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**SPECIFICATIONS FOR
TWELVE MILE LAKE DAM
REHABILITATION**

Issued for Construction

WSP PROJECT No: 161-05116-00

PCA PROJECT No: 1361-30029431

Revision Date: April 3, 2018

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Design Professionals:



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Project Engineer

END OF SECTION

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PART 1 - GENERAL

- 1.1 PRECEDENCE .1 For Federal Government Projects Division 1 sections take precedence over technical specifications in other Divisions.
- 1.2 RELATED SECTIONS .1 Section 01 14 00 - Work Restriction
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 35 43 - Environmental Procedures
- .4 Section 01 41 00 - Regulatory Requirements
- .5 Section 01 71 00 - Examination and Preparation
- 1.3 WORK COVERED BY CONTRACT DOCUMENTS .1 Work of this Contract is comprised of the demolition and reconstruction of the Twelve Mile Lake Dam, located in Minden, Ontario on the Gull River; and further identified as Parks Canada Project Number 4256244.
- .2 The Construction Work includes but is not limited to the following:
- .1 Demolition and removal of the existing Twelve Mile Lake Dam, including the concrete deck, the concrete piers, embedded metals, the abutments and the demolition and removal of the sill, as shown on the drawings.
- .2 Demolition and removal of the existing bridge immediately upstream of the existing Twelve Mile Lake Dam, including the bridge deck, piers, and buried supports.
- .3 Excavation and removal of earth and rock materials in the existing east abutment, as shown on the drawings.
- .4 Carefully remove, return and deliver to PCA the existing signage and railings.
- .5 New signage and railings, as shown on the drawings.
- .6 Carefully remove, return and deliver to PCA the existing Crab Winches.
- .7 New 2 Tonne Spur Gear Hand Winches are to be installed on the dam deck for operation of the new dam by the dam operators.
- .8 Manufacturing and delivery of new steel half stop-logs and log-pinning mechanisms.
- .9 Construction of a gravel parking area.
- .10 Off-site disposal of material.
- .11 Construction of temporary cofferdams to enable dewatering of the site. The design and installation of the
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- cofferdams is solely the responsibility of the Contractor. The cofferdam shall be designed in reference to crest elevations provided in the drawings for, at minimum, the 20 year return flood flow of 71 cms for the period of construction plus adequate freeboard. The Contractor is responsible for the control of water flow in the work area; disposal of excess water shall be in accordance with existing regulations and any required permits. All construction work (including cofferdam installation) to be completed with 2 sluiceways operational at all times.
- .12 Carefully remove, return and deliver to PCA all existing public safety appurtenances.
 - .13 New public safety appurtenances shown on the contract drawings including but not limited to:
 - .1 New signage and life rings/throw lines;
 - .2 Railing;
 - .3 Safety boom.
 - .14 Installation and maintenance of all environmental protection measures as well as monitoring for the effectiveness of environmental protection measures by a professional individual or firm trained and qualified to do so.
 - .15 Provision of all machinery, tools, vehicles, or other equipment required to perform the work, including on-site power if required (not supplied by PCA).
 - .16 Provision of all labour, skilled trades, supervision staff, divers, health and safety staff, sub-trades and other staff required to perform the work.
 - .17 Provisions to carry out all required permits applications and associated fees in order to complete the works.
 - .18 Removal and/or replacement of components of the existing data collection, storage and transmission system as described on the drawings.
 - .19 At the completion of the work, the site is to be restored to original or better condition.
 - .20 Provision of all surveying services required to ensure accurate lines and levels and shall also include the installation of new geodesic benchmarks on the completed dam. Confirm all elevation prior to starting any work.
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.21 Removal and reinstatement of water gauge at the upstream side of the dam, including coordination of removal with PCA operators. The area around the gauge cannot be dewatered until the gauge oil has been removed by PCA. Before the water gauge is taken offline, an alternative system (ex. staff gauge) will be installed and monitored by PCA.

1.4 CONTRACT METHOD

- .1 Lump sum and unit prices contract
- .2 Submit list of subcontractors.

1.5 WORK SEQUENCE

- .1 Construct Work in stages to accommodate the flow of water through at least one sluice over the construction period.
- .2 Construct Work in stages to minimize the need for a road closure.
- .3 Coordinate Work Schedule with Departmental Representatives.
- .4 Perform Work in a manner to maintain access routes and other operational and safety requirements for the Owner and Departmental Representative.
- .5 The Twelve Mile Lake Dam must be operational by no later than the date specified for such in Section 01 14 00 -Work Restrictions.

1.6 WORK BY OTHERS

- .1 The Contractor shall for the purpose of the Ontario Occupational Health and Safety Act and Regulation 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.

1.7 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises to the work of this project, including storage in designated areas and site access.
- .2 Allow for Owner and Departmental Representatives access.
- .3 Coordinate use of premises under direction of the Departmental Representative.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .5 Prevent injury or damage to all existing items or property which is not part of the work.

- .6 Repair or replace existing items or property which is not part of the work that are altered during construction operations to match existing or adjoining work.
 - .7 At completion of operations, the condition of existing items or property which are not part of the work to be equal to or better than before new work started.
- 1.8 OWNER OPERATION OF DAM
- .1 PCA will occupy premises during entire construction period for execution of normal dam operations.
 - .2 Provide access for PCA Representatives to operate the dam.
 - .3 Cooperate with Departmental Representative in scheduling operations to minimize conflict and to facilitate ongoing usage.
- 1.9 ALTERATIONS TO EXISTING SITE
- .1 Execute work with least possible interference or disturbance to property, operations and normal use of premises by PCA and the Departmental Representative.
- 1.10 COMMUNICATION PROTOCOL
- .1 Due to the nature of the work of ongoing water management and control issues, a communication protocol will need to be established between the Departmental Representative, the Contractor and PCA, prior to the commencement of work (i.e. during the startup meeting).
 - .2 In general terms the Communication Protocol will address:
 - .1 Daily communication related to water management and control;
 - .2 Communication related to urgent safety concerns;
 - .3 Communication related to scheduled and unscheduled PCA operation activities;
 - .4 Communication related to construction and contract issues;
 - .5 Communication with the general public.
- 1.11 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 Departmental Representative's inspection of the work for issuance of the Final Certificate of Completion.
- 1.12 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 Departmental
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Representative's approval.

- .2 No Advertising will be permitted on this project.
- .3 PCA will provide a project sign which is to be installed by the contractor.

1.13 REGULATORY REQUIREMENTS

- .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. The Contractor will not make any claim for additional compensation due to delays on commencing work due to compliance with the above.

1.14 DOCUMENTATION

- .1 Maintain on site, one copy of each document as follows:
 - .1 Work Permit,
 - .2 Contract Drawings (Full Size),
 - .3 Specifications,
 - .4 Addenda,
 - .5 Reviewed Shop Drawings,
 - .6 List of Outstanding Shop Drawings,
 - .7 Field Test Reports,
 - .8 Copy of Approved Work Schedule,
 - .9 Site Specific Health and Safety Plan,
 - .10 Environmental Protection Plan
- .2 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 ACCESS AND
EGRESS

- .1 Before bidding, the Contractor shall fully familiarize himself with access considerations of the site of the proposed work, and shall fully inform himself of the existing conditions and limitations.
- .2 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND
FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Where security is reduced by work provide temporary means to maintain security.
- .3 Contractor is responsible to provide sanitary facilities for use by Contractor's personnel and to keep facilities clean.
- .4 Closures: protect work temporarily until permanent enclosures are completed.

1.3 EXISTING
SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions at minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for personnel, and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00.

1.4 SPECIAL
REQUIREMENTS

- .1 The restriction period for in-water work is October 31 to May 31. During the restriction period, the Contractor is not permitted to engage in any activity that may cause disturbance of the watercourse bottom and dispersion of sediment. Examples of prohibited activities include in-water

- excavation, in-filling, rock/armour stone placement, in-water concrete/tremie pours, and transfer/movement of granular material or aggregate. Transfer of cofferdam between phases (e.g. sheet piles) may be permitted during the restriction period, so long as the Contractor follows all required mitigations during the restriction period. Contractor to complete the installation and removal of cofferdam supporting elements (e.g. H-Piles, anchor plates etc.) outside of the restriction period.
- .2 Stoppage of flows during the construction work will not be permitted. Two sluiceways must be maintained operational at all times, this includes during the installation, transfer and removal of cofferdams. Contractor to include provisions for safe in-water work under continuous flows.
- .3 Maintain a dry work zone at all times. Take necessary measures to seal rock faults and fractures to ensure a dry work zone.
- .4 Refer to basic impact analysis (BIA) for details of the restriction window and required mitigations.
- .5 Where possible, site clearing/commencement of construction should be planned to occur outside of sensitive bird nesting times - April 8th to August 28th. If this is not feasible, then the site must be inspected by the contractor's biologist prior to clearing, to identify any potential for nests.
- .6 Water levels can vary beyond the control of Parks Canada. The Navigation Season is typically from Victoria Day to Thanksgiving. However normal levels are as follows:
- .1 During the navigation season, the normal headwater level is 307.75 m.
 - .2 During the navigation season, the normal tailwater level is 306.50 m.
 - .3 During the non-navigation season, the normal headwater level is 307.70 m.
 - .4 During the non-navigation season, the normal tailwater level is 306.30 m.
 - .5 Historical minimums, maximums, averages and daily levels for this year can be found at: http://www.pc.gc.ca/lhn-nhs/on/trentsevern/visit/ne-wl/trent_e.asp
- .7 Carry out noise generating Work Monday to Friday from 07:00 to 20:00 hours.
- .8 Submit schedule in accordance with Section 01 32 16.07.
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- .9 Dam and bridge removal and related in-water works to be scheduled in accordance with the construction window outlined in Section 01 32 16.07.
 - .10 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
 - .11 Keep within limits of work and avenues of ingress and egress.
 - .12 Subsurface utility protection (gas and water mains):
 - .1 The use of weighted and heavy equipment loads to be distributed and bridge over subsurface utilities to prevent load impact on subsurface utilities.
 - .13 Hydro and Bell overhead wires to be protected.
 - .14 Two sluiceways on the Twelve Mile Lake Dam must be operational at all times.
 - .1 The new section of the dam must be accessible by the PCA Operators.
 - .2 The new section must have an engineered barrier installed (i.e. railings) to provide fall protection.
 - .3 The operating winches must be installed.
- 1.5 SECURITY .1 Contractor to provide means to maintain security as required by Departmental 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 SECTION INCLUDES .1 This section covers the measurement of work for payment purposes, and the scope of work included in the pay items in the Lump Sum and Unit Price Tables.
- 1.2 APPLICATIONS FOR PROGRESS PAYMENT .1 Make applications for payment on account as provided in Agreement as work progresses.
- .2 Date applications for payment last day of payment period and ensure amount claimed is for value, proportional to amount of Contract, of Work performed and products delivered to place of work at that date.
- .3 Submit to Departmental Representative, at least fourteen (14) days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Amount, so as to facilitate evaluation of applications for payment.
- .4 Time and Materials work shall not take place without written approval from the Departmental Representative and PCA. The Contractor shall notify the Departmental Representative prior to starting work.
- 1.3 SCHEDULE OF VALUES .1 Make schedule of values out in such form and supported by such evidence as Departmental Representative may reasonably direct and when accepted by Departmental Representative, be used as basis for applications for payment.
- .2 Include statement based on schedule of values with each application for payment.
- .3 Support claims for products delivered to place of work but not yet incorporated into work by such evidence as Departmental Representative may reasonably require to establish value and delivery of products.
- 1.4 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS .1 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:
- .1 Cost of material.
- .2 Delivery and unloading at site.
- .3 Installation, overhead and profit.
- .2 Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of

Values.

1.5 MEASUREMENT AND
PAYMENT PROCEDURES

- .1 Lump Sum Price Item No.1 - "General Site Work" - All work that is not specifically designated in the Lump Sum or Unit Price Tables as individual items but is indicated in the tender package in order to complete the Work in full, shall be paid under the Lump Sum Price item "General Site Work". This item includes all costs associated to perform the work including but not limited to material, equipment, personnel, travel and accommodations, overhead, etc. Items included but not limited to in the Lump Sum Price are:
- .1 Mobilization;
 - .2 Demobilization;
 - .3 Excavation, removal and disposal of all existing soil in order to complete demolition of existing structures and construction of new dam;
 - .4 Designing, installing and maintaining all temporary access routes required to access the work areas;
 - .5 Temporary shoring of Taylor Road and ON-35 in order to complete the replacement of the dam.
 - .6 Clearing and grubbing;
 - .7 Providing construction fence and perimeter security measures around work and staging areas;
 - .8 Construction facilities including portable office trailer;
 - .9 Maintaining the work/storage area for the duration of the work;
 - .10 Removal of the temporary access routes;
 - .11 Health and safety;
 - .12 Coordinating and working adjacent to overhead lines.
 - .13 Environmental Procedures, including control work to provide effective environmental, waterbody, and fish habitat protection;
 - .14 Progressive and final site cleaning including snow removal;
 - .15 Area landscaping;
 - .16 Geodesic monuments;
 - .17 Surveying services;
 - .18 Engineering services.
- .2 Lump Sum Item No.2 - Traffic Control for Temporary Roadway Closure
- .1 This item includes all costs related to:
Signage, markings, traffic routing, maintenance and any other requirement as required for temporary roadway closure.
- .3 Lump Sum Item No.3 - Cofferdam and Dewatering Works
- .1 This item includes all costs related to:
 - .1 The installation and removal of upstream

PAYMENT PROCEDURES (Cont'd)

- and downstream cofferdams, including moving the cofferdams to enable staged demolition, construction and operation of the dam.
- .2 Provisions for safe in-water work. Cofferdam installation, transfer and removal to be completed with two sluices operational at all times.
 - .3 Installation, monitoring, operation, and removal of pumps, as required to maintain dewatered work area.
 - .4 Maintain a dry work zone at all times. Take necessary measures to seal rock faults and fractures and ensure a dry work zone.
 - .5 Sediment control measures.
 - .6 Straw bale filtration dam.
 - .7 Treatment of discharge.
 - .8 All other works required to maintain dewatered work areas.
- .4 Lump Sum Item No.4 - Removal of All Existing Signage and Railings at the Site
- .1 This item includes all costs related to the removal of all existing signage and railings and handover to PCA.
 - .2 Includes delivery to a facility as directed by PCA.
- .5 Lump Sum Item No.5 - Removal of Existing Crab Winches During Staged Construction
- .1 This item includes all costs related to the removal of existing Crab Winches.
 - .2 Handover and delivery of existing Crab Winches to PCA.
- .6 Lump Sum Item No.6 - Removal for Salvage and Reuse by PCA of Components of the Existing Data Collection, Storage and Transmission System, including all costs related to:
- .1 The removal of existing gauge and protection for reinstallation.
 - .2 This item includes coordination with PCA who will remove silicon oil before the area is dewatered and before the contractor removes and reinstates the casing
- .7 Lump Sum Item No.7 - Site Restoration at the Completion of the Work
- .1 This item includes all costs related to the restoration of the site to original site conditions, unless indicated otherwise in the project drawings and specifications.
 - .2 This item includes all costs related to hydraulic seeding, topsoil placement, and any other works required to restore the site to

original site conditions.

- .8 Lump Sum Item No.8 - Manufacture, Deliver and Install Railings and Gates
 - .1 This item includes all costs related to the manufacture in accordance to PCA standards, delivery and installation of all new railings and gates shown on the project plans.
- .9 Lump Sum Item No.9 - Remove PCA Safety Boom
 - .1 The existing PCA safety boom is to be removed. This item includes all costs related to the detachment of the safety boom from the anchors.
- .10 Lump Sum Item No.10 - Supply and Install Dam Signage and Public Safety Measures
 - .1 This item includes all costs related to the manufacture and installation of new PCA standard signage and lifesaving equipment as detailed in the contract drawings.
- .11 Lump Sum Item No. 11 - Bridge Deck Removal
 - .1 This item includes all costs related to the removal and disposal of the existing bridge deck immediately north of the existing dam. Items included in the Lump Sum Price are:
 - .1 Removal and disposal of timber supports;
 - .2 Removal and disposal of existing bridge beams;
 - .3 Removal and disposal of existing steel deck and railing;
- .12 Lump Sum Item No. 12 - New PCA Safety Boom
 - .1 Supply and install a complete new safety boom. This item includes all costs related to the supply and installation of the new upstream safety boom as included in the contract drawings.
- .13 Lump Sum Item No. 13 - Installation of New Winches and Support Frames
 - .1 This item includes all costs related to the supply and installation of new winches and support frames.
- .14 Lump Sum Item No. 14 - Installation of New Steel Storage Box
 - .1 This item includes all costs related to the supply and installation of a new steel storage box
- 1.5 MEASUREMENT AND PAYMENT PROCEDURES (Cont'd)
 - .15 Unit Price Item No. 1 - Concrete Removal
 - .1 Item No. 1 shall be paid at the contract unit price by the unit cubic meter. This item

includes all costs related to removal of the existing concrete bridge piers, buried concrete structures and wingwalls, and existing concrete dam including concrete deck, abutments, and concrete piers. This item also includes all costs related to removal of the sill and complete removal of east wing wall as directed by Departmental Representative as described in Section 02 41 16 and 02 41 21. This item includes all costs related to transport and disposal of waste material off site.

- .16 Unit Price Item No. 2 - Reinforcing Steel
- .1 Item No.2 shall be paid at the contract unit price by the unit kilogram (kg). This item shall include all costs related to the work described in Section 03 20 00. Mass of reinforcing steel shall be computed from the theoretical unit mass specified in CAN/CSA-G30.18 for lengths and sizes of bars as indicated on drawings or authorized in writing by Departmental Representative.
- .17 Unit Price Item No. 3 - Cast-in-Place Concrete.
- .1 Item No.3 shall be paid at the contract unit price by the unit CUBIC meter calculated from neat dimensions indicated. This item shall include all costs related to the work described in Section 03 30 00; to supply, place and finish concrete in the construction of the:
 - .1 Sill slab,
 - .2 Piers,
 - .3 West abutment structure,
 - .4 West core wall,
 - .5 East core wall,
 - .6 Deck of the dam, and
 - .7 West approach slab
 - .2 No deductions will be made for volume of concrete displaced by reinforcing steel.
 - .3 Include in the prices of concrete the bonding agent and pre-saturation of concrete substrate.
 - .4 Include in the prices of concrete the installation of all items embedded therein.
 - .5 Include in the prices of concrete the work described in Section 03 10 00.
 - .6 Include in the prices of concrete the heating, cooling, hot and cold weather protection and extended wet curing and all additional measures described in Section 03 30 00.
 - .7 Include in the prices of concrete, specialty mix for mass concrete (greater than 500 mm) to reduce the heat of hydration and minimize thermal cracking.
 - .8 Include in the prices of concrete the supply and installation of waterstops, joint filler, bond breaker and joint sealer.

- .9 Do not include in the prices of concrete any costs related to reinforcing steel which is to be measured separately for payment.

.18 Unit Price Item No. 4 - Fill Concrete.

- .1 Item No.4 shall be paid at the contract unit price by the unit CUBIC meter calculated from field measured dimensions authorized in writing by the Departmental Representative. This item shall include all costs related to the work described in Section 03 30 00; to supply and place cast-in-place C-1 concrete at areas of rock over break or to construct a "working slab" to place reinforcement mats.

.19 Unit Price Item No. 5 - U-Fill Concrete

- .1 Item No.5 shall be paid at the contract unit price by the unit CUBIC meter calculated from neat dimensions indicated. This item shall include all costs related to the work described in Section 03 30 00; to supply and place U-Fill concrete in the west abutment structure.

.20 Unit Price Item No. 6 - Stoplog Sills

- .1 Shall be paid at the contract unit price per embedded sill. This item includes all costs related to the supply and installation of the embedded stoplog sill beams as detailed in the project drawings and specifications.

.21 Unit Price Item No. 7 - Main Stoplog Gain Embedded Parts

- .1 Shall be paid at the contract unit price per gain. This item includes all costs related to the supply and installation of the embedded stoplog gains, includes plates, channels, studs, jacking posts as detailed in the project drawings and specifications.

.22 Unit Price Item No. 8 - Downstream Service Gain Embedded Parts

- .1 Shall be paid at the contract unit price per gain. This item includes all costs related to the supply and installation of the embedded stoplog gains, includes plates, channels and studs as detailed in the project drawings and

specifications.

