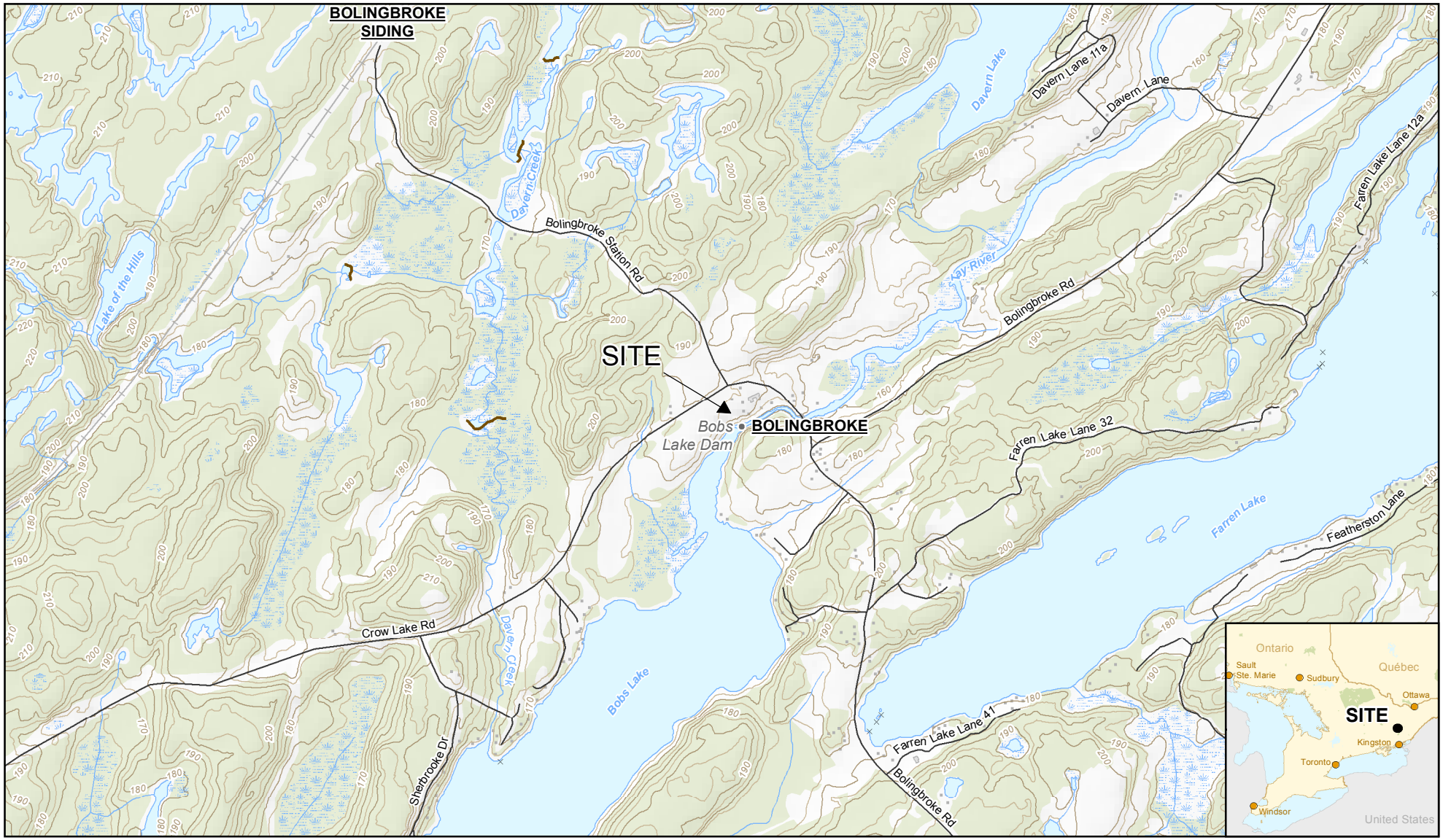
If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by GHD is completed.

All of Which is Respectfully Submitted,

GHD Limited

Bahareh Vazhbakht, M.A.Sc.

Joseph B. Bennett, P. Eng.



Source: MNRF NRVIS, 2015. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2015;
Inset Map: ESRI Data & Maps 2008 Data Distribution Application (DDA)

0 200 400 600
Meters

Coordinate System:
NAD 1983 UTM Zone 18N

CIMA + C/O PARKS CANADA
BOB'S LAKE DAM, 169 CROW LAKE ROAD, MABERLY, ON

11103700
Sep 21, 2015

SITE LOCATION MAP

FIGURE 1

GIS File: Q:\GIS\PROJECTS\11103000s\11103700\Layouts\KONC001\11103700-00(KONC001)GIS-OT001.mxd

LABEL	LAT	LONG	X_COORD	Y_COORD	COORD_TYPE
F1	44.75926	-76.52279	379479.556	4957335.701	UTM Zone 18 NAD 83
F2	44.75936	-76.52271	379485.462	4957346.454	UTM Zone 18 NAD 83
F3	44.75919	-76.52261	379493.640	4957327.674	UTM Zone 18 NAD 83
F4	44.75940	-76.52304	379460.019	4957351.300	UTM Zone 18 NAD 83
F5	44.75948	-76.52289	379471.378	4957360.690	UTM Zone 18 NAD 83
F6	44.75934	-76.52310	379454.943	4957344.798	UTM Zone 18 NAD 83
F7	44.75960	-76.52293	379468.579	4957378.493	UTM Zone 18 NAD 83
PROBE1	44.76011	-76.52390	379393.445	4957432.118	UTM Zone 18 NAD 83
PROBE2	44.75986	-76.52359	379417.305	4957403.701	UTM Zone 18 NAD 83
PROBE3	44.75976	-76.52316	379451.085	4957391.369	UTM Zone 18 NAD 83
PROBE4	44.76021	-76.52274	379485.132	4957440.965	UTM Zone 18 NAD 83
PROBE5	44.75990	-76.52284	379476.553	4957406.650	UTM Zone 18 NAD 83

0 10 20 30
Meters

Coordinate System:
NAD 1983 UTM Zone 18N

CIMA + C/O PARKS CANADA
BOB'S LAKE DAM, 169 CROW LAKE ROAD, MABERLY, ON

11103700
Feb 5, 2016

BOREHOLE LOCATION PLAN

FIGURE 2

GIS File: Q:\GIS\PROJECTS\11103000s\11103700\Layouts\001\11103700-A1(001)GIS-OT001.mxd

Appendices

Appendix A
Borehole Logs and Notes on Boreholes and Test Pits

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 1

BOREHOLE No.: F1

ELEVATION: 162.30 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 11, 2015 DATE (FINISH): August 13, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	162.30		GROUND SURFACE			%	ppm	N	
			WATER						
2.0									
	159.7		**SEDIMENTS** - silty sand, cobbles and boulders		SS1	13		12	
					SS2	100		R	
4.0					RC1	100			
	157.7		**MARBLE** - highly fractured, coarse grained calcite marble, moderately weathered, close irregular discontinuity, white to pale grey, massive, poor quality		RC2	70		37	
6.0					RC3	100		38	
					RC4	100		71	
8.0					RC5	100		31	
					RC6	100		24	
10.0	152.3		Becoming slightly weathered and pink						
	151.4		Fresh to faint weathering, very close to close discontinuity, pale grey		RC7	100		48	
12.0					RC8	100		67	
	149.6		Borehole terminated within bedrock at 12.7m						
14.0									
16.0									
18.0									
20.0									
22.0									
24.0									

NOTES:

BOREHOLE LOG 11103700-A1-BOREHOLE LOGS.GPJ INSPEC_SOL.GDT 2/5/16

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 2

BOREHOLE No.: F2

ELEVATION: 162.30 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 14, 2015 DATE (FINISH): August 14, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	162.30		GROUND SURFACE			%	ppm	N	
			WATER						
2.0	159.9		**SEDIMENTS** - silty sand, cobbles and boulders		SS1	100		R	
	158.9		**MARBLE** - highly fractured, coarse grained calcite marble, very close discontinuity, faint weathering, grey, massive, fair to poor quality		RC1	91		58	
4.0	157.8		**GNEISS** - coarse grained calcite, weakly bonded, highly weathered, unknown discontinuity, dark grey, poor quality		RC2	100		33	
	156.9		**MARBLE** - medium grained with trace pyrite, slightly weathered, extreme close discontinuity, pale grey, massive, very poor to fair quality		RC3	100		55	
6.0									
8.0					RC4	78		22	
					RC5	100		63	
10.0									
					RC6	100		60	
12.0	150.2								
	149.8		**GNEISS** - coarse grained, slightly weathered on fractures, extremely close discontinuity, massive		RC7	100		23	
	148.9		**GNEISS** - medium to fine grained, faintly weathered, extreme close to close discontinuity, pale grey, massive, very poor quality						
14.0			Borehole terminated within bedrock at 13.4m						
16.0									
18.0									
20.0									
22.0									
24.0									

NOTES:

BOREHOLE LOG 11103700-A1-BOREHOLE LOGS.GPJ INSPEC_SOL.GDT 2/5/16

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 3

BOREHOLE No.: F3

ELEVATION:

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 17, 2015 DATE (FINISH): August 17, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters			GROUND SURFACE			%	ppm	N	
			WATER						
			SEDIMENTS - silty sand, cobbles and boulders						
2.0			**MARBLE** - highly fractured, coarse grained calcite marble, faintly weathered, becoming slightly weathered, very close to close discontinuity, very poor quality, becoming fair quality between 9 to 17 m		RC1	76		16	
					RC2	100		33	
4.0					RC3	48		0	
6.0					RC4	100		7	
8.0					RC5	100		37	
					RC6	100		60	
10.0					RC7	100		63	
12.0					RC8	100		73	
14.0					RC9	100		72	
					RC10	100		68	
16.0					RC11	100		38	
18.0					RC12	77		17	
20.0					RC13	100		55	
					RC14	100		29	
22.0			Borehole terminated within bedrock at 22.0m						
24.0									

NOTES:
Inclined Borehole (45°) - Elevation 162.3m

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 4

BOREHOLE No.: F4

ELEVATION: 163.30 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 19, 2015 DATE (FINISH): August 20, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	163.30		GROUND SURFACE			%	ppm	N	
	163.2		**TOPSOIL**						
			SILTY SAND - brown, loose, moist		SS1	4		5	
					SS2	43		R	
2.0			Possible cobbles and boulders						
	160.6		**MARBLE** - highly to moderately fractured coarse grained calcite marble, slightly weathered, extremely close to close discontinuity, massive, very poor to fair quality		RC1	91		26	
4.0					RC2	77		40	
					RC3	83		0	
6.0									
					RC4	68		15	
8.0					RC5	90		42	
	154.2		Some stylolites at 15.2m, increasing quartz content, becoming fair to excellent quality						
10.0					RC6	88		62	
					RC7	100		90	
12.0					RC8	100		96	
14.0					RC9	100		95	
16.0					RC10	97		85	
					RC11	100		96	
18.0	145.1		Borehole terminated within bedrock at 18.2m						
20.0									
22.0									
24.0									

NOTES:

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 5

BOREHOLE No.: F5

ELEVATION: 166.20 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 20, 2015 DATE (FINISH): August 20, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	166.20		GROUND SURFACE			%	ppm	N	
	166.1		**TOPSOIL**						
			SILTY SAND - with cobbles, brown, compact, moist		SS1	100		R	
	164.8				RC1	100		39	
2.0			**MARBLE** - moderately fractured, coarse to medium grained calcite marble, slightly weathered to fresh, extremely close discontinuity, pale grey to grey, generally massive with gneissic banding and foliation, poor to fair quality		RC2	100		58	
4.0					RC3	100		49	
	161.3		Mineralization at 4.9m and high weathering		RC4	97		37	
6.0					RC5	100		52	
8.0					RC6	95		67	
10.0					RC7	98		61	
					RC8	100		23	
12.0	154.3		Highly fractured layer						
					RC9	92		70	
14.0					RC10	97		80	
16.0					RC11	100		95	
	149.3		Borehole terminated within bedrock at 16.9m						
18.0									
20.0									
22.0									
24.0									

NOTES:

BOREHOLE LOG 11103700-A1-BOREHOLE LOGS.GPJ INSPEC_SOL.GDT 2/5/16

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 6

BOREHOLE No.: F6

ELEVATION:

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 21, 2015 DATE (FINISH): August 21, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters			GROUND SURFACE			%	ppm	N	
			OVERBURDEN SOIL - Topsoil and silty sand with cobbles - No soil samples collected.						
8.0			**MARBLE** - highly fractured, coarse to medium grained marble, highly weathered, grey brown, very poor quality		RC1	63		10	
10.0					RC2	82		0	
			Large veins of feldspar, foliation/shist		RC3	40		0	
12.0			Moderately fractured, fine to medium grained, fresh to slightly weathered, extreme to very close fractures, pale grey, some mineralization on joints, notable around 15.8m, fair becoming excellent quality		RC4	100		55	
14.0					RC5	95		77	
16.0					RC6	97		85	
					RC7	97		83	
18.0					RC8	98		77	
20.0					RC9	100		95	
22.0			Borehole terminated within bedrock at 21.2m						
24.0									

NOTES:
Inclined Borehole (45°) - Elevation 163.3m

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 7

BOREHOLE No.: F7

ELEVATION: 174.90 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 26, 2015 DATE (FINISH): August 26, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	174.90		GROUND SURFACE			%	ppm	N	
	174.7		**TOPSOIL**		SS1	58		13	
	174.1		**SILTY SAND** - possible cobbles and boulders, brown, compact, moist		SS2	100		R	
2.0			Refusal to SPT at 0.8m						
4.0									
6.0									
8.0									
10.0									
12.0									
14.0									
16.0									
18.0									
20.0									
22.0									
24.0									

NOTES:

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 8

BOREHOLE No.: P1

ELEVATION: 177.80 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 26, 2015 DATE (FINISH): August 26, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	177.80		GROUND SURFACE			%	ppm	N	
2.0			Refusal to DCPT at 2.6m						
4.0									
6.0									
8.0									
10.0									
12.0									
14.0									
16.0									
18.0									
20.0									
22.0									
24.0									

NOTES:

BOREHOLE LOG 11103700-A1-BOREHOLE LOGS.GPJ INSPEC_SOL.GDT 2/5/16

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 9

BOREHOLE No.: P2

ELEVATION: 175.50 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 26, 2015 DATE (FINISH): August 26, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	175.50		GROUND SURFACE			%	ppm	N	
			Refusal to DCPT at 1.2m						
2.0									
4.0									
6.0									
8.0									
10.0									
12.0									
14.0									
16.0									
18.0									
20.0									
22.0									
24.0									

NOTES:

BOREHOLE LOG 11103700-A1-BOREHOLE LOGS.GPJ INSPEC_SOL.GDT 2/5/16

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 10

BOREHOLE No.: P3

ELEVATION: 173.30 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 26, 2015 DATE (FINISH): August 26, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa
meters	173.30		GROUND SURFACE			%	ppm	N	10 20 30 40 50 60 70 80 90
			Refusal to DCPT at 1.5m						
2.0									
4.0									
6.0									
8.0									
10.0									
12.0									
14.0									
16.0									
18.0									
20.0									
22.0									
24.0									

NOTES:

BOREHOLE LOG 11103700-A1-BOREHOLE LOGS.GPJ INSPEC_SOL.GDT 2/5/16

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 11

BOREHOLE No.: P4

ELEVATION: 174.20 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 26, 2015 DATE (FINISH): August 26, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- N Penetration Index based on Split Spoon sample
- N Penetration Index based on Dynamic Cone sample
- Cu Shear Strength based on Field Vane
- Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	174.20		GROUND SURFACE			%	ppm	N	
2.0			Refusal to DCPT at 2.4m						
4.0									
6.0									
8.0									
10.0									
12.0									
14.0									
16.0									
18.0									
20.0									
22.0									
24.0									

NOTES:

BOREHOLE LOG 11103700-A1-BOREHOLE LOGS.GPJ INSPEC_SOL.GDT 2/5/16

REFERENCE No.: 11103700-A1 ENCLOSURE No.: 12

BOREHOLE No.: P5

ELEVATION: 175.10 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Cima + c/o Parks Canada

PROJECT: Geotechnical Investigation - Proposed Dam Relocation/Reconstruction

LOCATION: Bob's Lake Dam, 169 Crow Lake Road, Bolingbroke, Ontario

DESCRIBED BY: J. Poisson CHECKED BY: B. Vazhbakht

DATE (START): August 26, 2015 DATE (FINISH): August 26, 2015

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa
meters	175.10		GROUND SURFACE			%	ppm	N	10 20 30 40 50 60 70 80 90
2.0			Refusal to DCPT at 2.7m						
4.0									
6.0									
8.0									
10.0									
12.0									
14.0									
16.0									
18.0									
20.0									
22.0									
24.0									

NOTES:

BOREHOLE LOG 11103700-A1-BOREHOLE LOGS.GPJ INSPEC_SOL.GDT 2/5/16

Notes on Borehole and Test Pit Reports

Soil description :

Each subsurface stratum is described using the following terminology. The relative density of granular soils is determined by the Standard Penetration Index ("N" value), while the consistency of clayey sols is measured by the value of undrained shear strength (Cu).