- .23 Unit Price Item No. 9 Upstream Stainless Steel Pier Nosing and Gain Embedded Parts
 - .1 Shall be paid at the contract unit price per pier. This item includes all costs related to the supply and installation of the steel pier nosing as described in the project drawings and specifications, including the embedded plate, Nelson studs, stoplog gain which includes plates, channels and studs as detailed in the project drawings and specifications.
- .24 Unit Price Item No. 10 - Aluminium Stoplog Gain Covers
 - .1 Shall be paid at the contract unit price per complete gain cover. This item includes all costs related to the supply and installation of the stoplog gain covers.
- .25 Unit Price Item No. 11 - HSS Log Rest
 - .1 Shall be paid at the contract unit price per linear meter. This item includes all costs related to the supply and installation of the rails.
- .26 Unit Price Item No. 12 - Pinning brackets
 - .1 Shall be paid at the contract unit price per set of two (2) pinning brackets to support the log-pinning mechanism. This item includes all costs related to the supply and installation of the jacking pins.
- .27 Unit Price Item No. 13 - Manufacture and Deliver - Log-Pinning Mechanisms
 - .1 Shall be paid at the contract unit price per log pinning mechanism. This item includes all costs related to manufacturing and delivery to site of log-pinning mechanisms.
- .28 Unit Price Item No. 14 - Manufacture and Deliver - New Steel Half Stoplogs
 - .1 Shall be paid at the contract unit price per steel half stoplog. This item includes all costs related to manufacturing of steel half stoplogs to PCA standards and delivery to site of steel half stoplogs.
- .29 Unit Price Item No. 15 - Stainless Steel Edging Around Main Gain Openings
 - .1 Shall be paid at the contract unit price per gain opening. This item includes all costs related to the manufacturing, delivery and installation of the stainless steel edging.
- .30 Unit Price Item No. 16 - Gain Crossers

- .1 Shall be paid at the contract unit price per gain crosser. This item includes all costs related to manufacturing and delivery to site of gain crosser.
- .31 Unit Price Item No. 17 - Rock Excavation
 - .1 Shall be paid at the contract unit price per metric tonne. This item includes all costs related to Rock Excavation.
- .32 Unit Price Item No. 18 - Reptile and Amphibian Exclusion Fencing
 - .1 Shall be paid at the contract unit price per linear meter. This includes all costs related to any Reptile and Amphibian Exclusion Fencing included in the Contractor`s environmental controls plan approved by the Departmental Representative and any additional Reptile and Exclusion Fencing requested by the Departmental Representative as the work progresses.
- .33 Unit Price Item No. 19 - Sediment Fencing
 - .1 Shall be paid at the contract unit price per linear meter. This includes all costs related to any sediment fencing included in the Contractor`s environmental controls plan approved by the Departmental Representative and any additional silt fencing requested by the Departmental Representative as the work progresses.
- .34 Unit Price Item No. 20 - Turbidity Curtains
 - .1 Shall be paid at the contract unit price per linear meter. This includes all costs related to any floating silt or turbidity curtains included in the Contractor`s environmental controls plan approved by the Departmental Representative and any additional curtains requested by the Departmental Representative as the work progresses.
- .35 Unit Price Item No. 21 - Coarse 75-100 mm Caliber Rip-Rap
 - .1 Shall be paid at the contract unit price per metric tonne. This item includes all costs related to the supply and installation of rip rap. Consists of new stone or the re-use and certification of rock fragments from excavation.
- .36 Unit Price Item No. 22 - Heavy 300-500 mm Caliber Rip-Rap
 - .1 Shall be paid at the contract unit price per metric tonne. This item includes all costs related to the supply and installation of rip rap. Consists of new stone or the re-use and

certification of rock fragments from excavation.

- .37 Unit Price Item No. 23 - Geotextile
 - .1 Shall be paid at the contract unit price per square meter ground area covered. This item includes all costs related to the supply and installation of geotextile.
- .38 Unit Price Item No. 24 - Granular A Fill Material
 - .1 Shall be paid at the contract unit price per metric tonne. This item includes all costs related to the supply and installation of Granular A.
- .39 Unit Price Item No. 25 - Granular B Fill Material
 - .1 Shall be paid at the contract unit price per metric tonne. This item includes all costs related to the supply and installation of Granular B.
- .40 Unit Price Item No. 26 - 19 mm Crushed Stone
 - .1 Shall be paid at the contract unit price per metric tonne. This item includes all costs related to the supply and installation of Clean Stone.

1.6 SUBSTANTIAL
PERFORMANCE OF WORK

- .1 Prepare and submit to Departmental Representative a comprehensive list of items to be completed or corrected and apply for a review by Departmental Representative to establish Substantial Performance of Work or Substantial Performance of designated portion of Work when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion thereof which Departmental Representative agrees to accept separately is substantially performed. Failure to include an item on list does not alter responsibility to complete the Contract.
- .2 Submit an application for final payment when work is completed.
- .3 Departmental Representative will, no later than ten (10) days after receipt of an application for final payment, review work to verify validity of application. Departmental Representative will give notification that application is valid or give reasons why it is not valid, no later than seven (7) days after reviewing work.
- .4 Departmental Representative will issue a Certificate of Completion and a Certificate of Measurement when application for final payment is found valid.

END OF SECTION

PART 1 - GENERAL

- 1.1 ADMINISTRATIVE
- .1 Schedule and administer project meetings throughout the progress of the work at the call of the Departmental Representative.
 - .2 Prepare agenda for meetings.
 - .3 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.
 - .4 Provide physical space and make arrangements for meetings.
 - .5 Preside at meetings.
 - .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
 - .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants, affected parties not in attendance and Departmental Representative.
 - .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.
- 1.2 PRECONSTRUCTION MEETING
- .1 Within ten (10) days after award of Contract, 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 ten 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 Health and Safety Plan
 - .3 Environmental Issues and Mitigation Measures
 - .4 Schedule of Work: in accordance with Section 01 32 16.07.
 - .5 Submittal Schedule: Submit submittals in

- accordance with Section 01 33 00.
- .6 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Sections 01 51 00 and 01 56 00.
- .7 Site security in accordance with Departmental Representative requirements.
- .8 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .9 Monthly progress claims, administrative procedures, photographs, hold backs.
- .10 Appointment of inspection and testing agencies or firms.
- .11 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work and two weeks prior to project completion, schedule progress meetings bi-weekly.
- .2 Contractor, major Subcontractors involved in Work, and the Departmental Representative are to be in attendance.
- .3 Notify parties minimum five days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three days after meeting.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Corrective measures and procedures to regain projected schedule.
 - .6 Revision to construction schedule.
 - .7 Progress schedule, during succeeding work period.
 - .8 Review submittal schedules: expedite as required.
 - .9 Maintenance of quality standards.
 - .10 Review proposed changes which affect construction schedule and completion date.
 - .11 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.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.
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1.2 REQUIREMENTS

- .1 Specified Contract completion date is September 31, 2020.
- .2 The construction window for dam demolition and removal is dependent on fish migration and spawning periods. Refer to Section 01 14 00 -Work Restrictions, for the restriction window to in-water works. The Contractor is responsible for implementing required mitigations.
- .3 Where possible, site clearing/commencement of construction should be planned to occur outside of sensitive bird nesting times; see Section 01 14 00 -Work Restrictions. If this is not feasible, then the site must be inspected by a biologist prior to clearing, to identify any potential for nests.
- .4 The contractor shall make every effort to minimize time working
- .5 in the streams or water body. Accordingly all necessary materials and equipment should be on site before proceeding with removal such that delays waiting for materials or equipment do not occur once in-stream activities have commenced.
- .6 Ensure Project Schedule is practical and remains within specified Contract duration.
- .7 Detail Project Schedule to include a breakdown of work activity.
- .8 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.
- .9 Submit Project Schedule to Departmental Representative for comment and update accordingly.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
 - .2 Submit to Departmental Representative 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 Departmental Representative within five working days of receipt of acceptance of Master Plan.
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- 1.4 MASTER PLAN .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within five working days.
- .3 Revise impractical schedule and resubmit within five working days. Accepted revised schedule will become Master Plan and be used as baseline for updates.
- 1.5 PROJECT SCHEDULE .1 Develop detailed Project Schedule derived from Master Plan and specified contract duration.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
- .1 Award.
 - .2 Permits.
 - .3 Mobilization
 - .4 Roadway closure.
 - .5 Roadway reopening.
 - .6 Installation of environmental controls.
 - .7 Dewatering sequence.
 - .8 Construction staging sequence.
 - .9 Installation of cofferdam supports.
 - .10 Demolish east cut-off wall of existing dam and east bridge piers
 - .11 Construct new east cut-off wall, east sill, east pier, centre pier, and east deck.
 - .12 Demolish east pier, deck and sill of existing dam.
 - .13 Construct west sluice of new dam including west sill, west pier and west deck.
 - .14 Demolish west side of existing dam including west deck, centre pier, and west pier.
 - .15 Construct west side of new dam including west cut-off wall, west sill, west pier and west deck.
 - .16 Removal of cofferdam supports.
 - .17 Installation of operating and safety equipment.
 - .18 Installation of railings and signage.
 - .19 Site remediation and landscaping.
 - .20 Demobilization.
 - .21 Contract Closeout.
- 1.6 PROJECT SCHEDULE REPORTING .1 Update Project Schedule on 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
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delays and impact with possible mitigation.
Contractor to resubmit updated Project Schedule to
Departmental Representative for review in case of
delays due to severe weather conditions.

.3 Updated Project Schedule is to be submitted with
every request for Progress Payment.

1.7 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.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Not used.
- 1.2 REFERENCES .1 Not used.
- 1.3 ADMINISTRATIVE .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.
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- .11 Summary of submittal requirements as a minimum:
 - .1 Project Schedule, 01 32 16.07 Section 1.3
 - .2 Monthly Photographic Documentation, 01 33 00 Section 1.7
 - .3 Site Specific Health and Safety Plan, 01 35 29.06 Section 1.2
 - .4 Site Health and Safety Reports, 01 35 29.06 Section 1.2
 - .5 MOL Reports, 01 35 29.06 Section 1.2
 - .6 Incident and Accident Reports, 01 35 29.06 Section 1.2
 - .7 Notice of project, 01 35 29.06 Section 1.3
 - .8 Environmental Protection Plan, 01 35 43 Section 1.3
 - .9 WHMIS Material Safety Data Sheets, 01 47 15 Section 1.4
 - .10 Construction Control and Monitoring Plan, 01 48 00 Section 1.6
 - .11 Pre-construction Condition Survey, 01 48 00 Section 1.9 and 31 23 33.01 Section 1.5
 - .12 Waste Reduction Workplan (WRW), 01 74 21 Section 1.1, 1.6
 - .13 Monthly WRW Reports, 01 74 21 Section 1.4
 - .14 Waste Source Separation Program (WSSP), 01 74 21 Section 1.7
 - .15 Operation Manuals, 01 78 00 Section 1.3
 - .16 Final Documents, 01 78 00 Section 1.3
 - .17 Final Survey, 01 78 00 Section 1.8
 - .18 Survey Reference Points, 02 41 16 Section 1.5
 - .19 Master Plan of Concrete Placement, 03 10 00 Section 1.4
 - .20 Joint Type Shop Drawing, 03 10 00 Section 1.4
 - .21 Formwork, 03 10 00 Section 1.4
 - .22 Reinforcing Steel Shop Drawing, 03 20 00 Section 1.5
 - .23 Mill Test, 03 20 00 Section 1.6
 - .24 Concrete Warranty Performance and Data Sheets, 03 30 00 Section 1.5
 - .25 Concrete Mix Design, 03 30 00 Section 1.5
 - .26 RMCAO Certificate, 03 30 00 Section 1.6
 - .27 Concrete QC Procedures, 03 30 00 Section 1.6
 - .28 Alkali Aggregate Testing, 03 30 00 Section 1.6
 - .29 Shrinkage Testing, 03 30 00 Section 1.6
 - .30 Cold Weather Protection Plan, 03 30 00 Section 3.5
 - .31 Hot Weather Protection Plan, 03 30 00 Section 3.6
 - .32 Metal Fabrication Shop Drawings, 05 50 00 Section 1.4
 - .33 Aggregates Product Data, 31 05 16 Section 1.4, 2.2
 - .34 Utilities Locate, 31 23 33.01 Section 1.8
 - .35 Geotextile Data Sheet, 31 32 19.01 Section 1.4 and 35 49 25 Section 1.5
 - .36 Topsoil Test Report, 32 91 19.13 Section 1.6
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- .37 Hydraulic Seeding Data Sheet, 32 92 19.16
Section 1.5
- .38 Material Sourcing, 32 94 00 Section 1.5
- .39 Dewatering System Shop Drawing, 35 20 22
Section 1.5
- .40 Sediment Control Plan, 35 49 25 Section 1.5.3
- .41 Final Cofferdam Drawings, 35 62 16 Section
1.6
- .42 Cofferdam Certification Letter, 35 62 16
Section 1.6
- .43 Cofferdam QC Plan, 35 62 16 Section 1.7

1.4 SHOP DRAWINGS AND
PRODUCT DATA

- .1 Submissions are to include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .2 After Departmental Representative's review, distribute copies.
- .3 Submit electronic copy] of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .4 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized

- manufacture of product.
- .5 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
 - .6 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
 - .7 Submit electronic copies of manufacturers' instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .8 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .9 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .10 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
 - .11 Delete information not applicable to project.
 - .12 Supplement standard information to provide details applicable to project.
 - .13 If upon review by Departmental Representative no
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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.

- .14 The review of shop drawings by Parks Canada Agency and its representatives (PCA) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PCA 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.

1.5 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
 - .2 Deliver samples prepaid to Departmental Representative's site office.
 - .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
 - .4 Where colour, pattern or texture is criterion, submit full range of samples.
 - .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative] [DCC Representative prior to proceeding with Work.
 - .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
 - .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.
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- 1.6 MOCK-UPS .1 Not used.
- 1.7 PHOTOGRAPHIC DOCUMENTATION .1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 4 locations.
.1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: monthly or as directed by Departmental Representative,
.1 Upon completion of: excavation, foundation, framing and services before concealment, of Work.
- 1.8 CERTIFICATES AND TRANSCRIPTS .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.
- 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 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .3 Canadian Standards Association (CSA).
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .4 National Building Code (NBC) 2015.
 - .1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .5 National Fire Code (NFC) 2015.
 - .1 NFC 2015, Division B, Part 2, Emergency Planning, subsection 2.8.2 Fire Safety Plan.
- .6 Province of Ontario
 - .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.0.1, as amended and O. Reg. 213/91 as amended - Updated 2005.
 - .2 Forest Fires Prevention Act of Ontario 1990, Chapter 24.
 - .3 Workplace Safety and Insurance Act, 1997.
 - .4 Municipal Statutes and authorities.
- .7 Treasury Board of Canada Secretariat (TBS):
 - .1 Treasury Board, Fire Protection Standard April 1, 2010. www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316§ion=text.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Use Parks Canada Safety Template.
- .3 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 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.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
- .11 Complete and Submit Parks Canada Attestation and Proof of Compliance with Occupational Health and Safety.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location. Contractor shall provide a written acknowledgement of this responsibility with 1 week of contract award, or prior to beginning work, whichever is sooner.
- .3 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

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

1.5 WORK PERMIT

- .1 Obtain road permits related to project prior to

- commencement of Work.
- .2 Obtain all other permits related to the project, as required, such as well decommissioning, prior to commencement of the work.
- 1.6 MEETINGS
- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.
- 1.7 REGULATORY REQUIREMENTS
- .1 Do Work in accordance with Section 01 41 00.
- .2 Comply with the Acts and Regulations of the Province of Ontario and Canada.
- .3 Comply with specified standards and regulations to ensure safe operations at site.
- 1.8 PROJECT/SITE CONDITIONS
- .1 The following are known or potential project related health, environmental and safety hazards at site which must be properly managed if encountered during course of work:
- .1 Work adjacent to streams and water.
 - .2 Working within and adjacent to roadway.
 - .3 Working in a remote location.
 - .4 Upstream leakage between stoplogs creating strong drawing force.
 - .5 Rapidly changing flows and water levels below a dam.
 - .6 Steep embankments and retaining walls may impede quick egress from dangers.
 - .7 Slippery conditions due to ice formation during winter months in and around dams.
 - .8 Unprotected gain openings on the dam present a fall hazard.
 - .9 Hazards related to working in a remote and natural area including insect, vegetation and wildlife related hazards.
 - .10 Possible tripping hazards include tracks, anchor points, and gain covers.
 - .11 Slipping hazard on upstream and downstream side of earth embankments due to steep slopes, uneven or loose soil and rocks.
 - .12 Working adjacent to overhead electrical lines.
 - .13 Above list shall not be construed as being complete and inclusive of potential health, and safety hazards encountered during work. Include above items into hazard assessment process.
- .2 For work in isolated locations Contractor to comply with Occupational Health and Safety Act, S.25 (2)(h)-Duties of employers and other applicable regulations.
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- .3 For working near, on or above a body of water Contractor to comply with Safe Boating Guide issued by Transport Canada, OHS Regulation 213/91 - Section 27, CAN/CGSB-65.7 for use of life jackets and CAN/CGSB-65.11 for use of Personal Flotation Devices (PFDs)
- .4 Provide traffic control measures when working on, or adjacent to, roadways in accordance with the "Traffic Control Manual for Roadwork Operations", Department of Transportation and Works.
- .5 Erect safety barricades, lights and signage on site to effectively delineate work areas, protect pedestrian and vehicular traffic around and adjacent to work and to create a safe working environment.
- .6 Contractor to comply with Municipal Bylaws and Owner's bylaws for the use of ATV's and side-by-side off-road vehicle on site.
- .7 For Forest Safety Worker's to show valid certificates on training in First Aid, Forest Safety, Forest Survival, Heat/Cold Stress and use of an auto-injector (EpiPen) and to comply with Occupational Health and Safety Act (OHSA).
- .8 For helicopter use, contractor to comply with applicable regulations.
- .9 For Thermal Exposure - Heat/Cold stress Contractor to comply with OHS Regulation 213/91 and other applicable regulations.
- .10 Work of this nature may involve:
 - .1 Contact with silica in concrete, concrete block and ceramic tile.
 - .2 Contact with mercury in switches, lights and thermostats.
 - .3 Contact with asbestos in pipe covering, wall shingles, gypsum board, joint compound, asphalt shingles, roof and wall felt paper.
 - .4 Contact with lead in paint, solder.
 - .5 Contact with coal, cinders, ash, nylon debris, copper, beryllium, nickel, molybdenum and PAH impacted soils.
 - .6 Contact with PCBs in ballasts.
 - .7 Contact with benzene, arsenic and acrylonitrile in paints, and adhesives.

1.9 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 Departmental Representative 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.
- .3 Relief from or substitution for any portion or provision of minimum Health and Safety Standards specified herein or reviewed site-specific. Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.10 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Contractor will be responsible and shall be designated "Constructor" as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.
- .3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.11 UNFORSEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factors, hazards, or conditions occur during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.
- .2 Follow procedures in accordance with Acts and Regulations of Province of Ontario and advise Departmental Representative verbally and in writing.

1.12 HEALTH AND SAFETY COORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have site-related working experience specific to activities associated with abatement of lead and asbestos containing material and contaminated soil.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

- .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.
- 1.13 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 Departmental Representative.
 - .1 Contractor's Safety Policy.
 - .2 Contractor's name.
 - .3 Notice of project.
 - .4 Name, trade and employer of Health and Safety Representative or Joint Health and Safety committee member.
 - .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 safety plan.
 - .11 Valid certificate of on-duty First Aider.
 - .12 WSIB "In Case of Injury at Work" poster.
 - .13 Location of toilet and clean-up facility.
- 1.14 CORRECTION OF NON-COMPLIANCE
- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
 - .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
 - .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.
- 1.15 BLASTING
- .1 Blasting or other use of explosives is not permitted.
- 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 and/or competent supervisor to stop or start Work when, at Health and Safety Coordinator and/or competent supervisor's discretion, it is necessary or advisable for reasons of health and safety. Departmental
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Representative may also stop Work for health and safety considerations.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 01 74 11 - Cleaning.
 - .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .3 Basic Impact Analysis and Environmental Standards and Guidelines will be provided to the Contractor upon contract award
- 1.2 DEFINITIONS
- .1 Environmental Pollution and Damage:
 - .1 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:
 - .1 Prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, air; biological and cultural resources and includes management of visual aesthetics; noise; solid, chemical, gaseous and liquid waste; radiant energy and radioactive material as well as other pollutants.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 33 00.
 - .2 Before commencing construction activities or delivery of materials to site, submit a site specific Environmental Protection Plan (EPP) for review and acceptance by Departmental Representative.
 - .1 Include a list of key project activities and identify the actual and potential environmental impacts associated with each activity.
 - .3 It is recommended that the qualified environmental professional(s) prepare the EMP or its component plans. EMP will detail frequency of monitoring and list high-risk construction activities.
 - .4 Environmental Protection Plan (EPP) must include comprehensive overview of known or potential environmental issues, as assessed in the BIA to be
-

addressed during construction. EPP must show consideration of early winter thaw and spring freshet conditions in the event that project timing slips into this period. EPP must demonstrate that this condition is planned for and work activities will be halted or revised accordingly. The potential environmental issues associated with the construction activities include, but are not limited to, the following:

- .1 Introduction of fines or sediment into the waterways - during placement of rock fill; rock excavation; cofferdam construction; dewatering; construction of new dam; demolition of existing dam; coffer dam removals; commissioning of new dam
- .2 Contamination of waterways due to spills - during refueling; during concrete pours or cleanout; a hydraulic line rupture; an accidental spill of lubricants
- .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .6 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Final Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations. The plan will describe water quality standards to be adhered to and frequency of monitoring on-site.
 - .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking

limits of use areas and methods for protection of features to be preserved within authorized work areas.