Classification (Unified system)

Clay	< 0.002 mm		
Silt	0.002 to 0.075 mm		
Sand	0.075 to 4.75 mm	fine	0.075 to 4.25 mm
		medium	0.425 to 2.0 mm
		coarse	2.0 to 4.75 mm
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm
		coarse	19 to 75 mm
Cobbles	75 to 300 mm		
Boulders	>300 mm		

Terminology

"trace"	1-10%
"some"	10-20%
adjective (silty, sandy)	20-35%
"and"	35-50%

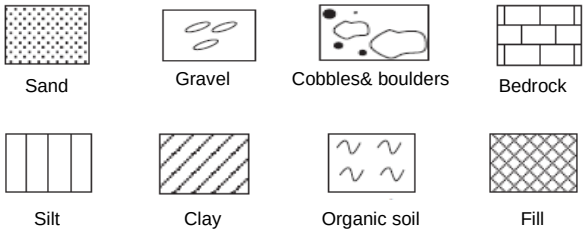
Relative density of granular soils	Standard penetration index "N" value (BLOWS/ft – 300 mm)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Consistency of cohesive soils	Undrained shear strength (Cu) (P.S.F)	(kPa)
Very soft	<250	<12
Soft	250-500	12-25
Firm	500-1000	25-50
Stiff	1000-2000	50-100
Very stiff	2000-4000	100-200
Hard	>4000	>200

Rock quality designation

"RQD" (%) Value	Quality
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

STRATIGRAPHIC LEGEND



Samples:

Type and Number

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
SSE, GSE, AGE: Environmental sampling
ST: Shelby tube
PS: Piston sample (Osterberg)
AG: Auger
RC: Rock core
GS: Grab sample

Recovery

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil

RQD

The "Rock Quality Designation" or "RQD" value, expressed as percentage, is the ratio of the total length of all core fragments of 4 inches (10 cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration
N_c: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressure meter
k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

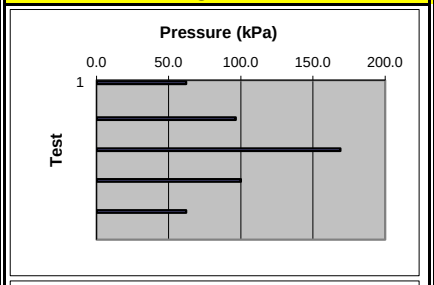
I_p: Plasticity index
W_l: Liquid limit
Wp: Plastic limit
H: Hydrometer analysis
GSA: Grain size analysis
A: Atterberg limits
w: Water content
γ: Unit weight
C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis
O.V.: Organic vapor

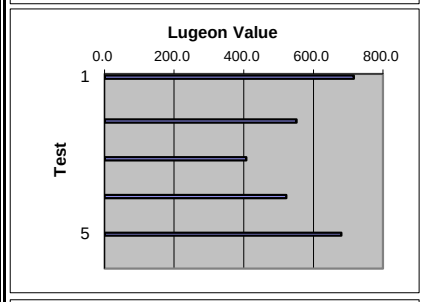
Appendix B
Lugeon Test (Packer Tests) Results

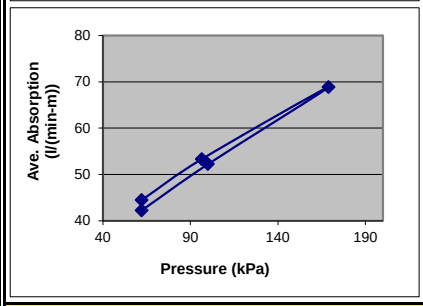
ROCK PERMEABILITY TEST RESULTS
LUGEON (PACKER) TEST METHOD

Borehole NO.:	F1
Project NO.:	11103700-A1
Test NO.:	1
Test Depth:	
Z (H) =	7.4 m (Top)
Z =	8.7 m (Bottom)

Figures







Calculations

Maxiumum Test Pressure
Pmax = 25H (kPa)
kPa to psi multiply by 0.14
psi to kPa,multiply by 6.9

Q = del B / del t

A = Q / Zbas - Zhaut

Lu = (moy. A x 1000) / P

Lugeon Value Lu =	407.5
Corresponding Pressure	169.1

Equivalent Permeability Coefficient

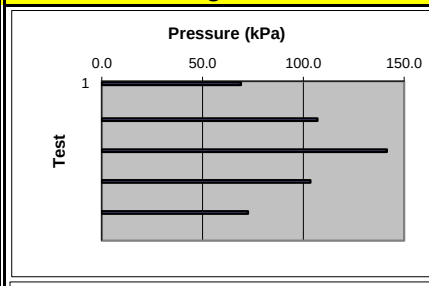
Equation

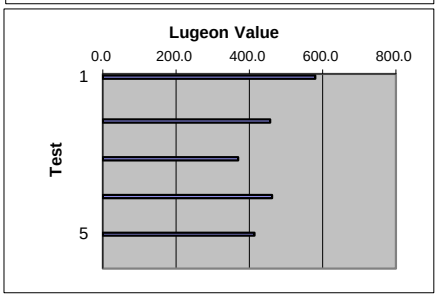
k = q / (2 x Pi x L x h) x Log_e (L / r)

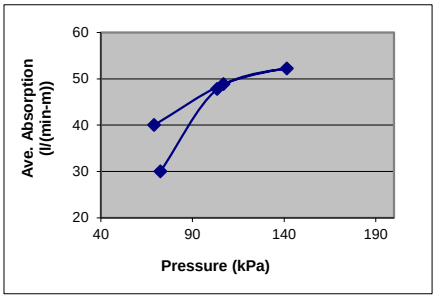
k = ***3.342E-03*** ***cm/s***

Borehole NO.:	F1
Project NO.:	11103700-A1
Test NO.:	2
Test Depth:	
Z (H) =	5.8 m (Top)
Z =	7.0 m (Bottom)

Figures







Calculations

Maxiumum Test Pressure
Pmax = 25H (kPa)
kPa to psi multiply by 0.14
psi to kPa,multiply by 6.9

Q = del B / del t

A = Q / Zbas - Zhaut

Lu = (moy. A x 1000) / P

Lugeon Value Lu =	369.2
Corresponding Pressure	141.5

Equivalent Permeability Coefficient

Equation

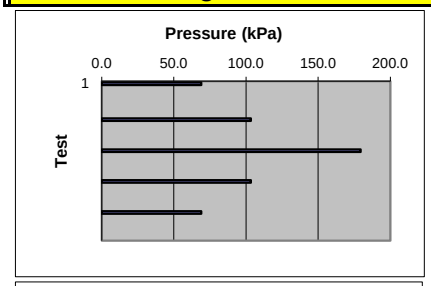
k = q / (2 x Pi x L x h) x Log_e (L / r)

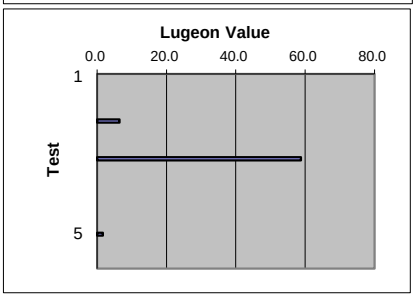
k = ***3.028E-03*** ***cm/s***

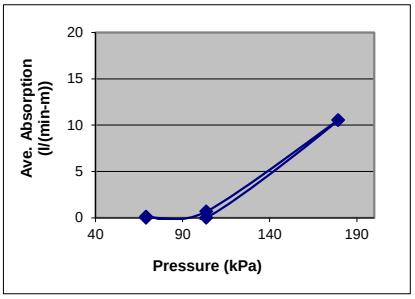
ROCK PERMEABILITY TEST RESULTS
LUGEON (PACKER) TEST METHOD

Borehole NO.:	F2
Project NO.:	11103700-A1
Test NO.:	1
Test Depth:	
Z (H) =	8.2 m (Top)
Z =	9.4 m (Bottom)

Figures







Calculations

Maxiumum Test Pressure	
Pmax = 25H (kPa)	
kPa to psi multiply by 0.14	
psi to kPa,multiply by 6.9	
Q = del B / del t	
A = Q / Zbas - Zhaut	
Lu = (moy. A x 1000) / P	
Lugeon Value Lu =	58.8
Corresponding Pressure	179.4

Equivalent Permeability Coefficient

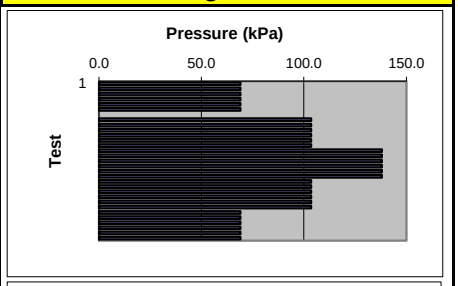
Equation

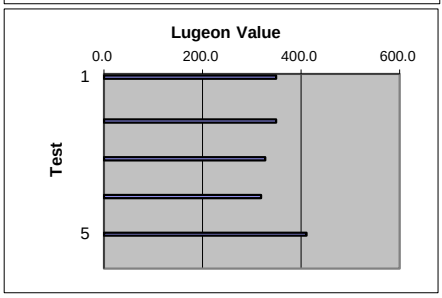
k = q / (2 x Pi x L x h) x Log_e (L / r)

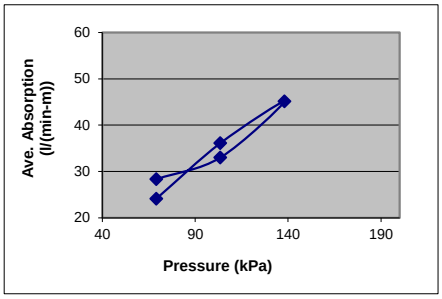
k = ***4.825E-04*** ***cm/s***

Borehole NO.:	F2
Project NO.:	11103700-A1
Test NO.:	2
Test Depth:	
Z (H) =	6.7 m (Top)
Z =	7.9 m (Bottom)

Figures







Calculations

Maxiumum Test Pressure	
Pmax = 25H (kPa)	
kPa to psi multiply by 0.14	
psi to kPa,multiply by 6.9	
Q = del B / del t	
A = Q / Zbas - Zhaut	
Lu = (moy. A x 1000) / P	
Lugeon Value Lu =	326.9
Corresponding Pressure	138.0

Equivalent Permeability Coefficient

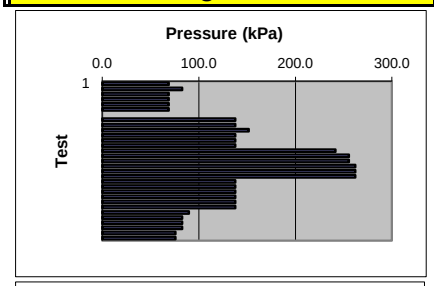
Equation

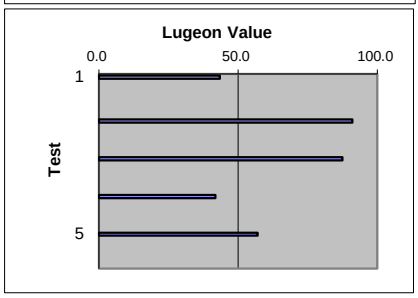
k = q / (2 x Pi x L x h) x Log_e (L / r)

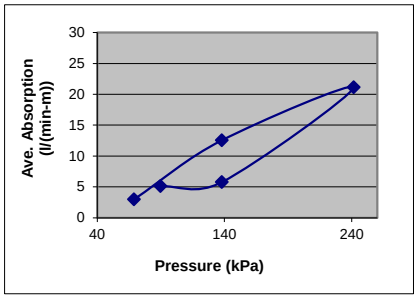
k = ***2.681E-03*** ***cm/s***

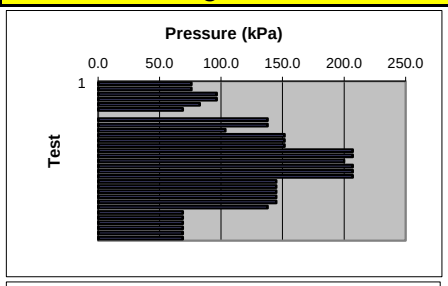
ROCK PERMEABILITY TEST RESULTS
LUGEON (PACKER) TEST METHOD

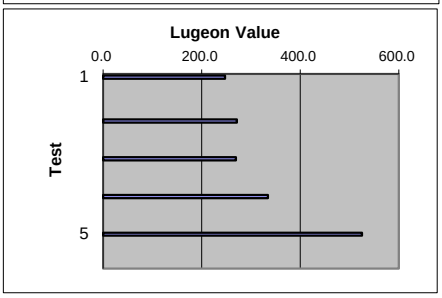
Borehole NO.:	F3		**Borehole NO.:**	F3		**Borehole NO.:**	F3	
Project NO.:	11103700-A1		**Project NO.:**	11103700-A1		**Project NO.:**	11103700-A1	
Test NO.:	1		**Test NO.:**	2		**Test NO.:**	3	
Test Depth:			**Test Depth:**			**Test Depth:**		
Z (H) =	18.5	m (Top)	Z (H) =	17.0	m (Top)	Z (H) =	15.5	m (Top)
Z =	19.8	m (Bottom)	Z =	18.2	m (Bottom)	Z =	16.7	m (Bottom)
Figures			**Figures**			**Figures**		

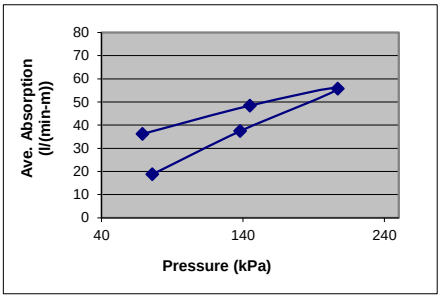


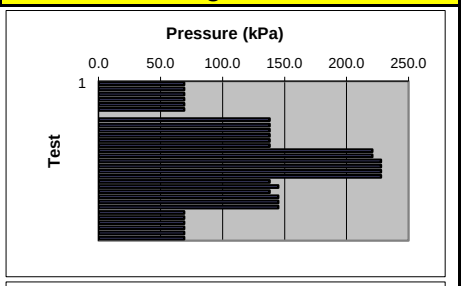


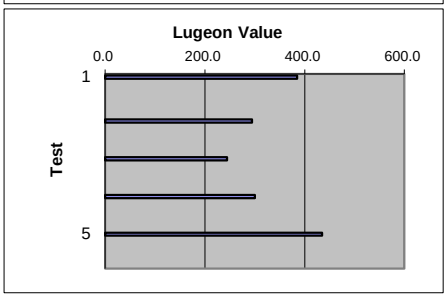


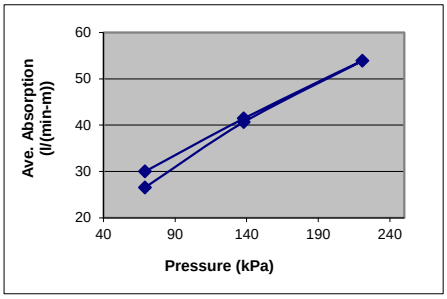








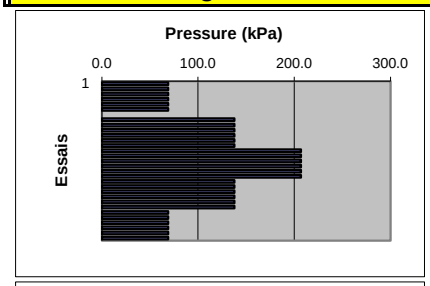


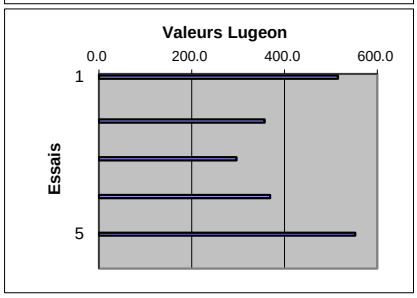


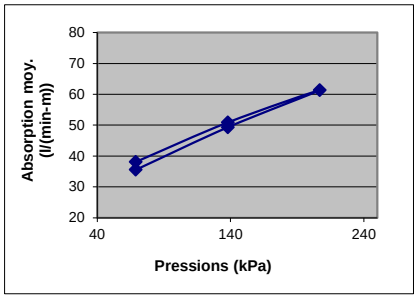
Calculations		**Calculations**		**Calculations**	
Maxiumum Test Pressure		Maxiumum Test Pressure		Maxiumum Test Pressure	
Pmax = 25H (kPa)		Pmax = 25H (kPa)		Pmax = 25H (kPa)	
kPa to psi multiply by 0.14		kPa to psi multiply by 0.14		kPa to psi multiply by 0.14	
psi to kPa,multiply by 6.9		psi to kPa,multiply by 6.9		psi to kPa,multiply by 6.9	
Q = del B / del t		Q = del B / del t		Q = del B / del t	
A = Q / Zbas - Zhaut		A = Q / Zbas - Zhaut		A = Q / Zbas - Zhaut	
Lu = (moy. A x 1000) / P		Lu = (moy. A x 1000) / P		Lu = (moy. A x 1000) / P	
Lugeon Value Lu =	87.4	Lugeon Value Lu =	269.5	Lugeon Value Lu =	244.1
Corresponding Pressure	241.5	Corresponding Pressure	207.0	Corresponding Pressure	220.8
Equivalent Permeability Coefficient		**Equivalent Permeability Coefficient**		**Equivalent Permeability Coefficient**	
Equation		*Equation*		*Equation*	
$k = q / (2 \times Pi \times L \times h) \times \log_e (L / r)$		$k = q / (2 \times Pi \times L \times h) \times \log_e (L / r)$		$k = q / (2 \times Pi \times L \times h) \times \log_e (L / r)$	
k =	***7.169E-04 cm/s***	***k =***	***2.210E-03 cm/s***	***k =***	***2.002E-03 cm/s***