- .8 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .9 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .10 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .11 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .12 Waste Water Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from 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. Note that if wastewater has a pH greater than or equal to 12.5 it is considered a hazardous waste under Ontario Regulation 347. The contractor would be responsible for proper disposal.
- .13 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
- .14 Plan to include provisions for protecting species at risk (SAR), including procedures for reporting if SAR found in the project area and measures for keeping at risk turtles out of the project site (including, but not necessarily limited to, installation of reptile exclusion fencing around disturbed soils and stockpiles). Should any suspected SAR be encountered, or if there is potential to negatively impact SAR (or wildlife generally), contact Departmental Representative.

1.4 DISPOSAL AND 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.

1.5 DRAINAGE

- .1 As part of the EMP, develop and submit Erosion and Sediment Control Plan (ESC) identifying 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.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
 - .1 Water with harmful substances to be disposed in accordance with local authority, provincial and federal regulatory requirements.
- .3 Ensure pumped water into waterways or drainage systems is free of suspended materials.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority, provincial, and federal requirements.
- .5 The following factors must be considered in determining the suitability of specific erosion control practices:
 - .1 Run-off Quantity and Velocity: Dictates the suitability of products;
 - .2 Soil Characteristics: Soil texture and chemistry can affect the performance of many erosion control practices. Grain size characteristics of concrete sediment must be considered when selecting filter fabric material. Filter fabric material shall be designed around the principles of maintaining sufficient hydraulic flow and preventing particle movement through the material;
 - .3 Topography: The selection and success of erosion control practices is dependent on slope length and gradient. The ease or difficulty of diverting clean run-off around the site is dependent on the terrain and drainage patterns;
 - .4 Climate and Season
Contingency measures for extreme water events including rainfall and flooding need to be considered in the Plan.
 - .5 Temporary vs. Permanent Controls: Some erosion control practices are intended as permanent measures;

- .6 Accessibility: Some practices require access for specialized equipment (i.e. hydro-seeding);
- .7 Erosion and sediment control requirements by construction phase.

1.6 SITE CLEARING
AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated on approved site/work plans.
- .2 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .3 Minimize stripping of topsoil and vegetation. Restrict grubbing and clearing to locations previously identified in construction site plans.
- .4 Restrict tree removal in areas of work and as designated by Departmental Representative. Tree removal to be restricted to locations previously identified in construction site plans.
- .5 Do not cut new trails to complete work.

1.7 WORK ADJACENT TO
WATERWAYS

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material.
- .3 Do not dump excavated fill, waste material and debris in waterways.
- .4 Do not skid logs or construction materials across waterways.
- .5 Any stockpiled materials shall be removed from site, or stored and stabilized a safe distance away from any watercourse, drainage course, or swales to prevent erosion and subsequent entry into the water body.

1.8 IN-WATER WORK

- .1 In-water work includes in-water excavation, in-filling, rock/armour stone placement, in-water concrete/tremie pours, transfer/movement of granular material or aggregate, and the removal of existing structures. Site locations and demolition details are provided in contract drawings.
- .2 All in water work must occur within the construction timing windows outlined in Section 01 32 16.07.

- .3 All work must comply with the Fisheries Act.
- .4 The contractor shall make every effort to minimize time working in the streams or water body. Accordingly, all necessary materials and equipment should be on site before proceeding with removal such that delays waiting for materials or equipment do not occur once in-stream activities have commenced.
- .5 In water work shall be performed in a manner that minimizes the disturbance of the watercourse bottom and dispersion of sediment.
1. At the discharge point into the watercourse - i.e. the interface between the work site and the natural waterbody - a maximum increase of 8 NTU caused by suspended sediment from background levels for a short-term exposure (< 24-h period). Maximum average increase of 2 NTU from background levels for a longer term exposure. If elevated turbidity is observed Parks Canada will stop work and assess potential impact to the aquatic environment. Additional mitigation measures may be required;
 2. 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 \geq 12.5 is considered toxic and treated as a hazardous waste under Ontario Regulation 347 of the Environmental Protection Act and wastewater in this condition must be removed from the site;
 3. Additional Environmental Mitigation Measures For Placement Of Concrete:
 - a. Ensure concrete forms are tight and no flow is occurring.
 - b. Isolate area with curtain or impermeable material specified for concrete particulates; Ensure fish exclusion is followed.
 - c. Isolated area should be the minimum size required to complete task.
 - d. For concrete pours, CO₂ system must be installed and operating along the entire length of the isolated area; The tank shall be used to release carbon dioxide gas into an affected area to neutralize pH levels. Ensure sufficiently sized tanks for the concrete volumes used.
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- e. Workers shall be trained in the use of the system.
- f. Use of neutralizing acids is not permitted in the river.
- g. pH monitoring conducted inside and outside the containment area, includes measurements outside of the CO₂ line that would be treating the water.

- .6 Work should occur in the dry using appropriate dewatering procedures for the site. Dewatering procedures to be set out in EMP/EPP as applicable and accepted by Parks Canada.
- .7 Fish and wildlife stranded within the work area, particularly de-watered areas, shall be captured and released live in suitable habitat on the same side of the work area from which they were captured, and under the supervision of a qualified aquatic biologist.
- .8 It is recommended that the qualified environmental professional(s) that prepared the EMP or its component plans be available on-site for the inspection, testing and maintenance of structures, facilities, equipment and systems critical to environmental protection in order to ensure compliance with the EMP. EMP will detail frequency of monitoring and list high-risk construction activities where a qualified environmental professional must be onsite.

1.9 POLLUTION CONTROL

- .1 It is required that a qualified environmental professional(s) that prepared the EPP or its component be available for on-site for the inspection, testing and maintenance of structures, facilities, equipment and systems critical to environmental protection in order to ensure compliance with the EPP. The EPP will detail frequency of monitoring and list high-risk construction activities where a qualified environmental professional must be on-site.
- .2 No acid-bearing (containing sulphides) or limestone rock shall be used for in water works.
- .3 Maintain temporary erosion and pollution control features installed under this Contract.
- .4 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .5 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond

application area by providing temporary enclosures.

- .6 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .7 Spills of deleterious substances (includes pH readings of 9 or over):
 - .1 Immediately contain, limit spread and clean up in accordance with provincial regulatory requirements and to the satisfaction of the Departmental Representative. Documentation of remediation, testing and results must be provided to the Departmental Representative.
 - .2 Report spills with accordance to Ministry of the Environment and Climate Change. Notify the Departmental Representative and PCA of all spills.
 - .3 Further information on dangerous goods emergency clean-up and precautions including a list of companies performing this work can be obtained from Transport Canada 24 hr. collect number 613-996-666.

1.10 HISTORICAL/
ARCHAEOLOGICAL CONTROL

- .1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.
- .2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

1.11 NOTIFICATION

- .1 The Contractor shall monitor compliance with the Contractor's environmental plan, logging compliance and non-compliance issues. The log shall be presented to the Departmental Representative for review on a regular basis and after a high risk in-water activity.
- .2 Departmental Representative will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

- .3 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .4 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .5 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 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
 - .2 Ensure public waterways, storm and sanitary sewers, and roadways remain free of waste and volatile materials disposal.
 - .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
 - .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES AND
CODES

- .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 Perform Work in accordance with National Building Code of Canada (NBC), 2015, National Fire Code of Canada (NFC), 2015 and Ontario Building Code (OBC), 2012 including amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .3 Perform work in adherence to Fisheries Act, federal and provincial Species at Risk Acts, federal and provincial Environmental Protection Acts, Ontario Water Resources Act and Migratory Bird Act.
- .4 Perform work in adherence with the restrictions listed in Section 01 14 00 - Work Restrictions.
- .5 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS
MATERIAL DISCOVERY

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.3 BUILDING
SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.

1.4 RELICS AND
ANTIQUITIES

- .1 Relics and antiquities, and items of historical or scientific interest, such as cornerstones and contents, commemorative plaques, inscribed tables, and similar objects found on site shall remain the property of the Departmental Representative.

Protect such articles and request directives from
Departmental 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

<u>1.1 ABBREVIATIONS AND ACRONYMS</u>	.1	The abbreviations and acronyms are commonly found in the Project Manual and represent the associated organizations or terms.
<u>1.2 MATERIALS, EQUIPMENT AND METHODS</u>	.1	A: .1 AL: aluminum. .2 AB: anchor bolt. .3 ANOD: anodized. .4 ARCH: architecture.
	.2	B: .1 B: base. .2 BEAST: benthic assessment of sediment. .3 BH: bore hole. .4 BL: bottom layer. .5 BLK: block. .6 BLKD: bulkhead. .7 BM: beam. .8 BOT: bottom. .9 BMP: best management practice. .10 B PL: base plate. .11 BRG: bearing. .12 BTEX: benzene, toluene, ethylbenzene .13 BUR: built-up roof.
	.3	C: .1 CAL: caliper. .2 CANTIL: cantilever. .3 CB: catch basin. .4 CC: centre to centre. .5 CCN: contemplated change notice. .6 CDF: controlled density fill. .7 CEC: Canadian electrical code. .8 CHAN: channel. .9 CHS: Canadian hydrographic service. .10 CJ: construction joint. .11 CL: centreline. .12 CLG: ceiling. .13 CLR: clear. .14 COL: column. .15 CONC: concrete. .16 CONC BLK: concrete block. .17 CONC BRK: concrete brick. .18 CONT: continuous. .19 CONT J: control joint. .20 COMPL: complete. .21 CM: centimetre. .22 CPM: critical path method. .23 CT: ceramic tile. .24 C/W: complete with.

- .4 D:
 - .1 D: deep.
 - .2 DEG: degree.
 - .3 DIA: diameter.
 - .4 DIM: dimension.
 - .5 DL: dead load.
 - .6 DP: dampproofing.
 - .7 DR: door.
 - .8 DWL: dowel.

 - .5 E:
 - .1 EA: each.
 - .2 ECF: engineered containment facility.
 - .3 EE: each end.
 - .4 EF: each face.
 - .5 EL: elevation.
 - .6 ELEC: electric.
 - .7 EM: expanded metal.
 - .8 ENCL: enclosure.
 - .9 EQ: equal.
 - .10 EXH: exhaust.
 - .11 EXIST: existing.
 - .12 EXPJ: expansion joint.
 - .13 EXP STRUCT: exposed structure.
 - .14 EXT: exterior.
 - .15 EW: each way.

 - .6 F:
 - .1 FC: fuel contributed.
 - .2 FDN: foundation.
 - .3 FIN: finish.
 - .4 FL: floor.
 - .5 FLD: field.
 - .6 FR: frame.
 - .7 FTG: footing.

 - .7 G:
 - .1 GALV: galvanized steel.
 - .2 GC: General Conditions.
 - .3 GF: ground floor.

 - .8 H:
 - .1 HDW: hardware.
 - .2 HDWD: hardwood.
 - .3 HOR: horizontal.
 - .4 HOR EF: horizontal each face.
 - .5 HP: hydro pole.
 - .6 HT: height.

 - .9 I:
 - .1 ID: inside diameter.
 - .2 INS: insulation.

 - .10 J:
 - .1 JT: joint.
-

- .11 L:
.1 LG: long.
.2 LL: live load.
- .12 M:
.1 MAS: masonry.
.2 MAS FL: masonry flashing.
.3 MAX: maximum.
.4 MECH: mechanical.
.5 MET: metal.
.6 MET DK: metal deck.
.7 MET FL: metal flashing.
.8 MET GRTG: metal grating.
.9 MH: maintenance hole.
.10 MIN: minimum.
.11 MO: masonry opening.
.12 MWP: membrane waterproofing.
- .13 N:
.1 NBC: National Building Code.
.2 NF: near face.
.3 NFC: National Fire Code.
.4 NIC: not in contract.
.5 NRC: noise reduction coefficient.
.6 NRP: non removable pin.
.7 NTS: not to scale.
- .14 O:
.1 OBC: Ontario Building Code
.2 OC: on centre.
.3 OD: outside diameter.
.4 OPNG: opening.
.5 OPR: operator.
.6 OVHD: overhead.
.7 OWSJ: open web steel joist.
- .15 P:
.1 P: prefinished.
.2 PAH: polynuclear aromatic hydrocarbons.
.3 PARG: parging.
.4 PCC: precast concrete.
.5 PL: plate.
.6 PLYWD: plywood.
.7 PR: pair.
.8 PREFAB: prefabricated.
.9 PRFL: profile.
.10 PT: preservative treated (wood).
.11 PVC: polyvinyl chloride.
- .16 R:
.1 R: radius.
.2 RC: reinforced concrete.
.3 REINF: reinforced/reinforcing.
.4 REQD: required.
.5 REQT: requirement.
-

- .6 RM: room.
 - .7 RO: rough opening.
 - .8 RWL: rain water leader.

 - .17 S:
 - .1 SAN SEW: sanitary sewer.
 - .2 SCHED: schedule.
 - .3 SCRN: screen.
 - .4 SECT: section.
 - .5 SL: sliding.
 - .6 SPEC: specification.
 - .7 SS: stainless steel.
 - .8 STD: standard.
 - .9 STL: steel.
 - .10 STL BM: steel beam.
 - .11 STC: sound transmission class.
 - .12 STL FL DK: steel floor deck.
 - .13 STL PL: steel plate.
 - .14 STN: stone.
 - .15 STR: structure or structural.
 - .16 ST SEW: storm sewer.
 - .17 S&U: stain and urethane.
 - .18 S&V: stain and varnish.

 - .18 T:
 - .1 T: top.
 - .2 T&B: top and bottom.
 - .3 TCB: turbidity control plan.
 - .4 TEL: telephone.
 - .5 THKNS: thickness.
 - .6 THR: threshold.
 - .7 TOPG: topping.
 - .8 TRANSV: transverse.
 - .9 TYP: typical.

 - .19 U:
 - .1 U: urethane.
 - .2 UCUT: undercut.
 - .3 UGRD: underground.
 - .4 UNO: unless noted otherwise.
 - .5 UOS: unless otherwise specified.
 - .6 U/S: underside.
 - .7 UR: urinal.
 - .8 UTM: universal transverse mercator

 - .20 V:
 - .1 VERT: vertical.
 - .2 VERT EF: vertical each face.

 - .21 W:
 - .1 WD: wood.
 - .2 WHMIS: workplace hazardous materials information system.
 - .3 WP: waterproofing.
 - .4 WSIB: workplace safety and insurance board.
 - WT: weight.
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1.3 STANDARDS
ORGANIZATIONS

- .1 Standards writing organizations:
- .1 AA - Aluminum Association.
 - .2 ACPA - American Concrete Pipe Association.
 - .3 ANSI - American National Standards Institute.
 - .4 ASHRAE - American Society of Heating and Refrigerating and Air-Conditioning Engineers.
 - .5 ASTM - American Society for Testing and Materials.
 - .6 AWI/AWMAC - Architectural Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada.
 - .7 AWPA - American Wood Preservers' Association.
 - .8 AWWA - American Water Works Association.
 - .9 BHMA - Builders Hardware Manufacturers Association.
 - .10 CCA - Canadian Construction Association.
 - .11 CCDC - Canadian Construction Documents Committee.
 - .12 CCMPA - Canadian Concrete Masonry Producers Association.
 - .13 CGSB - Canadian General Standards Board.
 - .14 CNTA - Canadian Nursery Trades Association.
 - .15 CPCA - Canadian Painting Contractors Association.
 - .16 CRCA - Canadian Roofing Contractors Association.
 - .17 CSA - Canadian Standards Association.
 - .18 CSC - Construction Specifications Canada.
 - .19 CSDMA - Canadian Steel Door Manufacturers Association.
 - .20 CSI - Construction Specifications Institute.
 - .21 CSSBI - Canadian Sheet Steel Building Institute.
 - .22 CRCA - Canadian Roofing Contractors Association.
 - .23 DHI - Door and Hardware Institute.
 - .24 EEMAC - Electrical and Electronic Manufacturer's Association of Canada.
 - .25 ESA - Electrical Safety Authority.
 - .26 FCC - Fire Commissioner of Canada.
 - .27 FSC - Forest Stewardship Council.
 - .28 GANA - Glass Association of North America.
 - .29 HMMA - Hollow Metal Manufacturers Association.
 - .30 IEEE - Institute of Electrical and Electronics Engineers Inc.
 - .31 ISO - International Organization for Standardization.
 - .32 IWFA - International Window Film Association.
 - .33 LEED - LEED Canada, Leadership in Energy and Environmental Design.
 - .34 MPI - Master Painters Institute.
 - .35 NAAMM - National Association of Architectural Metal Manufacturers.
 - .36 NCPI - National Clay Pipe Institute.

- .37 NEMA - National Electrical Manufacturers Association.
- .38 NFPA - National Fire Protection Association.
- .39 OPSD - Ontario Provincial Standard Drawings.
- .40 OPSS - Ontario Provincial Standard Specifications.
- .41 PPI - Plastics Pipe Institute.
- .42 SDI - Steel Door Institute.
- .43 SCAQMD - South Coast Air Quality Management District.
- .44 TIA - Telecommunications Industry Association.
- .45 TIAC - Thermal Insulation Association of Canada.
- .46 TTMAC - Terrazzo Tile and Marble Association of Canada.
- .47 UL - Underwriters Laboratories.
- .48 ULC - Underwriters Laboratories of Canada.
- .49 US EPA - United States Environmental Protection Agency.
- .50 WH - Warnock Hersey.

1.4 FEDERAL GOVERNMENT
DEPARTMENTS AND AGENCIES

- .1 Departments, agencies and crown corporations.
 - .1 CEAA - Canadian Environmental Assessment agency.
 - .2 CSC - Correctional Service Canada.
 - .3 CRA - Canada Revenue Agency.
 - .4 DND - Department of National Defence.
 - .5 EC - Environment Canada.
 - .6 FHBRO - Federal Heritage Buildings Review Office.
 - .7 HC - Health Canada.
 - .8 HCD - Heritage Conservation Directorate.
 - .9 LC - Labour Canada.
 - .10 PC - Parks Canada.
 - .11 PWGSC - Public Works and Government Services Canada.
 - .12 RCMP - Royal Canadian Mounted Police.
 - .13 TBS - Treasury Board Secretariat.
 - .14 TC - Transport Canada

<u>1.5 PROVINCIAL GOVERNMENT DEPARTMENTS AND AGENCIES</u>	.1	MOEE - Ontario Ministry of Environment and Energy.
	.2	MOL - Ontario Ministry of Labour.
	.3	MTO and MOT - Ontario Ministry of Transportation.
	.4	MNRF - Ontario Ministry of Natural Resources and Forestry.
<u>1.6 INTERNATIONAL GOVERNMENT DEPARTMENTS AND AGENCIES</u>	.1	DOHMH - New York City Department of Health and Mental Hygiene, USA.
	.2	GSA - Government Services Administration, USA.
<u>1.7 UNITS OF MEASURE (METRIC)</u>	.1	The following abbreviations of units of measure commonly found in the Project Manual:
	.1	cm: centimetre.
	.2	kg: kilogram.
	.3	kg/m ³ : kilogram per cubic metre.
	.4	kN: kilonewton.
	.5	kPa: kilopascals.
	.6	kW: kilowatts.
	.7	l/s: litre per second.
	.8	m: metre.
	.9	m ³ : cubic metre.
	.10	mg/kg: milligrams per kilogram.
	.11	mg/L: milligrams per litre.
	.12	mm: millimetres.
	.13	MPa: megapascal.
	.14	NTU: nephelometric turbidity unit.
	.15	ppm: parts per million.
	.16	ug/L: micrograms per litre.
	.17	ug/m ³ : micrograms per cubic metre.
<u>1.8 UNITS OF MEASURE (IMPERIAL)</u>	.1	The following abbreviations of units of measure commonly found in the Project:
	.1	F: Fahrenheit.
	.2	ft: foot/feet.
	.3	ga: guage.
	.4	gpm: gallons per minute.
	.5	in: inches.
	.6	lbs: pounds.
	.7	NTU: nephelometric turbidity unit.
	.8	psi: pounds-force per square inch.
	.9	ppm: parts per million.
<u>PART 2 - PRODUCTS</u>		
<u>2.1 NOT USED</u>	.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.
- 1.2 INSPECTION
- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
 - .2 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
- 1.3 INDEPENDENT INSPECTION AGENCIES
- .1 Independent Inspection/Testing Agencies may be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by PCA.
 - .2 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.
- 1.4 ACCESS TO WORK
- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
 - .2 Co-operate to provide reasonable facilities for such access.
- 1.5 REJECTED WORK
- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents at no additional cost to PCA.
 - .2 Make good other Contractor's work damaged by such removals or replacements promptly.
-

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 PRECEDENCE .1 For Federal Government Projects, Division 01 Sections take precedence over technical specifications in other Divisions of this Project Manual.
- 1.2 RELATED REQUIREMENTS .1 Section 01 35 43 : Environmental Procedures
- 1.3 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 Environmental Choice Program
- .1 CCD-016-[97(R2005)], Thermal Insulation Materials.
- .2 CCD-020-[95(R2007)], Gypsum Wallboard.
- .3 CCD-029-[96], Water Conserving Products.
- .4 CCD-045-[95], Sealant and Caulking Compounds.
- .5 CCD-046-[95], Adhesives.
- .6 CCD-047-[98(R2005)], Architectural Surface Coatings.
- .7 CCD-048-[95(R2006)], Surface Coatings - Recycled Water-Borne.
- .8 CCD-127-[95], Recycled Plastic Products.
- .9 CCD-144-[2003], Naturally-Derived Phenol Substitutes.
- .10 CCD-150-[2004], Steel for Use in Construction Products.
- .11 CCD-152-[2001(R2005)], Flooring Products.
- .12 CCD-167-[2007], Mosaic Tiles.
- .3 Forest Stewardship Council (FSC)
- .1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.
- .4 Green Seal Environmental Standards (GS)
- .1 GS-03-[97], Environmental Criteria for Anti-Corrosive Paints.
- .2 GS-11-[11], Standard for Paints and Coatings.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00.
- .2 Submittals required:
- .1 Submit name and experience of Green Design Co-ordinator to Departmental Representative for approval.
- .2 Compliance Report indicating requirement to purchase energy efficient and environmentally benign products.
- .3 Use Report indicating understanding of
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requirement to use materials and methods of construction, which improve energy and water efficiency, reduce hazardous by-products, and use recycled materials, or materials, which can be reused.