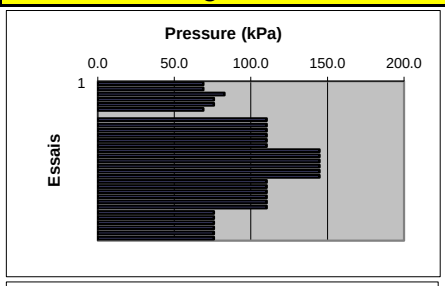
ROCK PERMEABILITY TEST RESULTS
LUGEON (PACKER) TEST METHOD

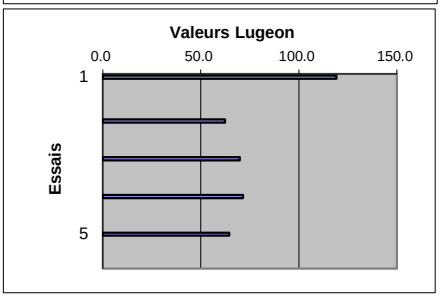
Borehole NO.:	F4		**Borehole NO.:**	F4		**Borehole NO.:**	F4	
Project NO.:	11103700-A1		**Project NO.:**	11103700-A1		**Project NO.:**	11103700-A1	
Test NO.:	1		**Test NO.:**	2		**Test NO.:**	3	
Test Depth:			**Test Depth:**			**Test Depth:**		
Z (H) =	15.5	m (Top)	Z (H) =	10.9	m (Top)	Z (H) =	7.9	m (Top)
Z =	16.7	m (Bottom)	Z =	12.1	m (Bottom)	Z =	9.1	m (Bottom)
Figures			**Figures**			**Figures**		

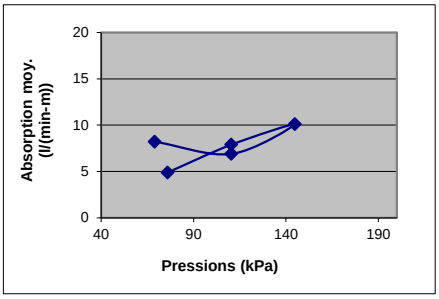


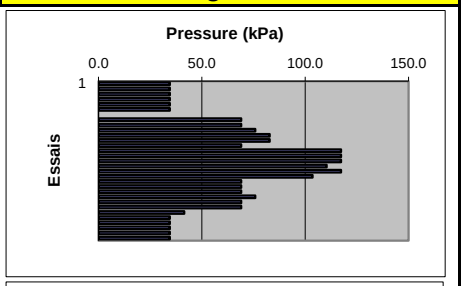


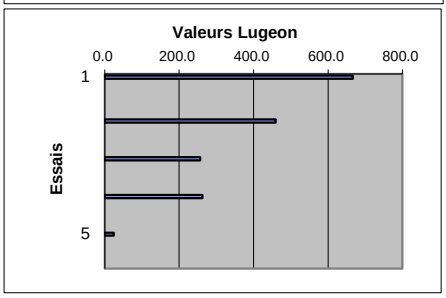


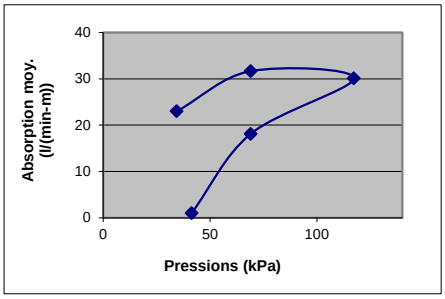








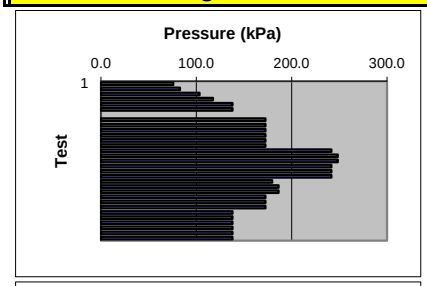


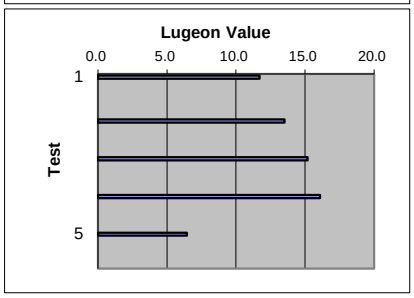


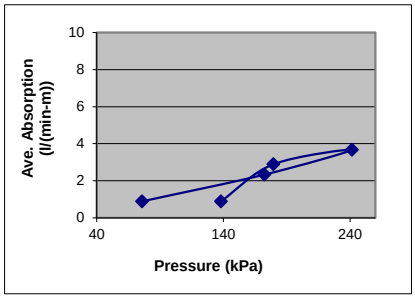
Calculations		**Calculations**		**Calculations**	
Maxiumum Test Pressure		Maxiumum Test Pressure		Maxiumum Test Pressure	
Pmax = 25H (kPa)		Pmax = 25H (kPa)		Pmax = 25H (kPa)	
kPa to psi multiply by 0.14		kPa to psi multiply by 0.14		kPa to psi multiply by 0.14	
psi to kPa,multiply by 6.9		psi to kPa,multiply by 6.9		psi to kPa,multiply by 6.9	
Q = del B / del t		Q = del B / del t		Q = del B / del t	
A = Q / Zbas - Zhaut		A = Q / Zbas - Zhaut		A = Q / Zbas - Zhaut	
Lu = (moy. A x 1000) / P		Lu = (moy. A x 1000) / P		Lu = (moy. A x 1000) / P	
Lugeon Value Lu =	296.3	Lugeon Value Lu =	69.8	Lugeon Value Lu =	256.7
Corresponding Pressure	207.0	Corresponding Pressure	144.9	Corresponding Pressure	117.3
Equivalent Permeability Coefficient		**Equivalent Permeability Coefficient**		**Equivalent Permeability Coefficient**	
Equation		*Equation*		*Equation*	
$k = q / (2 \times Pi \times L \times h) \times Log_e (L / r)$		$k = q / (2 \times Pi \times L \times h) \times Log_e (L / r)$		$k = q / (2 \times Pi \times L \times h) \times Log_e (L / r)$	
k =	***2.430E-03 cm/s***	***k =***	***5.723E-04 cm/s***	***k =***	***2.105E-03 cm/s***

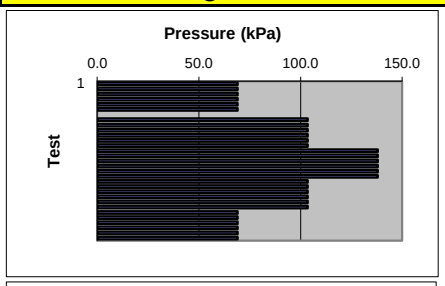
ROCK PERMEABILITY TEST RESULTS
LUGEON (PACKER) TEST METHOD

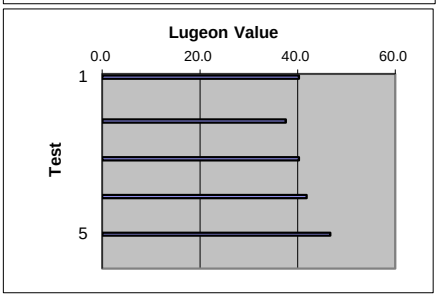
Borehole NO.:	F5		**Borehole NO.:**	F5		**Borehole NO.:**	F5	
Project NO.:	11103700-A1		**Project NO.:**	11103700-A1		**Project NO.:**	11103700-A1	
Test NO.:	1		**Test NO.:**	2		**Test NO.:**	3	
Test Depth:			**Test Depth:**			**Test Depth:**		
Z (H) =	14.1	m (Top)	Z (H) =	11.1	m (Top)	Z (H) =	8.0	m (Top)
Z =	15.5	m (Bottom)	Z =	12.3	m (Bottom)	Z =	4.2	m (Bottom)
Figures			**Figures**			**Figures**		

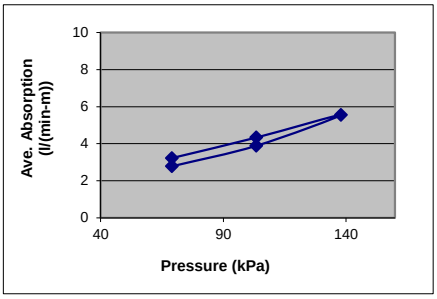


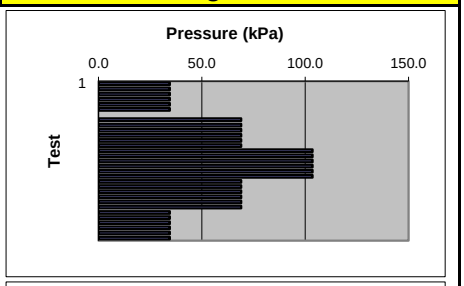


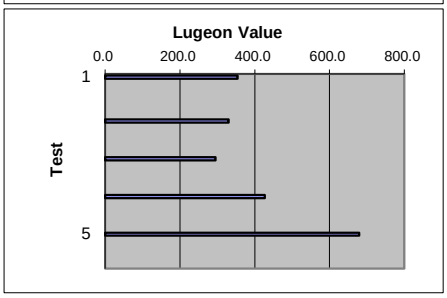


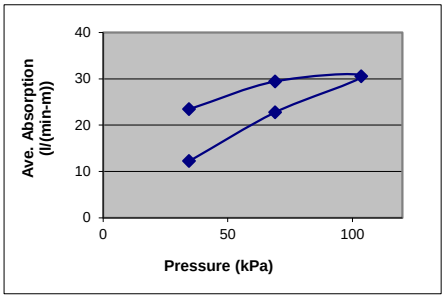








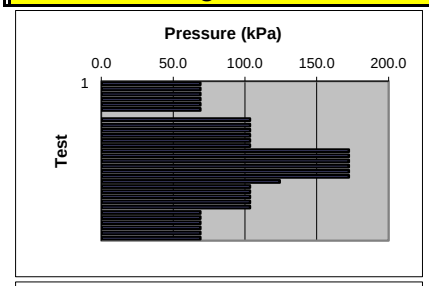


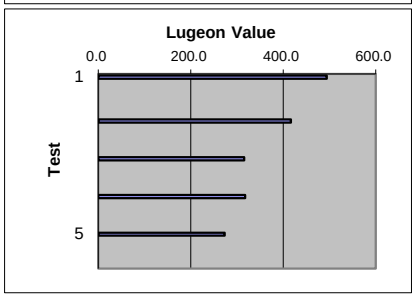


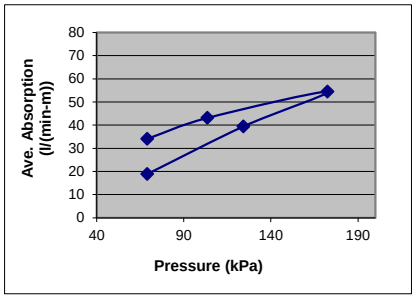
Calculations		**Calculations**		**Calculations**	
Maxiumum Test Pressure		Maxiumum Test Pressure		Maxiumum Test Pressure	
Pmax = 25H (kPa)		Pmax = 25H (kPa)		Pmax = 25H (kPa)	
kPa to psi multiply by 0.14		kPa to psi multiply by 0.14		kPa to psi multiply by 0.14	
psi to kPa,multiply by 6.9		psi to kPa,multiply by 6.9		psi to kPa,multiply by 6.9	
Q = del B / del t		Q = del B / del t		Q = del B / del t	
A = Q / Zbas - Zhaut		A = Q / Zbas - Zhaut		A = Q / Zbas - Zhaut	
Lu = (moy. A x 1000) / P		Lu = (moy. A x 1000) / P		Lu = (moy. A x 1000) / P	
Lugeon Value Lu =	15.2	Lugeon Value Lu =	40.3	Lugeon Value Lu =	295.2
Corresponding Pressure	241.5	Corresponding Pressure	138.0	Corresponding Pressure	103.5
Equivalent Permeability Coefficient		**Equivalent Permeability Coefficient**		**Equivalent Permeability Coefficient**	
Equation		*Equation*		*Equation*	
$k = q / (2 \times Pi \times L \times h) \times Log_e (L / r)$		$k = q / (2 \times Pi \times L \times h) \times Log_e (L / r)$		$k = q / (2 \times Pi \times L \times h) \times Log_e (L / r)$	
k =	***1.245E-04 cm/s***	***k =***	***3.301E-04 cm/s***	***k =***	***2.421E-03 cm/s***

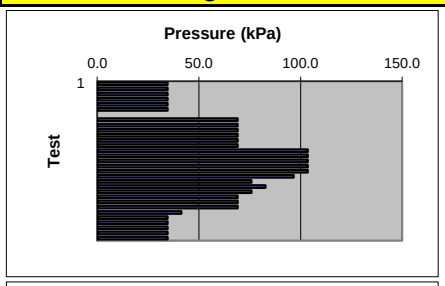
ROCK PERMEABILITY TEST RESULTS
LUGEON (PACKER) TEST METHOD

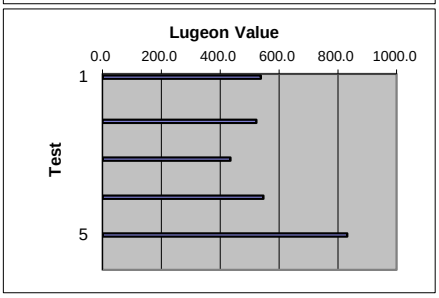
Borehole NO.:	F6	**Borehole NO.:**	F6	**Borehole NO.:**	F6
Project NO.:	11103700-A1	**Project NO.:**	11103700-A1	**Project NO.:**	11103700-A1
Test NO.:	1	**Test NO.:**	2	**Test NO.:**	3
Test Depth:		**Test Depth:**		**Test Depth:**	
Z (H) =	18.6 m (Top)	Z (H) =	14.0 m (Top)	Z (H) =	12.5 m (Top)
Z =	19.8 m (Bottom)	Z =	15.2 m (Bottom)	Z =	13.7 m (Bottom)
Figures		**Figures**		**Figures**	

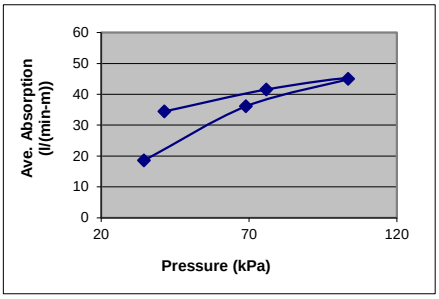


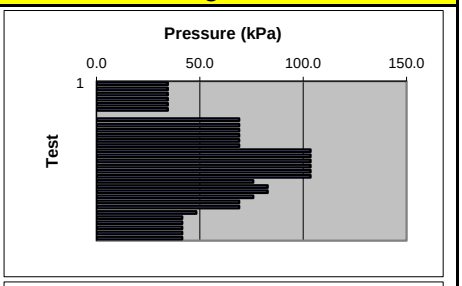


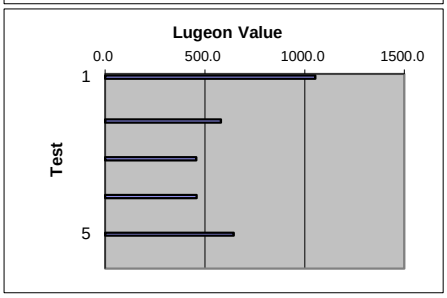


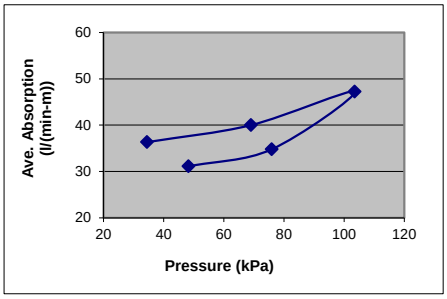












Calculations		**Calculations**		**Calculations**	
Maxiumum Test Pressure		Maxiumum Test Pressure		Maxiumum Test Pressure	
Pmax = 25H (kPa)		Pmax = 25H (kPa)		Pmax = 25H (kPa)	
kPa to psi multiply by 0.14		kPa to psi multiply by 0.14		kPa to psi multiply by 0.14	
psi to kPa,multiply by 6.9		psi to kPa,multiply by 6.9		psi to kPa,multiply by 6.9	
Q = del B / del t		Q = del B / del t		Q = del B / del t	
A = Q / Zbas - Zhaut		A = Q / Zbas - Zhaut		A = Q / Zbas - Zhaut	
Lu = (moy. A x 1000) / P		Lu = (moy. A x 1000) / P		Lu = (moy. A x 1000) / P	
Lugeon Value Lu =	315.6	Lugeon Value Lu =	434.8	Lugeon Value Lu =	456.3
Corresponding Pressure	172.5	Corresponding Pressure	103.5	Corresponding Pressure	103.5
Equivalent Permeability Coefficient		**Equivalent Permeability Coefficient**		**Equivalent Permeability Coefficient**	
Equation		*Equation*		*Equation*	
$k = q / (2 \times Pi \times L \times h) \times \log_e (L / r)$		$k = q / (2 \times Pi \times L \times h) \times \log_e (L / r)$		$k = q / (2 \times Pi \times L \times h) \times \log_e (L / r)$	
k =	***2.588E-03 cm/s***	***k =***	***3.566E-03 cm/s***	***k =***	***3.742E-03 cm/s***

Appendix C
Acoustic TeleViewer (ATV) Logs

JOB NUMBER	11102700-A1
CLIENT	Cima+ c/o Parks Canada
PROJECT	Bob's Lake Dam Relocation/Reconstruction
LOCATION	169 Crow Lake Road, Bolingbroke, Ontario
Plot Date:	2015/9/27