- .3 Submit 2 copies of WHMIS MSDS in accordance with Section [01 35 29.06 - Health and Safety Requirements] [01 35 43 - Environmental Procedures]. Indicate VOC emissions, prior to installation or use:
 - .1 Adhesives.
 - .2 Caulking compounds.
 - .3 Sealants.
 - .4 Insulating materials.
 - .5 Paints.
 - .6 Floor and wall patching or levelling materials.
 - .7 Lubricants.
 - .8 Clear finishes for wood surfaces.
- .4 Construction Schedule:
 - .1 Submit schedule of construction prior to start of work, in co-ordination with scheduling requirements, including:
 - .1 Sequence of finish applications and allowances for curing times.
 - .2 Identification of finish types.
 - .3 Delivery schedules of manufactured materials which are anticipated to off-gas in timely manner, which will allow for airing of those materials prior to their scheduled installation.

1.5 HAZARDOUS MATERIALS

- .1 Follow methods and procedures specified in Section 02 81 01 - Hazardous Materials.
- .2 Take measures to ensure chemical spills do not enter drains.
- .3 Provide proper storage and containment of herbicides and indoor pesticides.
 - .1 Design and construction of storage spaces for hazardous materials in accordance with authorities having jurisdiction.
 - .2 Include ventilation of areas, which contain potential sources of air contamination.
 - .1 Comply with standards for storage of flammable, combustible and hazardous materials, explosives, compressed gas cylinders, and reactive, corrosive and oxidizing materials.
 - .3 Storage conditions, ventilation requirements, construction materials storage areas, containers, drums and tanks, compatibility issues, and labelling: in accordance with federal and municipal guidelines supplemented

as follows:

- .1 Confine storage of chemicals and hazardous wastes to designated areas with security of access.
- .2 Ensure access to hose bib and water for mixing concentrated chemicals.
- .3 Include containment to prevent spills from entering drains.
- .4 Include venting to exterior.
- .5 Keep storage areas under negative pressure, where possible.

1.6 SITE MANAGEMENT

- .1 Enhancing ecological value of site by maintaining the native vegetation along the waterway

1.7 EROSION AND SEDIMENTATION CONTROL

- .1 Follow methods and procedures specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Establish long-term soil stabilization program as indicated.
- .3 Develop an Erosion and Sedimentation Control Plan to control stormwater runoff and other erosion measures.
- .4 Protect stockpiled topsoil.

1.8 REDUCING SITE DISTURBANCES

- .1 When building is on a previously undeveloped site comply with following requirements:
 - .1 Avoid major alterations to sensitive topography, vegetation and wildlife habitat in areas indicated.
 - .2 Create traffic patterns, which cause minimum site disruptions, as per Departmental Representative's approval.
- .2 Minimize disturbances to watershed using site water management measures to ensure that watersheds and groundwater will be preserved.
- .3 Construct and erect erosion barriers to locations indicated and as directed by Departmental Representative.
- .4 Take measures to avoid soil compaction.
- .5 Re-grade and plant vegetation in accordance with Sections 32 91 19.13 - Topsoil Placement and Grading and 32 92 19.16 - Hydraulic Seeding.

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- 1.9 GENERAL CONSTRUCTION MATERIALS/PRACTICES .1 Materials and Resources
- .1 Use uncontaminated demolition materials for fill and hardcore and/or granular base.
 - .2 Incorporate reused building materials as indicated.
 - .3 Use products and services that meet criteria of EcoLogo guidelines.
 - .4 Provide list of non-endorsed products and services, provided the green labelled product or services are capable of meeting specified performance requirements.
- .2 Construction Waste Management
- .1 Follow recommendations and requirements of this projects construction, renovation and demolition (CRD) waste management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Recycled Content
 - .1 Use materials with post-consumer and post-industrial recycled content.
 - .3 Local/Regional Materials
 - .1 Use systems and materials having 10 %, by cost, of total products or materials manufactured within 800 kilometers if transported by truck or 2400 kilometers if transported by rail or water of project site.
 - .4 Wood
 - .1 Use lumber sourced from independently certified well-managed forests in accordance with CAN/CSA-Z809 or FSC or SFI
- 1.10 PAINTS, STAINS, AND VARNISHES .1 Use paints and coatings with VOC limits to CCD-047.
- 1.11 SEALANTS, ADHESIVES AND COMPOUNDS .1 Use adhesives with VOC limits to CCD-046.
- .2 Use sealant products with VOC limits to CCD-045.
- 1.12 EXTERIOR SITE .1 Take measures to prevent soil erosion before, during, and after construction by controlling storm-water runoff and wind erosion. Use:
- .1 Detention ponds.
- .2 Infiltration trench.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

- .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 to discuss the CCM plan, report format, report frequencies, emergency report and distribution list.

1.7 GROUNDWATER WELL
MONITORING

- .1 The Departmental Representative will be undertaking a monitoring program of the drinking wells of the adjacent properties. The program will include sampling and testing of water and water levels prior to commencement of work and during the construction and post-construction phases.

- .2 Result of the initial sampling and sampling during the construction and post-construction phases will be shared with the Contractor.

- .3 If water quality changes during the construction phase of the project, the Contractor will be advised. The Contractor will be required to immediately stop work and take appropriate measures to reduce or eliminate water quality problems

1.8 TURBIDITY CONTROL
AND DRAINAGE WATER

- .1 The Contractor shall undertake quality (turbidity) monitoring of any discharge water to a receiving stream as part of their final Sediment and Erosion Control Plan as set out in Section 01 35 43 and 35 42 19.

1.9 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 Departmental Representative, 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 50 metres from laydown area. As a minimum, the following properties and structures are to be surveyed:
 - .1 Adjacent properties: cottages upstream and downstream of the dam.
 - .2 Coordinate survey with the Departmental Representative.
- .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 report their findings to the Township/Municipality and Departmental Representative. Repair and make good any damage to the satisfaction of the Local Authorities and the Departmental Representative.
- .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

- Contractor shall monitor vibration levels, and shall not exceed the established safe level to preclude damage to the adjacent structures.
- .3 The vibration monitoring equipment shall be capable of:
 - .1 Continuously record peak particle velocity.
 - .2 Providing permanent record of the entire vibration event.
 - .3 Providing an alarm when vibration limit exceed the established safe vibration level.
 - .4 Remotely monitored by the Monitoring Engineer.
 - .4 Copies of all vibration records and associated construction activities (sheet pile driving/vibrating, concrete demolition work, excavation of frozen ground, and operation of heavy construction equipment) data shall be provided to the Design Engineer and Departmental Representative on a daily basis.
 - .5 Reporting:
 - .1 The Monitoring Firm shall provide a written record of findings including new data and its interpretation including other figures and graphs. The record shall be continuous and shall be provided within 24 hours of the measurements being taken.
 - .2 The Contractor Design and Monitoring Engineer shall provide recommendations based on the findings to the Departmental Representative.
 - .3 The report shall be clear and concise and be acceptable to the Departmental Representative.
 - .4 Action requirements by the Contractor shall be clearly defined with schedule of implementation.
 - .5 An addendum to the report shall be made by the Monitoring Engineer based on the result of the action taken by the Contractor to address the construction issue.
 - .4 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 and Departmental Representative of the situation. Provide and implement remedial action to rectify the situation. Obtain written permission from Departmental Representative prior to resuming construction activities.
-

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 01 52 00 - Construction Facilities.
- 1.2 SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00.
- 1.3 INSTALLATION AND REMOVAL .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use and restore site to original conditions or better.
- 1.4 DEWATERING .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
- .1 Also in accordance with Section 01 35 43.
- 1.5 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 facilitate progress of work and provide adequate ventilation to meet health regulations for safe working environment.
- .4 Ventilating:
- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .5 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
- .1 Conform to applicable codes and standards.
- .2 Enforce safe practices.
-

- .3 Prevent abuse of services.
- .4 Prevent damage to finishes.
- .5 Vent direct-fired combustion units to outside.

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

1.6 TEMPORARY POWER
AND LIGHT

- .1 There is no lighting or power supply on site. Provide and pay for temporary power during construction for temporary lighting and operating of power tools.
- .2 Provide and maintain temporary lighting throughout project.
- .3 Access to private power supply on neighboring property is prohibited without prior arrangements being made with the private owner. Any requests for use of the private owner's property or facilities not explicitly indicated in these specifications and/or on the contract drawings must be approved first by the Departmental Representative. Do not contact the private owner directly.
- .4 Power distribution lines are located near site but there are no utility poles in the immediate vicinity of the dam. Where tying into municipal power supply advise Departmental Representative and contact the applicable jurisdictional power utility authorities.

1.7 WATER SUPPLY

- .1 There is no running water supply of any kind, potable or otherwise on site. No drilled well exists.
 - .2 Provide and pay for potable water supply for cast-in-place concrete works. Do not draw water from water course for concrete work.
 - .3 Water may be drawn from river and in fact may be encouraged for other activities on the job site such as cleaning, or watering of grassed areas during establishment period. Where drawing water from river, first advise Departmental Representative of intended use for approval. Where deemed unacceptable, potable water must be used.
 - .4 Ensure any water supply is filtered and treated to a potable state. Unfiltered and untreated water drawn from another water source may introduce foreign contaminants, organisms or invasive plants or species which may be an ecological threat to the site environment.
-

- 1.8 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 without exception.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

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

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 01 51 00 - Temporary Utilities.
 - .2 Section 01 56 00 - Temporary Barriers and Enclosures.
- 1.2 SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00.
- 1.3 INSTALLATION AND REMOVAL
- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
 - .2 Identify areas which have to be 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 and restore site to original conditions or better.
- 1.4 SCAFFOLDING
- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- 1.5 HOISTING
- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
 - .2 Hoists to be operated by qualified operator.
- 1.6 SITE STORAGE/LOADING
- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with equipment, debris piles, and removable bins outside of pre-approved staging area determined in advance of Work.
- 1.7 CONSTRUCTION PARKING
- .1 Parking will be permitted on site provided it does not disrupt the use of the facilities.
 - .2 The site area is limited and the Contractor must arrange and pay for any additional storage or work areas that are needed to complete the work.

- .3 Provide and maintain adequate access to project site.
 - .4 Clean areas where used by Contractor's equipment.
 - .5 Provide snow removal during progress of work as required for access to project site.
- 1.8 SECURITY
- .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays and for duration of project completion.
- 1.9 OFFICES
- .1 Provide a temporary portable office trailer for use as a site office by the Departmental Representative:
 - .1 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.
 - .2 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
 - .3 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
 - .4 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10 % upward light component.
 - .5 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.
 - .6 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.
 - .7 Maintain in clean condition.
 - .8 Provide internet connection.
 - .2 Provide marked and fully stocked first-aid case in a readily available location.
 - .3 Contractor and subcontractors to provide their own offices as necessary.
 - .4 Location of offices to be coordinated with the Departmental Representative.
- 1.10 LIVING FACILITIES
- .1 Living facilities and meals to be arranged by the Contractor.

1.11 EQUIPMENT,
TOOL AND MATERIALS
STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials. Storage space on site is very limited. Keep materials, tools and equipment within approved designated areas. Plan material deliveries or waste removals in a manner to limit site storage requirements.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities and private operator's site operations.

1.12 SANITARY
FACILITIES

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

1.13 CONSTRUCTION
SIGNAGE

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

1.14 PROTECTION AND
MAINTENANCE OF
TRAFFIC

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

.1 Also in accordance with Section 01 14 00.

.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. Consider spring load restrictions in planning deliveries to site.

.1 Also in accordance with Section 01 14 00.

.6 Do not construct new access trails or haul roads.

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

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

.9 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.

.10 Provide snow removal during period of Work.

1.15 CLEAN-UP

.1 Remove debris, waste materials, from work site daily to waste disposal staging area.

.2 Clean dirt or mud tracked onto paved or surfaced roadways and restore roadways to original conditions or better.

.3 Store materials resulting from demolition activities that are salvageable and removed from work site daily to waste disposal staging area.

.4 Stack stored new or salvaged material.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 TEMPORARY
EROSION AND
SEDIMENTATION CONTROL

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

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

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

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Not Used.
- 1.2 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 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.
- .3 Canadian Standards Association (CSA International)
.1 CSA-O121-[M1978(R2013)], Douglas Fir Plywood.
- .4 Ontario Ministry of Natural Resources (OMNR)
.1 Reptile and Amphibian Exclusion Fencing: Best Practices, Version 1.0. Species at Risk Branch Technical Note. [2013]
- 1.3 INSTALLATION AND REMOVAL .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.
- 1.4 HOARDING .1 As a minimum. erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on center. It is preferred that a modular fencing system is used for the work area. Provide one lockable truck gate. Maintain fence in good repair.
- .2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.
- 1.5 GUARD RAILS AND BARRICADES .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and deck of dam.
- .2 Provide as required by governing authorities.
- 1.6 REPTILE EXCLUSION FENCING .1 Erect temporary reptile exclusion fences as directed by the Departmental Representative per OMNR Best Practices 2013.
- 1.7 WEATHER ENCLOSURES .1 Design enclosures to withstand wind pressure and snow loading.
-

- 1.8 DUST TIGHT SCREENS .1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.
- 1.9 ACCESS TO SITE .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.
- 1.10 PUBLIC TRAFFIC FLOW .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.
- 1.11 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 PROTECTION OF BUILDING FINISHES .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.
- 1.14 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for 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 marks on top of the new dam structure 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 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 PCA'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 Departmental Representative and PCA.
- 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 Departmental Representative.
- .3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .4 Require surveyor to replace control points in accordance with original survey control.
- 1.6 SURVEY REQUIREMENTS .1 Establish two permanent benchmarks on site, referenced to established benchmarks 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 and sill elevations.
- 1.7 EXISTING SERVICES .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 5 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.
- 1.8 RECORDS .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations, 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 Departmental Representative
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform 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 RELATED REQUIREMENTS .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .2 Section 02 81 01 - Hazardous Materials
- 1.2 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 United States Environmental Protection Agency (USEPA)
- .1 EPA 833-F-11-006 - Stormwater Best Management Practices: Concrete Washout [2012]
- 1.3 PROJECT CLEANLINESS .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Clear snow and ice from access to work site; remove from site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Dispose of waste materials and debris at designated dumping areas off site.
- .8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
-

- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- .13 Collect, retain and dispose all the concrete washout water (or washwater) and solids in leak proof containers in accordance with:
 - .1 EPA 833-F-11-006 - Stormwater Best Management Practices: Concrete Washout (attached);
 - .2 Section 01 74 21 Construction/Demolition Waste Management and Disposal; and
 - .3 Section 02 81 01 - Hazardous Materials.

1.4 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
 - .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
 - .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
 - .4 Remove waste products and debris including that caused by Owner or other Contractors.
 - .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
 - .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
 - .7 Clean and polish hardware, stainless steel, and mechanical and electrical fixtures.
 - .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, walls, and deck.
 - .9 Clean lighting reflectors, lenses, and other
-

lighting surfaces.

- .10 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .11 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .12 Remove dirt and other disfiguration from exterior surfaces.
- .13 Sweep and wash clean concrete areas.
- .14 Clean equipment and fixtures to sanitary condition.
- .15 Clean drainage systems.
- .16 Remove snow and ice from access to dam.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for 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 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PCA's waste management goal and Contractor's proposed Waste Reduction Workplan for Construction, Renovation and /or Demolition (CRD) waste to be project generated.
- .2 Carefully deconstruct and source separate materials/equipment and divert waste destined for landfill to maximum extent possible.
- .3 Reuse, recycle, compost, burn or sell material for reuse except where indicated otherwise. On site sales are not permitted.
- .4 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.
- .5 Protect environment and prevent environmental pollution damage.

1.2 RELATED SECTIONS

- .1 Section 01 35 29.06 - Health and safety requirements.
- .2 Section 01 35 43 - Environmental procedures.
- .3 Section 01 41 00 - Regulatory requirements.
- .4 Section 01 74 11 - Cleaning.
- .5 Section 02 41 21 - Removals.
- .6 Section 02 81 01 - Hazardous Materials

1.3 REFERENCES

- .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 Reference Standards:
 - .1 Ontario Ministry of Environment:
 - .1 Ontario 3 R's Regulations (regulation 102/94) for waste management programs applicable to construction and demolition projects greater than 2,000 m².
 - .2 Ontario Environmental Protection Act (EPA)
 - .1 Regulation 102/94, Waste Audits

- .2 and Waste Reduction Workplans.
- .2 Regulation 103/94, Source Separation Programs.
- .3 Public Works and Government Services Canada (PWGSC)
 - .1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Prepare and submit following prior to project start-up:
 - .1 One copy and one electronic copy of completed Waste Audit (WA).
 - .2 One copy and one electronic copy of completed Waste Reduction Workplan.
- .3 Written monthly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.
- .4 Registration of activities on the Ontario Hazardous Waste Information Network (HWIN), if applicable.

1.5 WASTE AUDIT (WA)

- .1 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 separate wastes.
 - .2 Source separate the following waste:
 - .1 Cement and concrete.
 - .2 Corrugated cardboard.
 - .3 Wood.
 - .4 Steel.

1.6 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare and submit WRW (Schedule B) at least 10 days prior to project start-up.
- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations.
- .3 WRW should include but not limited to:
 - .1 Applicable regulations.
 - .2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
 - .3 List of approved Disposal Facilities
 - .4 List of approved Haulers
 - .5 Destination of materials identified.
 - .6 Deconstruction/disassembly techniques and schedules.

- .7 Methods to collect, separate, and reduce generated wastes.
- .8 Location of waste bins on-site.
- .9 Security of on-site stock piles and waste bins.
- .10 Protection of personnel, sub-contractors.
- .11 Clear labelling of storage areas.
- .12 Details on materials handling and removal procedures.
- .13 Recycler and reclaimer requirements.
- .14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
- .15 Requirements for monitoring on-site wastes management activities.

- .4 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project.

1.7 WASTE SOURCE
SEPARATION PROGRAM (WSSP)

- .1 As part of Waste Reduction Workplan, prepare a WSSP prior to project start-up.
 - .2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.
 - .3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.
 - .4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
 - .5 Locate containers to facilitate deposit of materials without hindering daily operations.
 - .6 Locate separated materials in areas which minimizes material damage.
 - .7 Clearly and securely label containers to identify types/conditions of materials accepted and assist in separating materials accordingly.
 - .8 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.
 - .9 On-site sale of salvaged materials is not permitted.
-

1.8 USE OF SITE AND FACILITIES

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility and provide temporary security measures approved by Departmental Representative.

1.9 WASTE PROCESSING SITES

- .1 Province of Ontario:
 - .1 Ministry of Environment and Energy, 135 St. Clair Avenue West, Toronto ON M4V 1P5.
Telephone: 1-800-565-4923 or 416-323-4321
Fax: 416-323-4682
 - .2 Recycling Council of Ontario, 215 Spadina Ave. #225, Toronto ON M5T 2C7.
Telephone: 416-657-2797
Fax: 416-960-8053
Email: rco@rco.on.ca
Website: <http://www.rco.on.ca/>
- .2 Contractor responsible for accessing a licensed/approved landfill site for both hazardous and nonhazardous materials. Submit location of the licensed landfill site to Departmental Representative for review.

1.10 QUALITY ASSURANCE

- .1 After award of Contract, a mandatory site examination will be held for this Project for Contractor responsible for renovation demolition/deconstruction waste management.
 - .1 Date, time and location will be arranged by Departmental Representative.
- .2 Waste Management Meeting: Waste Management Coordinator is to provide an update on status of waste diversion and management activities at each meeting. Written monthly Waste Diversion Report summary to be provided by Waste Management Coordinator.
- .3 Submit proof that all waste is being disposed of at a licensed landfill 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

1.11 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged

items.

- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed and salvaged materials from movement or damage.
- .6 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .7 Separate and store materials produced during project in designated areas.
- .8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
 - .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.12 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste volatile materials mineral spirits oil paint thinner into waterways, storm, or sanitary sewers.
- .3 Concrete waste water having a pH \geq 12.5 must be disposed of in accordance with Section 02 81 01 - Hazardous Materials.
- .4 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .5 Remove materials on-site as Work progresses.
- .6 Prepare project summary to verify destination and quantities on a material-by-material basis.

1.13 SCHEDULING

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

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 APPLICATION .1 Do Work in compliance with WRW and WSSP.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- 3.2 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11.
- .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.
- .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.
- .2 Source separate materials to be reused/recycled into specified sort areas.
- 3.3 DIVERSION OF MATERIALS .1 Separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
- .1 Mark containers or stockpile areas.
- .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged recovered reusable recyclable materials is not permitted.
- 3.4 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT .1 Schedule G - Government Chief Responsibility for the Environment:
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Province	Address	General Inquires	Fax
Ontario	Ministry of the Environment and Climate Change 135 St. Clair Avenue West Toronto ON M4V 1P5 Environment Canada Toronto ON	416-323-4321 800-565-4923 416-734-4494	416-323-4682

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 01 74 11 - Cleaning.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- 1.2 INSPECTION AND DECLARATION .1 Acceptance of Work Procedures:
- .1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
- .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
- .2 Request Departmental Representative's inspection.
- .2 Departmental Representative Inspection:
- .1 Departmental Representative and Contractor to inspect Work and identify deficiencies.
- .2 Contractor to correct Work as directed.
- .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
- .1 Work: completed and inspected for compliance with Contract Documents.
- .2 Defects: corrected and deficiencies completed.
- .3 Certificates required have been submitted.
- .4 Work: complete and ready for final inspection.
- .4 Final Inspection:
- .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
- .2 When Work is deemed incomplete according to Departmental Representative, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
- .6 Final Payment:
- .1 When Departmental Representative considers final deficiencies and defects corrected and requirements of

Contract met, make application for final payment.

.2 When Work deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

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

1.3 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

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 Product data, materials and finishes and related information.
- .2 Warranties and bonds.
- 1.2 RELATED REQUIREMENTS .1 Section 01 45 00 - Quality Control.
- 1.3 SUBMISSION .1 Prepare instructions and data using personnel experienced in maintenance and operations of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 If requested, furnish evidence as to type, source and quality of products provided.
- .5 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of manuals and documentation in English.
- .6 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .7 Pay costs of transportation.
- 1.4 FORMAT .1 Organize data in the form of a manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
.1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
-

- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in "dwg" format on CD.

1.5 CONTENTS - PROJECT
RECORD DOCUMENTS

- .1 Table of Contents: provide title of project;
 - .1 Date of submission; names
 - .2 Addresses and telephone numbers of Departmental Representative and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Section 01 45 00.

1.6 AS-BUILT DOCUMENTS
AND SAMPLES

- .1 Maintain, in addition to requirements in Supplementary Conditions, at site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed product data.
 - .6 Field test records.
 - .7 Inspection certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

- .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
 - .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
 - .5 Keep record documents and samples available for inspection by Departmental Representative.
 - .6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of Work.
 - .7 If project is completed without significant deviations from Contract drawings and specifications, submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".
- 1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS
- .1 Other Documents: maintain inspection certifications, field test records, required by individual specifications sections.
 - .2 Provide digital photos, if requested, for site records.
- 1.8 FINAL SURVEY
- .1 Submit final site survey certificate certifying that completed Work are in conformance, or non-conformance with Contract Documents.
- 1.9 MATERIALS AND FINISHES
- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
 - .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .4 Additional requirements: as specified in individual specifications sections.
- 1.10 DELIVERY, STORAGE AND HANDLING
- .1 Store maintenance materials, and special tools in manner to prevent damage or deterioration.
-

- .2 Store components subject to damage from weather in weatherproof enclosures.
- .3 Store paints and freezable materials in a heated and ventilated room.
- .4 Remove and replace damaged products at own expense and for review by Departmental Representative.
- 1.11 WARRANTIES AND BONDS
 - .1 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.

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 specifies the requirements for demolition to complete work as indicated by the drawings and specification.
 - .2 Work includes but is not limited to:
 - .1 Staged demolition of the existing Twelve Mile Lake Dam. This includes:
 - .1 Removal of existing concrete as shown in the project drawings.
 - .2 Preparation of all concrete surfaces against which new concrete is to be cast.
 - .3 Disposing off site all concrete debris and removed steel reinforcement.
 - .4 Disposing off site of all material not designated for salvage or reuse by owner
 - .2 Demolition of the existing bridge immediately upstream of the existing Twelve Mile Lake Dam. This includes:
 - .1 Removal of existing concrete to an elevation of 305.77 m.
 - .2 Preparation of all concrete surfaces against which new concrete is to be cast.
 - .3 Disposing off site all concrete debris and removed steel reinforcement.
 - .4 Disposing off site of all material not designated for salvage or reuse by owner.
- 1.2 RELATED SECTIONS
- .1 Section 01 35 43 - Environmental Procedures.
 - .2 Section 01 41 00 - Regulatory Requirements
 - .3 Section 01 74 21 - Waste Management and disposal.
 - .4 Section 02 41 21 - Removals.
 - .5 Section 03 30 00 - Cast in place concrete.
 - .6 Section 32 91 19 - Topsoil Placement.
 - .7 Section 35 20 22 - Dewatering.
-

1.3 REFERENCES

- .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .3 National Building Code of Canada (NBCC), including User's Guide, Part 8 - Safety Measures at Construction and Demolition Sites (2015).
- .4 Ontario Occupational Health and Safety Act (OSHA).
- .5 Ontario Building Code (OBC).
- .6 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA), 2012, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33
SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.4 MEASUREMENT AND PAYMENT

- .1 Measurement Procedures: in accordance with Section 01 22 01 - Measurement and Payment.
- .2 The work will be measured and paid for under payment items included in the Unit Price Table:
 - .1 Item No. 1 - Concrete Removal: This item covers the work described in section 1.1.2.1 and 1.1.2.2.
- .3 No payment will be made for excavation or demolition beyond the limits shown on the drawings, which has not been authorized by the Departmental Representative. Any overbreak beyond these limits shall be replaced with concrete at the Contractor's expense.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Hazardous Materials: provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.

- .3 Waste Reduction Workplan: prior to beginning of work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 and indicate:
 - .1 Descriptions of and anticipated quantities of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tippage.
 - .5 Name and address of haulers and waste facilities.
- .4 Certificates: submit certified weight bills and or receipts from authorized disposal sites and reuse and recycling facilities for material removed from site upon request of Departmental Representative.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers and facilities 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 Departmental Representative. Provide all data regarding the reference points to the Departmental Representative. Survey work shall be undertaken by an Ontario Legal Survey.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA, TDGA, Fisheries Act, Species at Risk Act, and applicable Provincial/Territorial regulations.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Perform Work in accordance with Section 01 35 43.
- .2 Storage and Protection.
 - .1 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Departmental Representative.
 - .2 Remove and store materials to be salvaged, in manner to prevent damage.
 - .3 Store and protect in accordance with requirements for maximum preservation of material.
 - .4 Handle salvaged materials as new materials.

- .3 Waste Management and Disposal.
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.
 - .2 Divert excess materials from landfill to site approved by Departmental Representative.
 - .3 Separate for reuse and recycling and place in designated containers Steel, Metal waste in accordance with Waste Management Plan.
 - .4 Place materials defined as hazardous or toxic in designated containers.
 - .5 Ensure emptied containers are sealed and stored safely.
 - .6 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt.
 - .7 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

1.8 SITE CONDITIONS

- .1 Site Environmental Requirements.
 - .1 Perform work in accordance with Section 01 35 43.
- .2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 Review existing site conditions and take necessary precautions to protect environment and adjacent non-work areas.

1.9 SCHEDULING

- .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
 - .1 Notify Departmental Representative in writing when unforeseen delays occur.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Prevent movement, settlement, or damage to any parts of structures and adjacent roadway that are to remain in place. Provide bracing and shoring as required.

- .2 Keep Noise, dust, and inconveniences to nearby occupants to a minimum.
- .3 Provide temporary dust screens, covers, railings, supports and other protection as required.
- 3.2 PROTECTION
 - .1 Support affected structures and, if safety of structure being demolished or remaining component of structure appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
- 3.3 SAFETY CODE
 - .1 Install temporary barriers and enclosures for demolition work in accordance with Section 01 56 00.
 - .2 Blasting operations not permitted during demolition.
- 3.4 DEMOLITION
 - .1 Demolish components of structure as shown on drawings and specified in specifications.
 - .2 Crush concrete generated due to demolition of structure to size suitable for recycling
 - .1 For further information regarding acceptable uses contact Provincial/Territorial aggregate producers associations and or Ministries of Transportation.
 - .3 Selective demolition as indicated on drawings.
 - .4 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
- 3.5 REMOVAL OPERATIONS
 - .1 Remove items as indicated.
 - .2 Do not disturb items designated to remain in place.
 - .3 Remove designated trees if required, during demolition.
 - .1 Obtain written approval of Departmental Representative prior to removal of trees not designated on the drawings.
 - .4 Grind, chip, or shred other vegetation for mulching and composting.
 - .5 Stockpile topsoil for final grading and landscaping.
 - .1 Provide erosion control and seeding if not immediately used.
 - .2 Provide reptile fencing around stockpiles to

prevent turtle nesting. Submit drawing to Departmental Representative for approval.

- 3.6 STOCKPILING .1 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .2 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling Procedures.
- 3.7 REMOVAL FROM SITE .1 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project.
- .2 Transport material designated for alternate disposal using approved facilities listed in Waste Reduction Workplan and in accordance with applicable regulations.
- .1 Written authorization from Departmental Representative is required to deviate from facilities listed in Waste Reduction Workplan.
- .3 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
- .1 Disposal Facilities: approved and listed in Waste Reduction Workplan.
- .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.
- 3.8 RESTORATION .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work.
- 3.9 CLEANING .1 Remove debris, trim surfaces and leave work site clean, upon completion of Work
- .2 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION
- .1 This section covers the removal and re-installation, after concrete work is completed, of the following items:
 - .1 Gauge system
 - .2 This section covers the careful removal for salvage and reuse by PCA of the following items:
 - .1 Existing crab winches
 - .2 Signage and railings
 - .3 This section includes the removal of existing stoplogs and all other items that not listed above but must be removed to complete the work and reinstalled after, as described in the specification and/or as shown on the drawings.
 - .4 Refer to drawings for locations of items to be re-installed. Some items may require modification prior to installation to suit the new dam as indicated on drawings and these specifications. Other minor modifications such as mounting details and hardware may also be coordinated on site with Departmental Representative.
- 1.2 RELATED SECTIONS
- .1 Section 01 22 01 - Measurement and Payment
 - .2 Section 02 41 16 - Structure Demolition
- 1.3 MEASUREMENT AND PAYMENT PROCEDURES
- .1 Removals of existing concrete dam including concrete deck, and concrete piers including steel gain liners above the existing dam sill will be measured by cubic meter for payment and includes all costs related to removal, transport and disposal of waste material off site. Removals extending beyond limits directed by Departmental Representative will not be paid for.
 - .2 Full removal of existing dam sill concrete as directed by Departmental Representative shall be measured by cubic metre for payment and includes all costs related to removal, transport and disposal of waste material off site. Removals extending beyond limits directed by Departmental Representative will not be paid for.
 - .3 Complete removal of existing east retaining wall as shown on the project drawings and as directed by Departmental Representative shall be measured by cubic metre for payment and includes all costs related to removal, transport and disposal of waste material off site. Removals extending beyond limits

directed by Departmental Representative will not be paid for.

.4 Removals of existing concrete bridge upstream of Twelve Mile Lake Dam including steel deck, steel beams and concrete piers above an elevation of 305.77 m will be measured by cubic meter for payment and includes all costs related to removal, transport and disposal of waste material off site. Removals extending beyond limits directed by Departmental Representative will not be paid for.

.5 Payment for all concrete removals not measured for payment as described above will be included in the Lump Sum Price.

1.4 PROTECTION

.1 Protect existing structures or parts of structures designated to remain. In the event of damage, make repairs and replacements to the approval of, and at no additional cost, to the Departmental Representative.

.2 Protect all exposed electrical wiring and conduits during the concrete excavation, forming, heating and placement of concrete.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect the site and verify with the Departmental Representative objects designated to be removed and objects to be preserved.

.2 Notify appropriate utility authorities as required before starting any excavation, demolition, clearing and grubbing.

3.2 REMOVALS

.1 Contractor and Departmental Representative to review the proposed vegetation removals prior to removal work beginning.

.2 Do not disturb adjacent work designated to remain in place.

.3 Items not designated to be salvaged are to be disposed of in a manner approved by the Departmental Representative. Some items may also be

reclaimed by Parks Canada. Where such is the case coordinate hand over and transport of material to Parks Canada storage facility with Departmental Representative.

- 3.3 SALVAGE .1 Carefully dismantle materials designated to be salvaged and safely stockpile at locations designated I approved by the Departmental Representative.
- .2 Carefully dismantle components designated to be salvaged, label, and take all measurements required for re-installation. Store in a location approved by the Departmental Representative.
- 3.4 REINSTALLATION .1 Reinstall all items which were removed as a result of construction activities to match prior to construction condition and the Departmental Representative's approval.
- .2 Reinstall as indicated on the drawings or as per existing details, and to the Departmental Representative's approval all items which were removed as a result of construction activities. Supply and install new anchors and hardware, for all items listed in this section, as required for re-installation.
- 3.5 DISPOSAL OF MATERIALS .1 Dispose of materials not designated for salvage or reuse in work off the site.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Not used.
- 1.2 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 Definitions:
- .1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .1 Waste water having a pH \geq 12.5 is considered a hazardous waste under Ontario Regulation 347.
- .3 Reference Standards:
- .1 Canadian Environmental Protection Act, 1999 (CEPA 1999)
- .1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
- .2 Department of Justice Canada (Jus)
- .1 Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).
- .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
- .3 Green Seal Environmental Standards (GS)
- .1 GS-11-[2008, 2nd Edition], Paints and Coatings.
- .2 GS-36-[00], Commercial Adhesives.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).
- .5 National Research Council Canada Institute for Research in Construction (NRC-IRC)
- .1 National Fire Code of Canada-[2005].
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
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- .1 SCAQMD Rule 1113-[A2007], Architectural Coatings.
 - .2 SCAQMD Rule 1168-[A2005], Adhesive and Sealant Applications.
 - .7 R.R.O. 1990, Regulation 347, General – Waste Management
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Sections 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
 - .1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.
 - .4 Storage and Handling Requirements:
 - .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
 - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
 - .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or

- Factory Mutual seal of approval.
 - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative
 - .5 Transfer of flammable and combustible liquids is prohibited within buildings.
 - .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
 - .7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.
 - .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
 - .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
 - .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
-

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Description:
- .1 Bring on site only quantities hazardous material required to perform Work.
 - .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

PART 3 - EXECUTION

- 3.1 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
 - .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .4 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
 - .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
 - .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
 - .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
 - .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
 - .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
 - .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
 - .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
 - .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.
 - .3 Lead-acid battery recycling.
-

- .4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

PART 1- GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 03 20 00 - Concrete Reinforcing.
 - .2 Section 03 30 00 - Cast-in-Place Concrete.
- 1.2 MEASUREMENT PROCEDURES
- .1 No measurement will be made under this Section. Include costs in items related to cast-in-place concrete for which concrete formwork, falsework and accessories are required.
- 1.3 REFERENCES
- .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
 - .2 ASTM
 - .1 ASTM C260-/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-16, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM D412-06a(2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .6 ASTM D570 -98(2010)el, Standard test Method for Water Absorption of Plastics
 - .7 ASTM 0624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .8 ASTM D1751-04(2013), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types.
 - .9 ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - .3 CSA
 - .1 CSA A23.1-14, Concrete Materials and Methods of Concrete Construction
 - .2 CSA A23.2-14, Test Methods and Standard Practices for Concrete.

- .3 CAN/CSA-086.1-01 (R2006), Engineering Design in Wood (Limit States Design).
- .4 CAN/CSA-086.181-05, Supplement No. 1 to -01, Engineering Design in Wood (Limit States Design).
- .5 CSA 0121-08, Douglas Fir Plywood.
- .6 CSA 0151-09 (R2014), Canadian Softwood Plywood.
- .7 O153-13, Poplar Plywood
- .8 CSA S269.1-16, Falsework for Construction Purposes.
- .9 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork.

1.4 SHOP DRAWINGS

- .1 Master Plan of Concrete Placement
 - .1 Submit master plan showing separate concrete placements and locations of construction joints, including proposed construction joints in addition to those indicated on the drawings.
- .2 Joints: Expansion, Construction and Control
 - .1 Submit detailed shop drawing of each joint type. Submit an elevation or section take through the plane of the joint showing the walls, piers and slabs at the joint.
 - .2 Details of waterstop system, types, splices, methods of securing and supporting waterstop in forms to maintain proper orientation and location during concrete placement.
 - .3 Details of joint fillers, sealant, adhesives and other appurtenances.
- .3 Formwork
 - .1 Shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Comply with CSA 8269.1, for falsework drawings.
 - .3 Comply with CSA S269.3 for formwork drawings.
 - .4 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, and materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.
 - .5 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
 - .6 Indicate sequence of erection and removal of formwork/falsework to minimize exposure time to adverse weather conditions.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 and Section 01 35 43.

- .2 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOCs. Maximum VOC level to be 250g/L based on EPA test method 24 and biodegradability as described by EPA as having a half-life of 28 days or less based on ASTM D5684/OECD 301B.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Formwork and Falsework:
 - .1 Wood and wood product formwork materials to CAN/CSA 086.1 CSA 0153.
 - .2 Falsework materials: to CSA S269.1.
 - .3 Form ties: use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
 - .4 Form release agent: non-toxic, biodegradable, low VOC. Maximum VOC level to be 250g/L based on EPA test method 24 and biodegradability as described by EPA as having a half-life of 28 days or less based on ASTM D5684/OECD 301B.
 - .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm²/s at 40°C, flashpoint minimum 150°C, open cup.
 - .6 Formwork liner: Reusable Type III controlled permeability formwork (CPF) liner consisting of integrally bonded non-woven fabric and plastic mesh.
 - .1 A maximum compression of less than 10% under pressure of 200 kPa.
 - .2 A maximum pore size of less than 0.05 mm.
 - .3 A minimum water retention capacity of 1.3 litres/m².
 - .4 A maximum absorbency of 0.1 litres/m².
- .2 Waterstops: BFL Mastix
 - .1 BFL Mastix 40/70R for new concrete to existing concrete/rock;
 - .2 BLF Mastix 40/70R4 for new concrete to new concrete.
- .3 Backing rods:
 - .1 Closed cell polyethylene foam backer rod. Rod diameter shall be 3 mm larger than the joint width.

- .4 Concrete brick:
 - .1 Acceptable for support of bottom layer of bar in foundation. Broken concrete blocks and wood supports not acceptable.
- .5 Bond breaker:
 - .1 Polyethylene tape or coated paper
- .6 Tape for joints:
 - .1 Adhesive-backed glazed butyl or polyethylene tape, same width as joints, that will adhere to premolded joint material or concrete surface.
- .7 Premoulded joint fillers:
 - .1 ASTM 0175-05 (2011) - Standard Specification for preformed Closed Cell polyolefin Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .8 Joint Sealer: to CAN/CGSB-19.12 Sealing Compound, Two part component, elastomeric, chemical curing. Type I for Horizontal joints, Type II for vertical joints.

PART 3 - EXECUTION

3.1 GENERAL

- .1 General
 - .1 Commence concrete placement after joint preparation is complete.
 - .2 Construction Joints in Unrestrained Slab on Grade and Sill Slabs.
 - .1 Slabs may be placed continuous from outside edge to outside edge unless shown otherwise.
 - .3 Construction Joints placed in Slab on Grade and Suspended Slabs Restrained by Connecting Walls
 - .1 Place slabs in strips with the larger dimension in any single placement no greater than 10 m.
 - .4 Locate construction joints in suspended slabs near the middle quarter of the spans of slabs, unless indicated otherwise on the Drawings.
 - .5 Checker boarding for slab pouring is not permitted.
- .2 Construction Joints in Walls
 - .1 Locate construction joints 2000 mm minimum away from junction of two or more walls, a

column or beam supported on wall, nearest edge of an opening wider than 600 mm, and a construction joint in a slab on which the wall rests.

- .2 Place wall in sequential section with a distance between vertical construction joints not exceeding 10 m.

3.2 SURFACE PREPARATION

- .1 Construction Joints:
 - .1 Perform cleaning so as not to damage water stop, if one is present.
 - .2 **Saturate concrete substrate continuously for 24 hours prior to pour.**
 - .3 Vacuum ponding water from the joint prior to concrete placement.
 - .4 Apply two coats of bonding agent and pour concrete immediately.