GHD

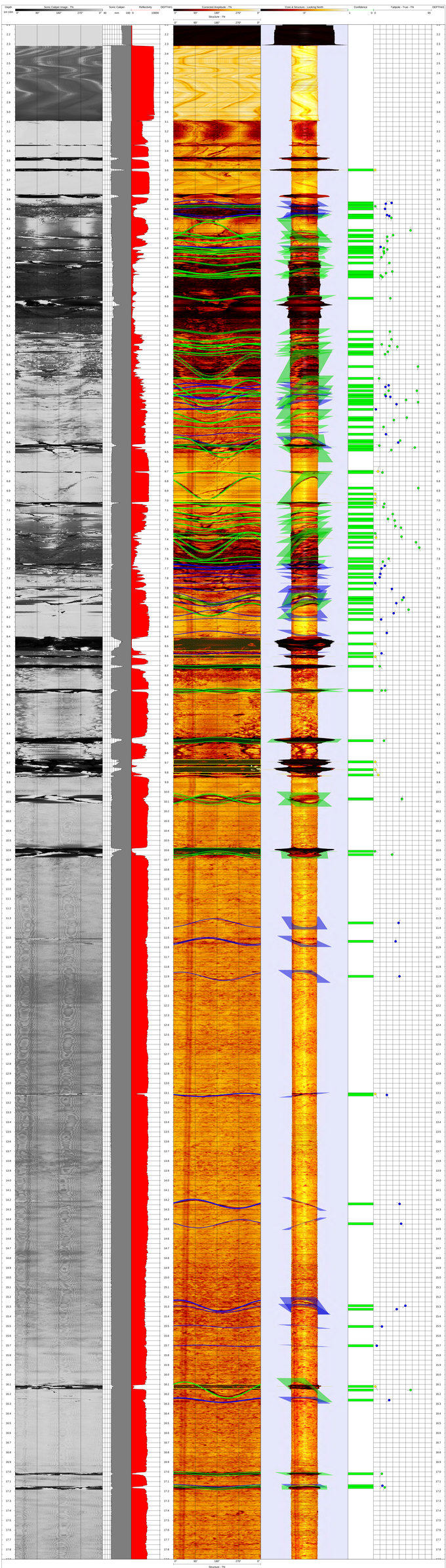
179 Colonnade Road South Suite 400
Ottawa Ontario K2E 7J4 Canada
T +1 613 727 0510 F +1 613 727 0704
W www.ghd.com

ACOUSTIC BOREHOLE IMAGER LOG

BORE HOLE NO.	F04	EASTING	379462
DRILLING METHOD	DDH CORING	NORTHING	4957351
HOLE DIAMETER	NQ (76 mm)	SURFACE ELEV'N	
DRILLED DEPTH	17.98 M	HORIZONTAL DATUM:	NAD 1983
LOGGED FROM TO	2.11 - 17.92 M	HEIGHT DATUM:	CGVD2013
LOGGED BY	N Loiom	HOLE INCLINATION	90
DATE LOGGED	21/08/2015	RUN NO.	1

Parks Canada Parcs Canada

PROCESSED BY	G Pettifer
CHECKED BY	J Rothfischer
APPROVED BY	B Vazhbakht
APPROVED DATE	2015/9/28
REVISION NO.	1



JOB NUMBER	11103700-A1
CLIENT	Cima+ c/o Parks Canada
PROJECT	Bob's Lake Dam Relocation/Reconstruction
LOCATION	169 Crow Lake Road, Bolingbroke, Ontario
Plot Date:	2015/9/27

GHD

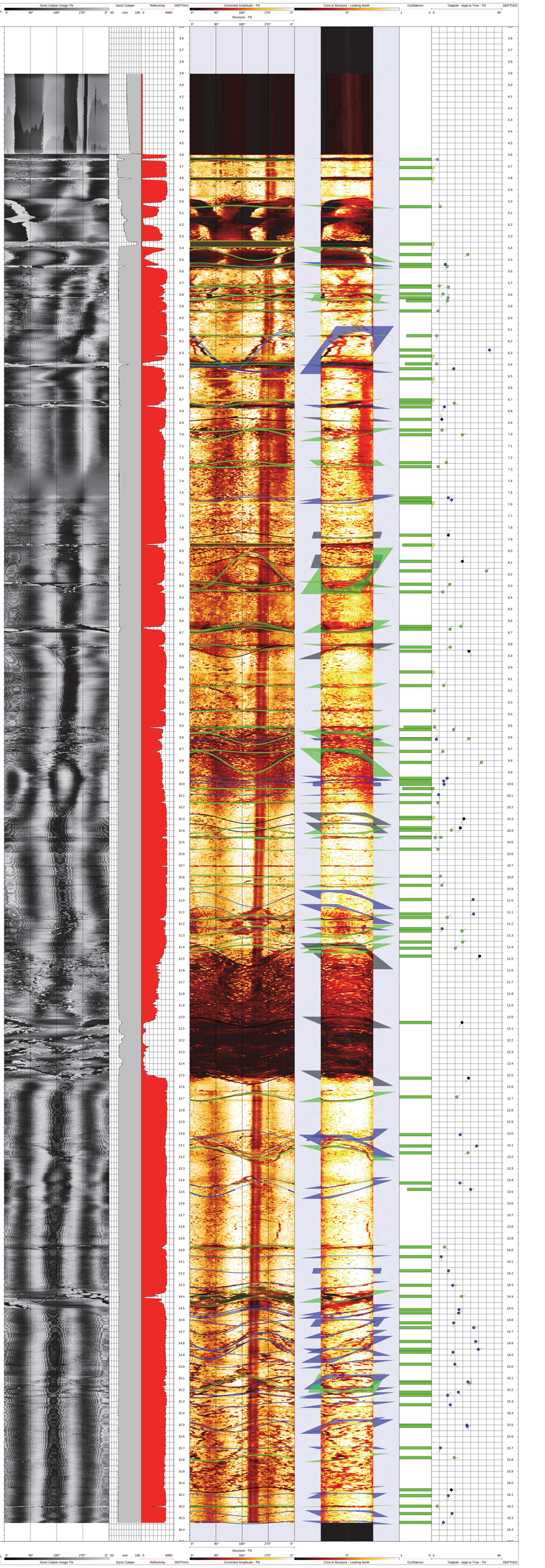
179 Colonnade Road South Suite 400
Ottawa Ontario K2E 7J4 Canada
T +1 613 727 0510 F +1 613 727 0704
W www.ghd.com

ACOUSTIC BOREHOLE IMAGER LOG

BORE HOLE NO.	F05	EASTING	379466
DRILLING METHOD	DDH CORING	NORTHING	4957362
HOLE DIAMETER	NQ (76 mm)	SURFACE ELEV'N	
DRILLED DEPTH	16.87 M	HORIZONTAL DATUM:	NAD 1983
LOGGED FROM TO	3.90 - 16.34 M	HEIGHT DATUM:	CGVD2013
LOGGED BY	N Lolom	HOLE INCLINATION	90
DATE LOGGED	21/08/2015	RUN NO.	1

Parks Canada / Parcs Canada

PROCESSED BY	G Pettifer
CHECKED BY	J Rothfischer
APPROVED BY	B Vazhbakht
APPROVED DATE	2015/9/28
REVISION NO.	1



Appendix D
Laboratory Analytical Results

POINT LOAD STRENGTH OF ROCK
(ASTM D5731)

CLIENT:	CIMA & c/o Parks Canada	**LAB No.:**	WLA 577-1
PROJECT/ SITE:	Bobs Lake Dam - Bolinbroke, ON	**PROJECT No.:**	11103700-A1
Borehole No.:	F-1	Sample No.:	RC-2
Depth, m:	4.5-6.0	Sample Description:	Rock Core

Trial #	Specimen Width W	Distance Between Platens D	Pressure Applied	Breaking Load P	Equivalent Core Diameter D_e	Point Load Strength Index I_s	Corrected Point Load Strength Index I_{s50}	Uniaxial Compressive Strength (predicted)
	mm	mm	MPa	kN	mm	MPa	MPa	MPa
1	47.0	47.0	11.6	11.0	53.0	3.9	4.0	84.3
2	47.0	47.0	6.3	6.0	53.0	2.1	2.2	52.1
3	47.0	47.0	3.7	3.5	53.0	1.2	1.3	36.1
4	47.0	30.0	5.6	5.3	42.4	2.9	2.7	61.2
5	47.0	26.5	4.8	4.5	39.8	2.8	2.5	58.0
Average	**47.0**	**39.5**	**6.4**	**6.0**	**48.3**	**2.6**	**2.5**	**58.4**

REMARKS:

PERFORMED BY:	Setareh Memarian	**DATE:**	October 2, 2015
VERIFIED BY:	Michael Braverman	**DATE:**	October 3, 2015

POINT LOAD STRENGTH OF ROCK
(ASTM D5731)

CLIENT:	CIMA & c/o Parks Canada	**LAB No.:**	WLA 577-2
PROJECT/ SITE:	Bobs Lake Dam - Bolinbroke, ON	**PROJECT No.:**	11103700-A1
Borehole No.:	F-2	Sample No.:	RC-1
Depth, m:	3.5-4.5	Sample Description:	Rock Core