3.3 FORMWORK INSTALLATION
AND REMOVAL

- .1 Formwork Fabrication and Erection:
 - .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
 - .2 Fabricate and erect falsework in accordance with CSA S269.1.
 - .3 Do not place shores and mud sills on frozen ground.
 - .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
 - .5 Fabricate and erect formwork in accordance with CSA S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1.
 - .6 Align form joints and make watertight. Keep form joints to minimum.
 - .7 Use 25 mm chamfer strips on external corners and edges of deck unless specified otherwise. Form 76 mm radius fillet on all edges and corners of piers unless specified otherwise. Refer to drawings for detailing of chamfers and fillets.
 - .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. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes.
 - .10 Clean formwork in accordance with CSA A23.1, before placing concrete.
- .2 Formwork Liner:
 - .1 Install controlled permeability formwork self-adhesive liner as per manufacturer's

instructions on all formed surfaces

- .3 Form Release Agent:
 - .1 No form release agent is required with CPF formwork liner applied as indicated.
 - .2 Apply agent where CPF formwork liner cannot be installed, such as but not limited to the corner chamfers. 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 saturation has been accomplished prior to first use.
 - .3 Application:
 - .1 Apply concrete form release in accordance with manufacturer's instructions.
- .4 Removal and Reshoring:
 - .1 With accordance to CSA A23.1 Section 6.5.
 - .2 Formwork shall be left in place until concrete has attained sufficient strength to support its own weight adequately, together with the construction loads likely imposed.
 - .1 Vertical elements: crack open formwork minimum 24 hours after concrete placement and flood cavity as required for Curing Type 3. Maintain formwork for minimum 5 days.
 - .3 Suspended elements: maintain until member has achieved minimum 75% of its design strength. 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.
 - .4 Re-use formwork and falsework subject to requirements of CSA A23.1.
 - .5 Do not remove winter protection
- .5 Formwork at rock and foundation interface:
 - .1 Scribe formwork and trim panels to prepare neat contact with foundation material.

3.4 INSTALLATION OF ACCESSORIES

- .1 Waterstops (BFL Mastix)
 - .1 Install Type R into existing concrete or rock by:
 - .1 Gluing with Mastix polymer black glue;
 - .2 Gluing with propane gas burner;
 - .3 Gluing with epoxy resin.
 - .2 Install Type R4 vertically into fresh concrete of concreting stage.
 - .3 Protect waterstop from intense sunshine, the bands should be kept wet in this case.
 - .4 Follow manufacturer specifications for complete installation procedures.
- .2 Embedded parts:
 - .1 Set other embedded parts and openings as indicated or specified elsewhere.
 - .2 Check locations and sizes of embedded parts and openings shown on drawings.
- .3 Anchor bolts:
 - .1 Set anchor bolts to templates in coordination with appropriate trade prior to placing concrete.
 - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
 - .1 Drilled holes: 25 mm minimum diameter larger than bolts used to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout
- .4 Joint filler:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .2 Locate and form construction and expansion joints as indicated. Install joint filler, bond breaker and sealer.
- .5 Joint Sealant:
 - .1 Install to manufacturer's recommendations.

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 REFERENCES .1 Measurement Procedures: in accordance with Section 01 22 01.
.2 Measure reinforcing steel including any dowels and splices in kilograms of steel incorporated into Work, computed from theoretical unit mass specified in CSA-G30.18 for lengths and sizes of bars as indicated or authorized in writing by Departmental Representative.
.3 Payment for concrete reinforcing shall include all material and labour for installation.
.4 LEN couplers, wire ties, bar supports, chairs, spacers and other accessories in addition to reinforcing steel are considered included in the placing of concrete and will not be measured separately for payment.
.5 All other work of this section, which is not identified as a unit price item, is to be included in the Lump Sum Price stated in the Tender Form.
- 1.4 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
.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.
.2 CSA
.1 CSA A23.1-14, Concrete Materials and Methods

- of Concrete Construction.
- .2 CSA A23.2-14, Test Methods and Standard Practices for Concrete.
- .3 CSA A23.3-14, Design of Concrete Structures.
- .4 CSA G30.3-M1983(R1998), Cold Drawn Steel wire for Concrete Reinforcement.
- .5 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
- .6 CSA G40.20-13, General Requirements for Rolled or Welded Structural Quality Steel.
- .7 CSA G40.21-13, Structural Quality Steel.
- .8 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2013, Reinforcing Steel Manual of Standard Practice.

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
 - .1 Submit drawings indicating 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 Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
 - .2 Detail lap lengths and bar development lengths to CSA A23.3, unless otherwise indicated.
 - .1 Provide type B tension lap splices unless otherwise indicated.

1.6 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 33 00.
 - .1 Mill Test Report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum three (3) weeks prior to beginning reinforcing work.
 - .2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

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

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
 - .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA G30.18, unless indicated otherwise.
 - .3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
 - .4 Chairs, bolsters, bar supports, spacers: to CSA A23.1.
 - .5 LEN Couplers permitted at locations where lapping is not feasible.
- 2.2 FABRICATION
- .1 Fabricate reinforcing steel in accordance with CSA A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario, Canada.
 - .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
 - .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
 - .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

PART 3 - EXECUTION

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA A23.1.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Minimum cover for reinforcement as per CSA A23.1 Table 17.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION

PART 1- GENERAL

- 1.1 DESCRIPTION .1 This section specifies the requirements for cast-in-place concrete placed as described by the drawings and the specifications.
- 1.2 RELATED SECTIONS .1 Section 03 10 00 - Concrete forming and Accessories.
.2 Section 03 20 00 - Concrete Reinforcing.
- 1.3 MEASUREMENT AND PAYMENT PROCEDURES .1 Measurement Procedures: in accordance with Section 01 22 01.
.2 Work covered by this section will be paid for under payment items included in the Unit Price Table:
.1 Cast-in-place concrete in the sill slab will be measured by the cubic metre calculated from neat dimensions indicated on drawings.
.2 Cast-in-place concrete in the piers will be measured by the cubic metre calculated from neat dimensions indicated on drawings.
.3 Cast-in-place concrete in the west abutment will be measured by the cubic metre calculated from field measured dimensions authorized in writing by the Departmental Representative.
.4 Cast-in-place concrete in the west retaining wall will be measured by the cubic metre calculated from field measured dimensions authorized in writing by the Departmental Representative.
.5 Cast-in-place concrete in the east retaining wall will be measured by the cubic metre calculated from field measured dimensions authorized in writing by the Departmental Representative.
.6 Unshrinkable-Fill (U-Fill) in the west abutment will be measured by the cubic metre calculated from field measured dimensions authorized in writing by the Departmental Representative.
.7 Cast-in-place concrete in the deck of the dam will be measured by the cubic metre calculated from neat dimensions indicated on drawings.
.8 Cast-in-place concrete in the west approach slab will be measured by the cubic metre calculated from neat dimensions indicated on drawings.
.9 No deductions will be made for volume of

- concrete displaced by reinforcing steel.
- .10 Include in the prices of concrete the installation of all items embedded therein.
- .11 Include in the prices of concrete the work described in Section 03 10 00 .
- .12 Include in the prices of concrete the supply and installations of waterstops.
- .13 Include in the prices of concrete the supply and installation of joint filler, bond breaker and joint sealer.
- .14 Include in the prices of concrete the heating, cooling, hot and cold weather protection, curing, and finishing.
- .15 All other work, necessary to the completion of the work of this section, will not be measured separately for payment, but will be considered incidental to the work.

1.4 REFERENCES

- .1 Reference Standards:
 - .1 ASTM
 - .1 ASTM C260-/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .2 CSA International
 - .1 CSA A23.1-14 Concrete Materials and Methods of Concrete Construction.
 - .2 CSA A23.2-14 Test Methods and Standard Practices for Concrete.
 - .3 CSA-A3000-13, Cementitious Material Compendium
 - .3 ACI
 - .1 ACI 350M-06, Code Requirements for Environmental Engineering Concrete Structures
- .2 Conform to all of the latest edition of reference standards. The standards provide the minimum requirements to be met by the Contractor and concrete supplier. Additional concrete requirements have been established in this specification. The most stringent requirement shall be followed and no deviation from the requirements will be considered at the time of construction.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33

00.

- .2 Submit warranty performance parameters of concrete for review, including supporting back-up data and manufacturer's data sheets.
- .3 At least four (4) weeks prior to beginning work, submit to Departmental Representative concrete mix design and product data of the following materials proposed for use: aggregate source, curing compound, joint filler, joint sealant, and waterstops.
- .4 Production and Delivery: provide for review by Departmental Representative deviations from CSA A23.1-14 Section 5 Production and Delivery.
- .5 Placing, Finishing and Curing: provide accurate records of start and finish time of activities, testing completed, weather conditions, manpower used and deviations from CSA A23.1-14 requirements.

1.6 QUALITY ASSURANCE

- .1 Provide Departmental Representative, 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.
- .2 Minimum four (4) weeks prior to starting concrete work, provide proposed quality control procedures that as a minimum meet the CSA A23.1-14 standards, for review by Departmental Representative on following items:
 - .1 Production.
 - .2 Delivery.
 - .3 Placing.
 - .4 Joints.
 - .5 Protection and Curing.
 - .6 Finishes.
 - .7 Formwork removal.
- .3 Refer to CSA A23.1-14 Annex B Alkali-Aggregate Reaction. Submit test data to ensure the following:
 - .1 Use of proven non-reactive aggregates.
 - .2 Use of a low-alkali hydraulic cement.
 - .3 Use of supplementary cementing materials or other admixtures in adequate quantities in the concrete with such materials are proven

effective in mitigating the detrimental effects of the reaction.

- .4 Refer to CSA A23.1-14 8.8 Low Shrinkage Concrete and provide testing in accordance with CSA A23.2-21C. The shrinkage of the proposed mix after 28 days of drying (at the concrete age of 35 days) shall not be greater than 0.040%.
 - .5 Refer to CSA A23.1-14 Table 2, Chloride on penetrability requirements to be less than 1500 coulombs at 28 days.
- 1.7 DELIVERY, STORAGE AND HANDLING
- .1 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1.
 - .2 Modifications to maximum time limit must be agreed by the Departmental Representative and concrete producer as described in CSA A23.1.
- 1.8 REQUIREMENTS OF REGULATORY AGENCIES
- .1 Conform to municipal, provincial and national codes relating to construction activities.
- PART 2 - PRODUCTS
- 2.1 APPROVALS
- .1 All materials to be new and approved by Departmental Representative.
 - .2 All concrete mixes to be approved by the Departmental Representative.
- 2.2 DESIGN CRITERIA
- .1 To CSA A23.1/A23.2, and as described in this specification.
- 2.3 MATERIALS
- .1 Cement: Normal Type GU as per CSA A3001.
 - .2 Supplementary cementing materials: Type S as per CSA A3001.
 - .3 Water: to CSA A23.1 Table 9 and Clause 4.1.1.2.
 - .4 Aggregates: 20 mm and 40 mm aggregates to CSA A23.1.
 - .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494/C494M.
 - .3 Superplasticizers: to ASTM C1017.

- 2.4 CONCRETE MIX .1 Provide the following concrete mixes:
- .1 C-1 (modified) 20 mm aggregate
 - .2 C-1 (modified) 40 mm aggregate, 30% slag.
 - .3 U-Fill
 - .4 Additional mixes as required for hot weather concreting, cold weather concreting and low heat of hydration mix to meet the requirements of Table 20 and Clause 8.5.5 of CSA A23.1.
- .2 Proportion concrete mix in accordance with CSA A23.1-14. Modifications to the mix design are with accordance to the requirements ACI 350M-06 Section 4.6 Protection Against Erosion.
- .3 Cast-in-place concrete: Class C-1 (modified).
- .1 Hard dense aggregate
 - .2 20 mm nominal maximum aggregate size (sections up to 500 mm in thickness)
 - .3 40 mm nominal maximum aggregate size (sections thicker than 500 mm). Minimum 30% Type S Slag (sections thicker than 500mm). Elements thicker than 500 mm are considered "mass concrete" contrary to the requirements of clause 7.5.3 of CSA A23.1-14 which defines mass concrete as elements of 1.0 m or more thickness.
 - .4 Slump range 50 to 100 mm (without superplasticizers)
 - .5 35 MPa within 28 days (contrary to within 56 days as specified in Table 2 of CSA A23.1-14)
 - .6 Air content maximum 6% (contrary to air content category specified in CSA A23.1-14)
 - .7 Minimum 362 kg of cementitious material per cubic meter of concrete
- .4 U-Fill: 0.4 MPa Compressive Strength
- .1 20 mm nominal maximum aggregate size
 - .2 Slump range minimum 150 mm
- 2.5 NON-SHRINK NON-METALLIC GROUT .1 Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents to CSA A23.1.
- .2 Compressive strength minimum 48 MPA at 28 days.

PART 3 - EXECUTION

- 3.1 PREPARATION .1 Obtain Departmental Representative's written approval 48 hours before placing concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix.
- .3 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- 3.2 FORMWORK .1 With accordance to CSA A23.1 Section 6.5 and 03 10 00 Concrete Forming and Accessories.
- 3.3 PLACING, FINISHING AND CURING .1 With accordance to CSA A23.1-14 Section 7.
- 3.4 CURING .1 Meet and exceed the requirements of CSA A23.1-14.
- .2 Install formwork liner on vertical elements to prevent moisture loss.
- .3 Curing Type 3 for all cast-in-place concrete. This requirement is the most stringent in CSA A23.1-14 and shall be followed. Consideration will not be given to any requests that reduce the curing period.
- .4 During curing period uncover only such areas that are immediately needed for finish treatment. Recover and continue curing.
- 3.5 COLD WEATHER PROTECTION .1 With accordance to CSA A23.1-14.
- .1 Protect concrete by a windproof shelter of canvas or other material to allow free circulation of inside air around fresh concrete. 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. Equipment shall be capable of keeping inside air at a constant temperature sufficiently high to maintain concrete at following curing temperatures:
- .2 Ensure that a minimum substrate temperature of 5 degrees Celsius shall be achieved and

- maintained, prior to concrete pour.
- .3 For an initial 3 days, at a temperature of not less than 15 degrees Celsius nor more than 27 degrees Celsius at concrete surfaces.
 - .4 Cure at not less than 10 degrees Celsius for an extra 4 days until 7 days from final pour.
 - .5 Keep concrete surfaces moist continuously while protected.
 - .6 Reduce temperature at a rate not exceeding 10 degrees Celsius per day until outside temperature has been reached.
- 3.6 HOT WEATHER REQUIREMENTS
- .1 When applicable, during hot weather place concrete to hot weather requirements of CSA-A23.1-14. Ensure concrete temperatures at placing meet the requirements of Table 14. Take suitable control measures when mixing ingredients.
- 3.7 FIELD QUALITY CONTROL
- .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Owner for review to CSA A23.2-14.
 - .1 Ensure testing laboratory is certified to CSA A283.
 - .2 Owner shall pay for costs of tests.
 - .3 If tests do not meet requirements of the Departmental Representative, take such measures as indicated in CSA A23.1 Clause 4.4.6
 - .4 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
 - .5 Contractor to submit a quality control plan to the Departmental Representative detailing proposed method of preventing cracking due to rapid shrinkage of the concrete.
 - .6 Cold Weather Concreting
 - .1 Additional test cylinders taken during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent for a minimum period of 72 hours.
 - .2 The Contractor must have maximum-minimum thermometers installed in accessible locations within the cold weather curing enclosure prior to pouring for the Departmental Representative to inspect during the pour and curing period. Ensure

thermometers are properly acclimatized to concrete pour temperature within the curing enclosure and reset immediately following the pour at start of curing period.

- .7 Standard Strength Tests
 - .1 Provide concrete for one standard strength test consisting of 3 cylinders for each 100 m³ of concrete of each type placed in any day. If the amount placed, for each type of concrete is less than 100 m³ in a day, provide concrete for one standard strength test. One cylinder will be tested at 7 days and two at 28 days.
 - .2 Complete one standard strength test for each 25 m³ of each type in any day at the start of the project until satisfactory control is established and the proposed mix has been accepted in the field by the Departmental Representative. Whenever tests fall outside of the specified limits, the testing frequency shall revert to one test per each 25 m³ of concrete.
- .8 Air Content Testing
 - .1 Every load or batch of concrete shall be tested until satisfactory control of the air content is established and fewer tests are required by the Departmental Representative and Owner as per Clause 4.4.4.1.1.1 of CSA A23.1. Whenever tests fall outside of the specified limits, the testing frequency shall revert to one test per load or batch until satisfactory control is re-established.

3.8 REPAIR OF DEFICIENT
CONCRETE

- .1 Cracks (<0.3 mm)
 - .1 Follow manufacture application procedures as it may vary from the procedure implied below.
 - .2 Achieve a concrete surface profile (CSP) of CSP 3 as per the International Concrete Repair Institute (ICRI).
 - .3 Install flexible cementitious waterproofing to a saturated dry surface or saturated damp surface.
 - .4 Trowel and brush two coats to a build of 1.6 to 3 mm layer.
 - .5 Embed reinforcing fabric within the waterproofing along length of crack.
- .2 Cracks (0.3 mm to 6 mm):
 - .1 Epoxy crack inject cracks with low viscosity adhesive.
 - .2 Follow manufacture application procedures as

- it may vary from the procedure implied below.
- .3 Set appropriate injection ports based on system used.
 - .4 Pressure inject at the lowest point and continue until there is an appearance of the resin at an adjacent port, thus indicating travel. Continue the procedure until all pressure injectable cracks have been filled.
 - .5 All packers shall be removed after injection is complete and all injection holes shall be patched with polymer modified repair mortar.
 - .6 Waterproof along length of crack and injection port holes with cementitious waterproofing and fabric reinforcement as described above in Section 3.8.1.
- .2 Cracks > 6 mm, honeycombing or deficient concrete areas:
- .1 25 mm deep saw-cut at perimeter of deficient area.
 - .2 Remove deficient, unsound or delaminated concrete around reinforcing steel (if encountered).
 - .3 Prepare surface to ICRI CSP-4 or higher and apply bonding agent.
 - .4 Form and place polymer modified cementitious material.
- 3.9 CLEANING
- .1 Cleaning of concrete equipment to be completed in accordance with Section 01 35 43.
 - .2 Divert unused concrete materials from landfill to local quarry or facility after receipt of written approval from Departmental Representative.
- 3.10 CONCRETE POUR RELEASE FORM
- .1 The Contractor shall obtain and document all concrete pours approval.



CONCRETE POUR RELEASE FORM

Twelve Mile Lake Dam Reconstruction
 Project No. 4256244

Location of Pour _____

Time of Pour _____

Date of Pour _____

Note: WSP, PCA and third party testing agency to be given 24 hours notice prior to pour.

1. All items of work have been completed for this pour and the following foreman have approved their work ready for inspection.

Rebar Steel	Signature:	Date:	Time:
Surface Preparation	Signature:	Date:	Time:
Inserts	Signature:	Date:	Time:

2. The formwork has been inspected by the formwork design engineer or his authorized designate for conformance to the formwork design.

Formwork Design Engineer	Signature:	Date:	Time:
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3. I have checked all items for this pour and request your inspection before pouring.

Contract Superintendent	Signature:	Date:	Time:
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4. The items of work have been inspected.

The pour may proceed subject to the Contractor being responsible for the work in accordance with the Contract.	<input type="checkbox"/>	(check)
OR		
Corrections are required as below	<input type="checkbox"/>	(check)

Resident Supervisor	Signature:	Date:	Time:
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NECESSARY CORRECTIONS AND REMARKS

END OF SECTION

PART 1- GENERAL

1.1 REFERENCES

- .1 ASTM
 - .1 ASTM C309 Specification for Liquid Membrane Forming Compounds for Curing Concrete.
 - .2 ASTM E1155M Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20, Surface Sealer for Floors.
 - .2 CGSB 51 GP 51M Polyethylene Sheet for Use in Building Construction.
- .3 CSA International
 - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.2 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 ENVIRONMENTAL REQUIREMENTS

- .1 Work area:
 - .1 Make work area water tight protected against rain and detrimental weather conditions.
- .2 Temperature:
 - .1 Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .3 Moisture:
 - .1 Ensure concrete substrate is within moisture limits prescribed by manufacturer.

- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Curing Compound:
 - .1 ASTM C309, Type 2.
 - .2 Combination curing and sealing compound: ASTM C309; Clear, non yellowing compound.
 - .2 Floor Hardener:
 - .1 Non metallic and non-coloured floor hardener: Premixed blend of mineral aggregates and densifying agents, and Portland cement, shake on type; Durag Premium by Sternson Ltd.; Diamag 7 by Sika Canada Inc., Maximent by Master Builders Technologies, Ltd.; Surfex by Euclid Admixture Canada, Inc.; or Quartz Tuff by Dayton Superior Canada Limited.
 - .3 Surface Sealer:
 - .1 Clear, liquid surface hardener and dustproofer; Florseal by Sternson Ltd; Sealhard 400 by Sika Canada Inc., Floor Seal by Euclid Admixture Canada, Inc., or Day Chem Sure Hard (J 17) by Dayton Superior Canada Limited.
 - .4 Wet Curing materials:
 - .1 Non staining waterproof curing paper, burlap, or canvas coverings.

PART 3 - EXECUTION

- 3.1 DEFECT REPAIRS
- .1 General
 - .1 Provide smooth form finish in accordance with CSA A23.1.
 - .2 Remove face formwork as soon as practical to facilitate repair of surface defects. Surface defects include formwork tie holes, bugholes with nominal diameter or depth greater than 6 mm, honeycomb and defective concrete, fins,

- projections, irregularities, offsets, spalled corners, and other defects.
- .3 Avoid damaging corners and keep edges sharp.
- .2 Formwork Tie Holes:
 - .1 Cut formwork ties 25 mm from surface of concrete.
 - .2 Make edges of depressions sharp.
 - .3 Fill depressions with preblended non shrink non ferrous grout of same colour as the concrete for exposed concrete surfaces.
- .3 Irregularities:
 - .1 Grind smooth fins, projections, irregularities, and offsets, including those at visible construction joints.
 - .2 Where irregularities, and offsets cannot be remedied by grinding, chip concrete surface sufficiently deep and apply thoroughly bonded preblended non shrink non ferrous grout in similar procedure for repair of honeycomb and defective concrete.
- .4 Surface Depressions:
 - .1 Fill bugholes, and other surface depressions with a sand cement mortar to match the surface of surrounding concrete.
- .5 Spalled Corners:
 - .1 Use repair materials of similar appearance and strength as the surrounding concrete to reconstruct corner to match adjacent corners.
- .6 Honeycomb and Defective Concrete:
 - .1 Do not repair honeycomb and defective concrete until reviewed by Departmental Representative and permission granted to proceed with the repair work.
 - .2 Remove honeycomb and defective concrete down to sound concrete with edges slightly undercut or perpendicular to the surface. Remove a minimum depth of 25 mm. No feather edges are permitted.
 - .3 Pre-dampen patch area.
 - .4 Use preblended non shrink non ferrous grout of same colour as the concrete for exposed concrete surfaces.
 - .5 Use bonding agents in patching work.
 - .6 Patch surface slightly higher than the surrounding concrete.
 - .7 Wet cure patches to equivalent of 10 days minimum.
 - .8 When patched surface has hardened, rub surface with carborundum brick to a true surface, free from streaks, discolourations, and other imperfections, to match flush with surrounding

concrete.

3.2 CONCRETE FINISHING

- .1 Sack-Rubbed Finish:
 - .1 Unless otherwise specified, provide sack rubbed finish on exposed concrete surfaces.
 - .2 Do not commence rubbing or grinding until surface defects are repaired and patching materials are hardened.
 - .3 Dress surfaces by rubbing or grinding with bricks of carborundum, emery, or other abrasive material to a smooth and even surface to the best grade of concrete work. Wet and rub surfaces until surfaces are even and of uniform smooth appearance. Prevent rounding edges, obliterating the bevel lines on edges and corners, and chipping or cracking the finished edges.
 - .4 After completion of surface preparation apply sack rubbed cement finish to form a smooth finish of uniform appearance. Apply a second coat of sack rubbed cement finish to produce a smooth uniform appearance if required to obtain acceptance.
 - .5 On completion thoroughly wash the surfaces with clean water.
- .2 Related Unformed Surfaces:
 - .1 Screed and float tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring in units cast in forms to a texture consistent with that specified for the formed surface unless some different finish is specified elsewhere.
- .3 Underside Elevated Slab Finish:
 - .1 After forms are removed grind off projections and patch defective areas.
- .4 Slabs or Floor Surfaces:
 - .1 Provide float finish as per CSA A23.1 Clause 7.6.4 Final Finishing.

3.3 CURING CONCRETE

- .1 Refer to 03 30 00 Cast-in-place Concrete for curing requirements.

END OF SECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION .1 This section specifies requirements for the supply and installation of all parts embedded in cast-in-place concrete including anchors unless specifically noted otherwise; other metal fabrications as described by the drawings and specification;
- .2 The work includes but is not necessarily limited to the supply and installation of:
- .1 Stoplog sill beams
 - .2 Stoplog gains
 - .1 Main stoplog gains
 - .2 Downstream service gains
 - .3 Upstream gains and pier nosing
 - .3 Stoplog gain covers
 - .4 Gain cover perimeter edge angle
 - .5 Stainless Steel Plate Storage box (1,800mm long x 750mm wide x 600 mm tall with lockable lid)
 - .6 Railings and gates
 - .7 Jacking Brackets
 - .8 Log Pinning Mechanisms
 - .9 Steel half logs
 - .10 Stoplog winch supporting racks
 - .11 Stoplog rests
 - .12 Gain crossers
- 1.2 RELATED SECTION .1 Section 03 30 00 - Cast In Place Concrete.
- 1.3 REFERENCE .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 ASTM International
- .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A276/A276M-16a, Standard Specification for Stainless Steel Bars and Shapes.
 - .3 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A480/A480M - 16a Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

- Galvanized Coatings.
- .6 ASTM A603-98(2009) e1, Standard Specification for Zinc-Coated steel Structural wire rope.
- .7 ASTM A492-95(2009), Standard Specification for stainless steel rope wire.
- .8 ASTM A449-14, Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use

- .3 Canadian General Standards Board (CGSB) CGSB 1-GP-1B1M-99 Coating, Zinc-Rich, Organic, Ready Mixed.
- .4 CSA International
 - .1 CSA G40.20-04(R2009)/G40.21-04(R2009, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16-14, Design of Steel Structures.
 - .3 CSA W48-06 (R2011), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .4 CSA W59-13, Welded Steel Construction (Metal Arc Welding) Metric.
 - .5 CSA W59.2-M1991(R2013), Welded Aluminum Construction.
 - .6 CSA G4.00(R2006), Steel Wire Rope for General Purpose and for Mine Hoisting And Mine Haulage.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 American Welding Society
 - .1 AWS D1.6/D1.6M, Structural Welding Code Stainless Steel.
- .7 Society for Protective Coatings (SSPC)
 - .1 SSPC SP10/NACE No 2, Near-White Blast Clearing.
 - .2 SSPC PA2, Procedure for Determining Compliance to Dry Coating Thickness Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTAL

- .1 Submit in accordance with Section 01 33 00
- .2 Shop Drawings:
 - .1 Submit drawings for all items listed in 1.1.2 in accordance with Section 01 33 00.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.5 MEASUREMENT AND
PAYMENT

.1 In accordance with Section 01 22 01 -Measurement and Payment

1.6 DELIVERY, STORAGE
AND HANDLING

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

.2 Storage and Handling Requirements:

- .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations.
- .2 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W or 350W, unless noted otherwise.
- .2 Stainless steel sections and plates: to ASTM A480, Grade 304L or 316L, unless noted otherwise.
- .3 Aluminum sections and bars: Grade 6061 or 6063.
- .4 Welding materials: to CSA W59, W59.2 and AWS D1.6/D1.6M.
- .5 Welding electrodes: to CSA W48 Series.
- .6 Bolts and anchor bolts: to ASTM A307.
- .7 Zinc primer: zinc rich, ready mix to CGSB 1-GP-181M.
- .8 PVC coated wire strand rope: to ASTM A603-98.
- .9 Stoplog winch: WINTECH two (2) ton spur gear hand winch equipped with ten (10) inch drum length and disc brake handle.
- .10 Stainless steel wire rope for stoplog winch: 6x37 IWRC improved plow steel wire rope with diameter of 7/16".
- .11 Stoplog winch mounting bolts: to ASTM A449-14, zinc plated.
- .12 Stoplog winch supporting rack anchors: Hilti HIT-HY 200 adhesive anchoring system with 1/2" HAS-R stainless steel threaded rods.

-
- 2.2 FABRICATION .1 Prepare shop drawings in accordance with Section 01 33 00.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Do welding work in accordance with CSA W59.
- .5 Stoplog winch supporting racks have been designed according to the provided documentation on the winch manufacturer's website. The contractor is to complete an assembly test prior to on-site deployment to ensure proper fit of the actual winch with the final arrangement of the supporting racks.
- 2.3 STOPLOG EMBEDDED PARTS TOLERANCES .1 Stoplog embedded parts shall not exceed the tolerances below:
- .1 Maximum deviation from true verticality for the overall height: 3 mm for each face.
- .2 Maximum deviation from general slope for each face: 2 mm, anywhere along the height.
- .3 Total width of lateral guide: 400 +-6 mm, anywhere along the height.
- .4 Total distance between lateral faces of guides for one passage: nominal distance +- 6 mm, anywhere along the height.
- .5 For the downstream face, maximum difference of 1.5 to 2 mm from every measurement when checking parallelism with the sill axis.
-

- 2.4 FINISHES
- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m², Coating Grade 85, to ASTM A123/A123M.
 - .1 Touch-up primer for galvanized coating SPCC 20 Type I inorganic zinc rich.
 - .2 Surface preparation and painting. Refer to 3.3.1 and 3.3.2.
 - .3 Metals shall have the following finish:
 - .1 Plain steel
 - .1 Stoplog sill beams
 - .2 Stoplog gains: main stoplog gains and downstream service gains
 - .3 Stoplog rests
 - .2 Epoxy Painted
 - .1 Stoplog winch supporting racks
 - .2 Gain crossers
 - .3 Hot-Dipped Galvanized
 - .1 Railings and gates
 - .2 Components of log pinning mechanisms as shown on Drawings
 - .3 Steel half logs
 - .4 Stainless steel
 - .1 Upstream gains and pier nosing
 - .2 Gain cover perimeter edge angle
 - .3 Storage box
 - .4 Jacking brackets
 - .5 Aluminum
 - .1 Stoplog gain covers
 - .2 Components of log pinning mechanisms as shown on Drawings
 - .4 For stainless steel metal, the surface area in contact with concrete shall be coated with Bitumastic 300M by Carboline.
 - .5 Where metal finish not specified in the drawings or specifications, assume stainless steel and confirm with Departmental Representative.

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 Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon

discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 ERECTION

- .1 Do welding work in accordance with CSA W59, W59.2 or AWS D1.6/D1.6M unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections. The various elements shall be securely fixed and adequately braced to ensure precise location and to avoid any warpage, misalignment or deformation during erection. Stoplog winch mounting plate on the supporting racks must be flat to within two (2) mm as per the manufacturer's recommendations.
- .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 Deliver items over for casting into concrete together with setting templates to appropriate location and construction personnel.
- .6 Touch-up scratched galvanized surfaces with zinc primer where damaged.
- .7 Touch-up scratched painted surfaces as per 3.3.3.
- .8 The required location of cast-in-place or post-installed concrete anchors shall be determined precisely, using templates as necessary. Preparation of holes and installation of post-installed anchors shall comply with the instructions provided by the manufacturer of the anchors. The effective embedment length of the anchors for the stoplog winch supporting racks shall be 114 mm.
- .9 Install stoplog winch supporting racks as shown on the performance drawings. These have been designed so that the stoplog exits the gain with the wire rope vertically plumb and stoplog transversally aligned in order to ensure worker safety and avoid excessive loading of the stoplog winch from the swinging of the stoplog.
- .10 Winch supporting racks may be shimmed, at anchor locations, to ensure plumb and stable erection, and

maintain safe winch operation. Shims shall be made of stainless steel and shall have a maximum thickness of 6.4 mm. Grind concrete where necessary. The Contractor shall submit details concerning the proposed shimming and/or grinding to PCA representative and get acceptance before proceeding with the works.

- .11 An anti-loosening compound, such as Loctite 242 or accepted equivalent, shall be applied to the bolting threads during installation.
- .12 For the anchors and bolted connections of the stoplog winch supporting racks, thick washers shall be used for slotted holes.
- .13 The required length of wire rope for the stoplog winch shall include five (5) complete dead wraps of wire rope (with the hook in the lowest position) plus the length required to complete the longest lift. The first wrap of wire rope must be flush against the drum sidewall where the clamping is arranged.

3.3 SURFACE PREPARATION
AND PAINTING

- .1 Surface preparation
 - .1 Rough textured welds and sharp edges shall be blended out with a grinder and weld spatter removed.
 - .2 Surface shall undergo abrasive blasting in accordance with SP10 standard by SSPC. The surface shall be inspected as required in visual inspection standard SP10 by SSPC-vis-1.
 - .3 All equipment, components, and surfaces that need not be cleaned and prepared for painting shall nevertheless be adequately protected against damage during cleaning operations.
 - .4 The Contractor shall use an abrasive that will yield the surface depth profile recommended by the paint manufacturer.
 - .5 The use of abrasive silica is not acceptable.
- .2 Painting Application
 - .1 After preparation, the surface shall be coated with at least two (2) coats of high coverage epoxy paint and one UV protection topcoat. The paint product shall be Bar-Rust 235 by Devoe, Interseal 670HS with Interthane 990HS by International, Amercoat Amerlock 2 with Amercoat 450HS by Ameron or an equivalent approved by the Departmental Representative.
 - .2 Generally, the colour of painted equipment shall be black, code 17038 of the American

FED-STD-595C standard.

- .3 The application and drying period for each coat of paint shall comply with the paint manufacturer instructions. All coats of paint in a given protection system shall originate from the same manufacturer. Minimum dry coat thickness shall be 125 microns per epoxy paint coat and 50 microns for the topcoat.
- .4 The application method shall ensure even distribution of the paint and prevent excessive build-up and drippings.
- .5 Instrument calibration, the measurement of dry coats and the acceptance criteria shall be carried out or managed in accordance with the SSPC-PA2 standard.
- .6 All the equipment, components and surfaces that need not be painted shall be adequately protected to prevent being covered during paint application.

.3 Paint Touch-up

- .1 Any paint touch-up shall be performed using the same paint system and to the requirements of this specification, except with respect to surface preparation and visual inspection. Surfaces shall be prepared using mechanical tools as required in SSPC-SP3 and visual inspection carried out to the applicable section of ST3 and SSPC-Vis-1.

.4 Inspection

- .1 Inspection of surface preparation shall be performed immediately before paint application.
- .2 The thickness of each coat of paint shall be measured during application to ensure required wet coating, followed by a verification of the dry coat after application.

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 RELATED REQUIREMENTS .1 Section 31 24 13 - Roadway Embankments
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling
- .3 Section 31 32 19.01 - Geotextiles
- .4 Section 32 91 19 13 - Topsoil Placement and Grading
- 1.2 MEASUREMENT AND PAYMENT .1 Measurement Procedures: in accordance with Section 01 22 01, the Items Backfill Material, Granular A, and Granular B will be paid per cubic meter.
- .2 The Unit Price will be for all labour, material and equipment necessary to supply, deliver, and place all aggregate materials as identified in the Contract Documents, Standards and Drawings. The Unit Bid Price includes any double handling of material during the manufacturing or delivery of the aggregate materials outlined in the Contract Documents.
- 1.3 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 ASTM International
- .1 ASTM D4791-[10], Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .3 U.S. Environmental Protection Agency (EPA)/Office of Water
- .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations.
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- .3 Samples:
 - .1 Submit 3 samples.
 - .2 Allow continual sampling by Departmental Representative during production.
 - .3 Provide Departmental Representative with access to source and processed material for sampling.
 - .4 Supply new or clean sample bags or containers according appropriate to aggregate materials.
 - .5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

1.5 DELIVERY, STORAGE
AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed 5 times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
 - .2 Reclaimed asphalt pavement.
 - .3 Reclaimed concrete material.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock (granite preferred).
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
 - .3 Light weight aggregate, including slag and expanded shale.

- .4 Reclaimed asphalt pavement.
- .5 Reclaimed concrete material.

2.2 SOURCE QUALITY CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 2 weeks minimum before starting production.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.
- .3 Advise Departmental Representative 2 weeks minimum in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Processing:
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.
 - .1 Use methods and equipment approved in writing by Departmental Representative.
- .2 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.
 - .1 Use only equipment approved in writing by Departmental Representative.
- .3 Stockpiling:
 - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
 - .2 Stockpile aggregates in sufficient quantities to meet project schedules.
 - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
 - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile

aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

- .5 Surround all stockpiled materials with reptile and amphibian exclusion fencing in accordance with Section 01 35 43.
- .6 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .7 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
- .8 Stockpile materials in uniform layers of thickness as follows:
 - .1 Maximum 1.5 m for coarse aggregate and base course materials.
 - .2 Maximum 1.5 m for fine aggregate and sub-base materials.
 - .3 Maximum 1.5 m for other materials.
- .9 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .10 Do not cone piles or spill material over edges of piles.
- .11 Do not use conveying stackers.
- .12 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 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 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .4 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.
- .5 Waste Management: separate waste materials for 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.
- .6 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

- .7 Restrict public access to temporary or permanently abandoned stockpiles by means acceptable to Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Not used.
- 1.2 MEASUREMENT PROCEDURES .1 In accordance with Section 01 22 01 - Measurement and Payment
- .2 There will be no measurement of work included in this Section.
- .3 Payment shall be included in the Lump Sum Price for General Site Work.
- 1.3 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 U.S. Environmental Protection Agency (EPA)/Office of Water
- .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- 1.4 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 and deadwood, and disposing of fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than specified depth below existing ground surface.
- 1.5 ACTION AND INFORMATION SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
-

- .2 Samples:
 - .1 Submit 1 sample of each material listed below for approval prior to delivery of materials to project site.
 - .2 Tree wound paint: one liter can with manufacturer's label.
 - .3 Herbicide: one liter can with manufacturer's label.
 - .3 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .4 Submit manufacturer's installation instructions.
- 1.6 QUALITY ASSURANCE
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .2 Safety Requirements: worker protection.
 - .1 Workers must wear gloves, respirators, dust masks, long sleeved clothing, eye protection and protective clothing when applying herbicide materials.
 - .2 Workers must not eat, drink or smoke while applying herbicide material.
 - .3 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.
- 1.7 STORAGE AND PROTECTION
- .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, root systems of trees, which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.
- 1.8 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.
 - .1 Trim limbs and tops, and saw into saleable lengths.
 - .2 Stockpile adjacent to site.
-

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
 - .2 Herbicide: effective for killing annual and perennial weeds, and bamboo grass, by being absorbed through roots and foliage.
 - .1 Spray applied on non-crop land areas.
 - .2 Type as approved by Departmental Representative
 - .3 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 PREPARATION
- .1 Inspect site and verify with Departmental Representative items designated to remain.
 - .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.
 - .3 Notify utility authorities before starting clearing and grubbing.
 - .4 Keep roads and walks free of dirt and debris.
 - .5 Confirm timing for clearing and grubbing is acceptable to Departmental Representative and is in accordance with Sections 01 35 43 -Environmental Procedures and 01 14 00 -Work Restrictions.
- 3.2 APPLICATION
- .1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
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- 3.3 CLEARING
- .1 Clearing includes felling, trimming, cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber snags, brush, and rubbish occurring within cleared areas.
 - .2 Clear as directed by Departmental Representative, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
 - .3 Cut off branches overhanging area cleared as directed by Departmental Representative.
 - .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.
 - .5 Apply herbicide in accordance with manufacturer's label to top surface of stumps designated not to be removed.
- 3.4 ISOLATED TREES
- .1 Cut off isolated trees as directed by Departmental Representative 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.
- 3.5 UNDERBRUSH CLEARING
- .1 Clear underbrush from areas as directed by Departmental Representative to within 100 mm of ground surface.
- 3.6 GRUBBING
- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
 - .2 Grub out stumps and roots to not less than 200 mm below ground surface.
 - .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 1.00 m³.
-

- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground
- 3.7 REMOVAL AND DISPOSAL
- .1 Remove cleared and grubbed materials off site to disposal area designated by Departmental Representative.
- .2 Cut timber greater than 125 mm diameter to lengths and stockpile as indicated. Stockpiled timber becomes property of Departmental Representative.
- .3 Mulch and spread cleared and grubbed vegetative material on site as directed by Departmental Representative.
- .4 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.
- 3.8 FINISHED SURFACE
- .1 Leave ground surface in condition suitable for stripping of topsoil to the approval of Departmental Representative.
- 3.9 CLEANING
- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

- 1.1 PRICE AND PAYMENT PROCEDURES .1 In accordance with Section 01 22 01 - Measurement and Payment
- 1.2 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 Definitions:
.1 Rock: any solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
- 1.3 ACTION AND INFORMATION SUBMITTAL .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Blasting Submittals (if required): submit for approval, written proposal of operations for removal of rock by blasting to Departmental Representative.
.1 Indicate proposed method of carrying out work, types and quantities of explosives to be used, loading charts and drill hole patterns, type of caps, blasting techniques, blast protection measures for items such as flying rock, vibration, dust and noise control. Include details on protective measures, time of blasting and other pertinent details.
.2 Submit records to Departmental Representative at end of each shift. Maintain complete and accurate record of drilling and blasting operations.
- .3 Sustainable Standards Certification:
.1 Erosion and Sedimentation Control: submit copy of Erosion and Sedimentation Control Plan for project highlighting implementation measures.
- .4 Qualification Statements:
.1 Retain licensed explosives expert to program and supervise blasting work, to interpret recommendations of pre-blasting report, and to determine precautions, preparation and operations techniques.
.2 Submit documentation verifying explosives expert's qualifications.
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- 1.4 DELIVERY STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Packaging Waste Management: remove for recycling packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 29.06 - Health and Safety Requirements.
 - .3 Remove rock to alignments, profiles, and cross sections as indicated.
 - .4 Explosive blasting is not permitted unless absolutely required to achieve project goals and only with prior approval of Departmental Representative and in accordance with DFO Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters.
 - .5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.
 - .6 Excavate rock to horizontal surfaces with slope not to exceed 1:10.
 - .7 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
 - .8 Excavate trenches to lines and grades to minimum of 100 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.
 - .9 Cut trenches to widths as indicated.
 - .10 Remove boulders and fragments which may slide or roll into excavated areas.
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- .11 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating, Trenching 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 location as approved by Departmental Representative.
 - .3 Rock fragments may qualify for shore protection.