Trial #	Specimen Width W	Distance Between Platens D	Pressure Applied	Breaking Load P	Equivalent Core Diameter D_e	Point Load Strength Index I_s	Corrected Point Load Strength Index I_{s50}	Uniaxial Compressive Strength (predicted)
	mm	mm	MPa	kN	mm	MPa	MPa	MPa
1	47.4	47.4	13.5	12.8	53.5	4.5	4.6	94.8
2	47.4	32.4	12.4	11.7	44.2	6.0	5.6	112.9
3	47.4	31.4	15.3	14.5	43.5	7.6	7.1	138.8
4	47.4	23.4	12.6	11.9	37.6	8.4	7.3	141.8
5	47.4	22.4	10.1	9.5	36.8	7.0	6.0	119.5
6	47.4	28.4	5.9	5.6	41.4	3.3	3.0	65.7
7	47.4	19.4	7.3	6.9	34.2	5.9	4.9	99.0
Average	**47.4**	**29.3**	**11.0**	**10.4**	**41.6**	**6.1**	**5.5**	**110.4**

REMARKS:

PERFORMED BY:	Setareh Memarian	**DATE:**	October 2, 2015
VERIFIED BY:	Michael Braverman	**DATE:**	October 3, 2015

POINT LOAD STRENGTH OF ROCK
(ASTM D5731)

CLIENT:	CIMA & c/o Parks Canada	**LAB No.:**	WLA 577-3
PROJECT/ SITE:	Bobs Lake Dam - Bolinbroke, ON	**PROJECT No.:**	11103700-A1
Borehole No.:	F-4	Sample No.:	RC-2
Depth, m:	3.5-4.5	Sample Description:	Rock Core

Trial #	Specimen Width W	Distance Between Platens D	Pressure Applied	Breaking Load P	Equivalent Core Diameter D_e	Point Load Strength Index I_s	Corrected Point Load Strength Index I_{s50}	Uniaxial Compressive Strength (predicted)
	mm	mm	MPa	kN	mm	MPa	MPa	MPa
1	47.3	47.3	13.5	12.8	53.4	4.5	4.6	95.1
2	47.3	27.8	12.4	11.7	40.9	7.0	6.3	125.1
3	47.3	21.8	15.3	14.5	36.2	11.0	9.4	178.5
4	47.3	29.8	12.6	11.9	42.4	6.6	6.1	120.7
5	47.3	26.3	10.1	9.5	39.8	6.0	5.3	107.6
Average	**47.3**	**30.6**	**12.8**	**12.1**	**42.5**	**7.0**	**6.4**	**125.4**

REMARKS:

PERFORMED BY:	Setareh Memarian	**DATE:**	October 2, 2015
VERIFIED BY:	Michael Braverman	**DATE:**	October 3, 2015

POINT LOAD STRENGTH OF ROCK
(ASTM D5731)

CLIENT:	CIMA & c/o Parks Canada	**LAB No.:**	WLA 577-4
PROJECT/ SITE:	Bobs Lake Dam - Bolinbroke, ON	**PROJECT No.:**	11103700-A1
Borehole No.:	F-5	Sample No.:	RC-2
Depth, m:	2.5-3.5	Sample Description:	Rock Core

Trial #	Specimen Width W	Distance Between Platens D	Pressure Applied	Breaking Load P	Equivalent Core Diameter D_e	Point Load Strength Index I_s	Corrected Point Load Strength Index I_{s50}	Uniaxial Compressive Strength (predicted)
	mm	mm	MPa	kN	mm	MPa	MPa	MPa
1	47.7	47.7	14.8	14.0	53.8	4.8	5.0	101.7
2	47.7	41.7	12.3	11.6	50.3	4.6	4.6	94.7
3	47.7	30.7	11.1	10.5	43.1	5.6	5.2	105.4
4	47.7	27.7	6.4	6.1	41.0	3.6	3.3	71.1
5	47.7	35.7	11.1	10.5	46.5	4.8	4.7	95.6
Average	**47.7**	**36.7**	**11.1**	**10.5**	**46.9**	**4.7**	**4.6**	**93.7**

REMARKS:

PERFORMED BY:	Setareh Memarian	**DATE:**	October 2, 2015
VERIFIED BY:	Michael Braverman	**DATE:**	October 3, 2015

Résistance à la traction par écrasement latéral sur échantillon de roc intact
ASTM D3967-05

Client : Cima+ c/o Parks Canada
N° de projet : 11103700-A1
Projet : Bobs Lake Dam, Bolingbroke, Ontario
N° d'échantillon : BH-1 / RC-3
Profondeur :

Appareils de mesure utilisés : Presse N° 500QCP9804 Vernier N° 8160

Données techniques

Diamètre (D):	47.4	47.4	(mm)
Longueur (L):	23.9	23.7	(mm)
Ratio L/D	0.50	Entre 0.20 et 0.75	
Condition d'humidité:	Dry		
Taux de chargement:	-		(MPa/min)
Type de fracture:	Shear		
Durée de l'essai	37sec	Entre 1 et 10 minutes	

Résistance en tension (Essai Brésilien) 5.8 (MPa)

Vue de l'échantillon

Avant essai

Après essai

Description macroscopique

Pinkish white medium grained quartzitic marble

Remarques :

Effectué par : F. Adenot. **Date :** October 30th, 2015

Vérifié par : B. Cyr. B. Sc. Géologie. **Date :** October 30th, 2015

Résistance à la traction par écrasement latéral sur échantillon de roc intact
ASTM D3967-05

Client : Cima+ c/o Parks Canada
N° de projet : 11103700-A1
Projet : Bobs Lake Dam, Bolingbroke, Ontario
N° d'échantillon : BH-2 / RC-1
Profondeur :

Appareils de mesure utilisés : Presse N° 500QCP9804 Vernier N° 8160

Données techniques

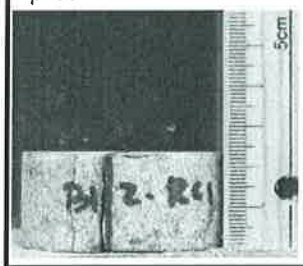
Diamètre (D):	47.3	47.3	(mm)
Longueur (L):	24.1	23.9	(mm)
Ratio L/D	0.51	Entre 0.20 et 0.75	
Condition d'humidité:	Dry		
Taux de chargement:	15187.2		(N/min)
Type de fracture:	Shear		
Durée de l'essai	1min 7sec	Entre 1 et 10 minutes	

Résistance en tension Brésilien) (Essai 10.1 (MPa)

Vue de l'échantillon

Avant essai

Après essai



Description macroscopique

Greenish white medium grained quartzitic marble

Remarques :

Effectué par : F. Adenot. **Date :** October 30th, 2015

Vérifié par : B. Cyr. B. Sc. Géologie. **Date :** October 30th, 2015

Résistance à la traction par écrasement latéral sur échantillon de roc intact
ASTM D3967-05

Client :	Cima+ c/o Parks Canada	**N° de projet :**	11103700-A1
Projet :	Bobs Lake Dam, Bolingbroke, Ontario	**N° d'échantillon :**	BH-5 / RC-2
		Profondeur :	

Appareils de mesure utilisés : Presse N° 500QCP9804 Vernier N° 8160

Données techniques

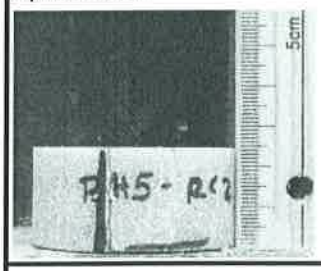
Diamètre (D):	47.4	47.4	(mm)
Longueur (L):	24.4	24.8	(mm)
Ratio L/D	0.52	Entre 0.20 et 0.75	
Condition d'humidité:	Dry		
Taux de chargement:	15271.8		(N/min)
Type de fracture:	Shear		
Durée de l'essai	1min 5sec	Entre 1 et 10 minutes	

Résistance en tension (Essai Brésilien) 9.9 (MPa)

Vue de l'échantillon

Avant essai

Après essai



Description macroscopique

White medium grained marble

Remarques :

Effectué par : F. Adenot. **Date :** October 30th, 2015

Vérifié par : B. Cyr. B. Sc. Géologie. **Date :** October 30th, 2015

Résistance à la traction par écrasement latéral sur échantillon de roc intact
ASTM D3967-05

Client :	Cima+ c/o Parks Canada	**N° de projet :**	11103700-A1
Projet :	Bobs Lake Dam, Bolingbroke, Ontario	**N° d'échantillon :**	F-4 / RC-2
		Profondeur :	

Appareils de mesure utilisés : Presse N° 500QCP9804 Vernier N° 8160

Données techniques

Diamètre (D):	47.3	47.3	(mm)
Longueur (L):	22.4	22.8	(mm)
Ratio L/D	0.48	Entre 0.20 et 0.75	
Condition d'humidité:	Dry		
Taux de chargement:	-		(N/min)
Type de fracture:	Shear		
Durée de l'essai	1min 2sec	Entre 1 et 10 minutes	

Résistance en tension (Essai Brésilien) 10.2 (MPa)

Vue de l'échantillon

Avant essai

Après essai

Description macroscopique

Greenish grey medium grained quartzite

Remarques :

Effectué par : F. Adenot. **Date :** October 30th, 2015

Vérifié par : B. Cyr. B. Sc. Géologie. **Date :** October 30th, 2015

www.ghd.com