- .3 Waste Management: separate waste materials for 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 RELATED REQUIREMENTS .1 Section 02 41 16 - Structure Demolition
- .2 Section 02 41 21 - Removals
- .3 Section 31 05 16 - Aggregate Materials
- .4 Section 31 23 16.26 - Rock Removal
- .5 Section 31 24 13 - Roadway Embankments
- .6 Section 31 32 19.01 - Geotextiles
- .7 Section 35 20 22 - Dewatering
- 1.2 MEASUREMENT PROCEDURES .1 In accordance with Section 01 22 01 - Measurement and Payment
- .2 There will be no measurement of work included in this Section.
- .3 Payment shall be included in the Lump Sum Prices for **General Site Work** as well as in the cost of removal of the existing structures.
- 1.3 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 American Society for Testing and Materials International (ASTM)
- .1 ASTM C117-[04], Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136-[05], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422-63[2002], Standard Test Method for Particle-Size Analysis of Soils.
- .4 ASTM D698-[00ae1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
- .5 ASTM D1557-[02e1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
- .6 ASTM D4318-[05], Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
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- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.
 - .4 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).
 - .5 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-[13], Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-[13], Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2-[14], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .6 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- 1.4 DEFINITIONS
- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
 - .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
 - .3 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
-

- .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.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422: Sieve sizes to CAN/CGSB-8.1.
 - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 10
0.02 mm	10 - 80
0.005 mm	0 - 45
 - .3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control:
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
 - .2 Submit for review by Departmental Representative proposed dewatering methods as described in PART 3 of this Section.
 - .3 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
 - .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
 - .5 Submit to Departmental Representative testing and inspection results as described in PART 3 of this Section.

- .3 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, location plan of relocated and abandoned services, as required.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
 - .3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.
 - .4 Ship samples to Departmental Representative, in tightly closed containers, to prevent contamination and exposure to elements.
 - .5 At least 2 weeks prior to beginning Work, inform Departmental Representative of source of fly ash and submit samples to Departmental Representative.
 - .1 Do not change source of Fly Ash without written approval of Departmental Representative.

1.6 QUALITY ASSURANCE

- .1 Submit design and supporting data at least 2 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 Keep design and supporting data on site.
- .4 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, shoring, bracing and underpinning required for Work.
- .5 Do not use soil material until written report of soil test results are approved by Departmental Representative.
- .6 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06

- Health and Safety Requirements.

- 1.7 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate waste materials for reuse and/or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Divert excess materials from landfill to local recycling facility for reuse as directed by Departmental Representative.
- 1.8 EXISTING CONDITIONS
- .1 Examine geotechnical report (if available).
 - .2 Buried services:
 - .1 Before commencing work establish location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Prior to beginning excavation Work, notify applicable Departmental Representative and authorities having jurisdiction, establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .6 Confirm locations of buried utilities by careful test excavations or soil hydrovac methods.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before re-routing. Costs for such Work to be paid by Contractor.
 - .9 Record location of maintained, re-routed and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.
 - .3 Existing buildings and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface
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features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

- .3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to [ASTM C136]. Sieve sizes to [CAN/CGSB-8.1].
 - .3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10
- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum cement content of 25 kg/m³ with 40% by volume fly ash replacement: to CSA-A3001, Type GU.
 - .3 Minimum strength of 0.07MPa at 24 h.
 - .4 Concrete aggregates: to CSA-A23.1/A23.2.
 - .5 Cement: Type GU.
 - .6 Slump: 160 to 200 mm.
- .4 Shearmat (if required): honeycomb type bio-degradable cardboard 100 mm thick, treated to provide sufficient structural support for poured

concrete until concrete cured.

.5 Geotextiles: to Section 31 32 19.01 - Geotextiles.

PART 3 - EXECUTION

3.1 SITE PREPARATION

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

3.2 PREPARATION/
PROTECTION

.1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.

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

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

3.3 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as indicated after area has been cleared of brush and removed from site.

.2 Strip topsoil to depths as directed by Departmental Representative.

.1 Do not mix topsoil with subsoil.

.3 Stockpile in locations as directed by Departmental Representative.

.1 Stockpile height not to exceed 2 m and should be protected from erosion.

.4 Dispose of unused topsoil off site as directed by Departmental Representative.

3.4 STOCKPILING

.1 Stockpile fill materials in areas designated by Departmental Representative.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 Implement sufficient erosion and sediment control measures to prevent sediment release off

construction boundaries and into water bodies.

- .4 Surround all stockpiled materials with reptile and amphibian exclusion fencing in accordance with Section 01 35 43.

3.5 COFFERDAMS, SHORING,
BRACING AND UNDERPIPPING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements and Health and Safety Act for the Province of Ontario.
 - .1 Where conditions are unstable, Departmental Representative to verify and advise on methods.
 - .2 Construct temporary Works to depths, heights and locations as indicated and approved by Departmental Representative.
 - .3 During backfill operation:
 - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
 - .4 When sheeting is required to remain in place, cut off tops at elevations as indicated.
 - .5 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as directed by Departmental Representative.

3.6 DEWATERING AND
HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
 - .2 Provide for Departmental Representative approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
 - .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
 - .4 Protect open excavations against flooding and damage due to surface run-off.
 - .5 Dispose of water in accordance with Section
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01 35 43 - Environmental Procedures and in a manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.7 EXCAVATION

.1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.

.2 Excavate to lines, grades, elevations and dimensions as indicated.

.3 Remove concrete, masonry, paving, walks, demolished foundations, rubble and other obstructions encountered during excavation in accordance with Section 02 41 16 - Structure Demolition.

.4 Excavation must not interfere with bearing capacity of adjacent foundations.

.5 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.6 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

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

.8 Restrict vehicle operations directly adjacent to open trenches.

.9 Dispose of surplus and unsuitable excavated material in approved location.

.10 Do not obstruct flow of surface drainage or natural watercourses.

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

- .12 Notify Departmental Representative when bottom of excavation is reached.
 - .13 Obtain Departmental Representative approval of completed excavation.
 - .14 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
 - .15 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
 - .16 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.
 - .17 Install geotextiles in accordance with Section 31 32 19.01 - Geotextiles.
- 3.8 FILL TYPES AND COMPACTION
- .1 Use types of fill as indicated or specified on drawings.
- 3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES
- .1 Place and compact granular material for bedding and surround of underground services as indicated.
 - .2 Place bedding and surround material in unfrozen condition.
- 3.10 BACKFILLING
- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
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- .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 grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
 - .1 **Place bedding and surround material as specified elsewhere.**
 - .2 **Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.**
 - .3 **Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 1 m.**
 - .4 **Where temporary unbalanced earth pressures are liable to develop on walls or other structures:**
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative:
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.
- .8 Install drainage system in backfill as indicated.

3.11 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 Departmental Representative.
 - .2 Replace topsoil as directed by Departmental Representative in accordance to Section 32 91 19.13 - Topsoil Placement and Grading.
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- .3 Reinststate natural ground to elevation which existed before excavation unless otherwise indicated or directed by Departmental Representative.
- .4 Reinststate pavements disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinststate areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 31 23 16.26 - Rock Removal
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling
- .3 Section 31 32 19.01 - Geotextiles
- .4 Section 32 91 19.13 - Topsoil Placement
- .5 Section 32 92 19.16 - Hydraulic Seeding
- 1.2 MEASUREMENT PROCEDURES .1 In accordance with Section 01 22 01 - Measurement and Payment
- .2 There will be no measurement of work included in this Section.
- .3 Payment shall be included in the Lump Sum Price for General Site Work.
- 1.3 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 Definitions:
- .1 Rock Excavation: excavation of:
- .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent to be considered integral with parent mass.
- .2 Boulder or rock fragments measuring in volume 1 cubic meter or more.
- .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.
- .3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the Work.
- .4 Free Haul: distance that excavated material is hauled without compensation. Free haul distance 0.5 km or less.
- .5 Stripping: excavation of organic material covering original ground.
- .6 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved.
- .7 Embankment: material derived from usable
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- excavation and placed above original ground or stripped surface up to top of subgrade.
- .8 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
 - .9 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.
 - .10 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.3 Reference Standards:

- .1 ASTM International
 - .1 ASTM D698-12e2, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³) (600 kN-m/m³).
 - .2 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO T99-10, Standard Method of test for Moisture-Density Relations of Soils Using a 2.5 kg (5.5lb) Rammer and 305 mm (12 in) Drop.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval and review blasting program including preshear details, powder factors fly-rock control, and vibration monitoring methods.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Adhere to regulations of authority having jurisdiction when blasting is required.
 - .2 Adhere to Provincial and National Environmental requirements when potentially toxic materials are involved.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Embankment materials require approval by Departmental Representative.
- .2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.
- .3 Borrow material:
 - .1 Obtain from sources such as quarry, or borrow pit as approved by Departmental Representative.

- .1 Earth Embankment materials to consist of acceptable earth material and processed rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials.
- .2 Rock Embankment material to consist of fragmented rock produced by drilling and blasting operations, and boulders which cannot be placed in layers as specified for Earth Embankments.
 - .1 Rock Embankment to conform to gradation as follows:

Sieve Designation	Percent Passing by Weight
150 mm	100
100 mm	85 - 100
75 mm	10 - 50
No. 200	* 0 - 3

- .2 *Gradation is determined by that portion passing 75 mm screen.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - .1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 COMPACTION EQUIPMENT
 - .1 Compaction equipment: vibratory rollers or vibrating plate compactors capable of obtaining required density in materials on project.
 - .1 Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.
 - .2 Replace or supplement equipment that does not achieve specified densities.
 - .2 Operate compaction equipment continuously in each embankment when placing material.
- 3.3 WATER DISTRIBUTORS
 - .1 Apply water with equipment capable of uniform distribution.

- 3.4 STRIPPING
- .1 Place top soil and finish grading in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.
 - .2 Commence topsoil stripping of areas as indicated after brush, weeds and grasses have been removed from these areas.
 - .3 Strip topsoil to depths as directed by Departmental Representative. Do not mix topsoil with subsoil.
 - .4 Stockpile in locations as directed by Departmental Representative.
 - .1 Stockpile height: not to exceed 2 m.
 - .5 Dispose of unused topsoil off site as directed by Departmental Representative.
 - .6 Remove clearing and grubbing debris from stripping.
 - .7 Spread organic stripping, on completion of excavation and embankment construction, on slopes and trim or remove from site if quantity exceeds ability to grade on site.
- 3.5 EXCAVATING
- .1 General:
 - .1 Notify Departmental Representative when waste materials are encountered and remove to depth and extent directed.
 - .2 Sub-excavate 500 mm below subgrade in cut sections unless otherwise directed by Departmental Representative.
 - .1 Compact top 150 mm below sub-excavate to minimum 95% maximum dry density, to ASTM D698.
 - .2 Replace with approved embankment material and compact to specified embankment density.
 - .3 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Departmental Representative.
 - .4 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Departmental Representative.
 - .2 Drainage:
 - .1 Maintain profiles, crowns and cross slopes to provide good surface drainage.
 - .2 Provide ditches as work progresses to provide drainage.
 - .3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.
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- .3 Rock excavation:
 - .1 Notify Departmental Representative when material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. Provide 24 hour notification.
 - .2 No blasting will be permitted.
 - .3 Shatter rock to 200 mm below subgrade elevation as indicated.

- .4 Borrow Excavation:
 - .1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.
 - .2 Obtain embankment materials, in excess of what is available from cut areas, from designated borrow areas.
 - .1 Departmental Representative to designate extent of borrow areas and allowable depth of excavation.
 - .2 Remove waste and stripping material from borrow pits to designated locations.
 - .3 Slope edges of borrow areas to minimum 2:1 and provide drainage as directed.
 - .4 Trim and leave borrow pits in condition to permit accurate measurement of material removed.

3.6 EMBANKMENTS

- .1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
 - .1 Method used to be to be pre-approved in writing by Departmental Representative.

 - .2 Break up or scarify existing road surface prior to placing embankment material.

 - .3 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized by Departmental Representative.

 - .4 Maintain crowned surface during construction to ensure ready run-off of surface water.

 - .5 Drain low areas before placing materials.
 - .1 Place and compact to full width in layers not exceeding 200 mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.
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- .6 Where material consists of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.
 - .2 Distribute rock material to fill voids with smaller fragments to form compact mass.
 - .3 Fill surface voids at subgrade level with rock spalls or selected material to form earth-tight surface.
 - .4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 300 mm of pavement subgrade elevation.
- .7 Deductions from excavation will be made for overbuild of embankments.

3.7 COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Deposit, spread, and level, embankment material in layers 300 mm maximum thickness before compaction.
 - .1 Compact each layer of embankment until compaction equipment achieves no further significant consolidation.
 - .2 Ensure required compaction for each layer before placing any material for next layer.
- .3 Use specialized compaction equipment supplemented by routing, hauling, and leveling equipment over each layer of fill.
- .4 Obtain written approval from Departmental Representative before using specialized compaction equipment such as tamping rollers, vibratory rollers, or other alternate compaction equipment that produces the required results
 - .1 For tamping rollers, use equipment that exerts 1000 kPa minimum of pressure on tamping surface of each tamping foot in transverse row.
- .5 Compact each layer to minimum 95% maximum dry density: ASTM D698 except top 150 mm of subgrade.
 - .1 Compact top 150 mm to 100% maximum dry density.
- .6 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

3.8 FINISHING

- .1 Shape entire roadbed to within 10 mm of design elevations not uniformly high or low.
- .2 Finish slopes, ditch bottoms and borrow pits true to lines, grades and drawings where applicable.

Scale slope by removing loose fragments, for cut slopes in bedrock steeper than 1:1.

- .3 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.
- .4 Hand finish slopes that cannot be finished satisfactorily by machine.
- .5 Round top of backslope 1.5 m both sides of top of slope.
- .6 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

3.9 CLEANING

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

3.10 PROTECTION

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Departmental Representative.
- .2 Provide silt fences, erosion protection and reptile exclusion fencing as required to mitigate and prevent impacts to the environment and the public.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 31 37 00 - Rip-Rap
- .2 Section 31 05 16 - Aggregate Materials
- .3 Section 31 23 33.01 - Excavating Trenching and Backfilling.
- 1.2 MEASUREMENT AND PAYMENT .1 In accordance with Section 01 22 01 - Measurement and Payment
- .2 Measure geotextiles in square metres of surface covered by material. No allowance will be made for seams and overlaps.
- 1.3 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 ASTM International
- .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM D4491-17, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- .3 ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- .4 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.
- .5 ASTM D4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-4.2 No. 11.2-2004, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
- .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
- .1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
- .2 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
- .3 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
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- .4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
- .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

- .4 CSA International
 - .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .5 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 1860-November 2010, Material Specification for Geotextiles.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit following samples 2 weeks prior to beginning Work.
 - .1 Minimum length of 2 m of roll width of geotextile.
 - .2 Methods of joining.
- .4 Test and Evaluation Reports:
 - .1 Submit copies of mill test data and certificate at least 2 weeks prior to start of Work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect geotextiles from direct sunlight and UV rays.
 - .3 Replace defective or damaged materials with new.
- .3 Packaging Waste Management: remove for recycling packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.
 - .1 Composed of: minimum 95% by mass of polypropylene or polyester with inhibitors added to base plastic to resist deterioration by UV and heat exposure for 60 days.
 - .2 Physical properties:
 - .1 Thickness: to CAN/CGSB-148.1, No.3, minimum 3.5 mm.
 - .2 Tensile strength and elongation (in any principal direction): to ASTM D4595.
 - .1 Tensile strength: minimum 1450 N, wet condition.
 - .2 Elongation at break: 70 to 110%.
 - .3 Tear strength: minimum 600 N.
 - .3 Bursting strength: to CAN/CGSB-148.1, No.6.1 minimum 3500 kPa, wet condition.
 - .4 UV Stability: to ASTM 04355 minimum 50% tensile strength retained after 500 hours.
 - .3 Hydraulic properties:
 - .1 Filtration opening size (FOS): to CAN/CGSB-148.1 No.10 40 - 110 µm.
 - .4 Securing pins and washers: to CSA G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to ASTM A123/A123M.
 - .5 Factory seams: sewn in accordance with manufacturer's recommendations.
 - .6 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 Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
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- 3.2 INSTALLATION
- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with hooks.
 - .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.
 - .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
 - .5 Join successive strips of geotextile by sewing.
 - .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
 - .7 After installation, cover with overlying layer within 4 hours of placement.
 - .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
 - .9 Place and compact soil layers in accordance with Sections 31 23 33.01 - Excavating, Trenching and Backfilling and 31 24 13 - Roadway Embankments
- 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 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.
 - .1 Replace all geotextiles traveled on with new material at the direction of the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 31 05 16 - Aggregate Materials
.2 Section 31 24 13 - Roadway Embankments
.3 Section 31 32 19.01 - Geotextiles
- 1.2 MEASUREMENT PROCEDURES .1 In accordance with Section 01 22 01 - Measurement and Payment
.2 Measure rip-rap without cement mortar in cubic meters of material placed.
- 1.3 REFERENCES .1 Not used.
- 1.4 WASTE MANAGEMENT DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
.3 Place materials defined as hazardous or toxic in designated containers.
.4 Fold up metal banding, flatten and place in designated area for recycling.
.5 Divert left over aggregate materials from landfill to local facility for reuse as approved by Departmental Representative.
.6 Divert left over geotextiles to local plastic recycling facility as approved by Departmental Representative

PART 2 - PRODUCTS

- 2.1 STONE .1 Hard, with relative density (formally specific gravity) not less than 2.65 (granite preferred), durable quarry stone (or from existing rock excavation), free from seams, cracks or other structural defects, to meet following size distribution for use intended:
.1 Coarse 75-100 mm caliber rip-rap:
.1 Not more than 10% of total volume of stones with individual volume less than 10 dm³.
.2 Not less than 50% of total volume of stones with individual volume of 8.5 dm³ or more.

- .3 Remaining percentage of total volume to have uniform distribution of stones between 7.5 and 10 dm³ size.
- .4 Supply rock spalls or cobbles to fill open joints
- .2 Heavy 300-500 mm caliber rip-rap:
 - .1 Not more than 10% of total volume of stones with individual volume less than 30 dm³.
 - .2 Not less than 50% of total volume of stones with individual volume of 40 dm³ or more.
 - .3 Remaining percentage of total volume to have uniform distribution of stones between 30 and 40 dm³ size.

2.2 CEMENT MOTAR .1 Not used.

2.3 GEOTEXTILE FILTER .1 Geotextile: in accordance with Section 31 32 19.01 - Geotextiles.

PART 3 - EXECUTION

- 3.1 PLACING
- .1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
 - .2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
 - .3 Place geotextile on prepared surface in accordance with Section 31 32 19.01- Geotextiles and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
 - .4 Place rip-rap to thickness and details as indicated.
 - .5 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.
 - .6 Hand placing:
 - .1 Use larger stones for lower courses and as headers for subsequent courses.
 - .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
 - .3 Finish surface evenly, free of large openings and neat in appearance.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 31 11 00 - Clearing and Grubbing.
.2 Section 31 24 13 - Roadway Embankments
- 1.2 MEASUREMENT AND PAYMENT .1 In accordance with Section 01 22 01 - Measurement and Payment
.2 There will be no measurement of work included in this Section.
.3 Payment shall be included in the Lump Sum Prices for Site Restoration and General Site Work.
- 1.3 TESTING .1 Testing of topsoil: Departmental Representative will pay for cost of tests if required. Should topsoil quality be found to be substandard, the Contractor shall repay the full value of performed testing.
- 1.4 REFERENCES .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
.2 Agriculture and Agri-Food Canada
.1 The Canadian System of Soil Classification, Third Edition, 1998.
.3 Canadian Council of Ministers of the Environment
.1 PN1340-[2005], Guidelines for Compost Quality.
.4 U.S. Environmental Protection Agency (EPA)/Office of Water
.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- 1.5 DEFINITIONS .1 Compost:
.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
.3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below 25), and contain no toxic or
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- growth inhibiting contaminates.
- .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category A.
- 1.6 ACTION AND INFORMATIONAL SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control submittals :
- .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- 1.7 QUALITY ASSURANCE .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements
- 1.8 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.
- PART 2 - PRODUCTS
- 2.1 TOPSOIL .1 Topsoil for seeded areas: mixture of particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth.
- .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
- .2 Contain no toxic elements or growth inhibiting materials.
- .3 Finished surface free from:
- .1 Debris and stones over 50 mm diameter.
- .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .4 Consistence: friable when moist.
- 2.2 SOIL AMENDMENTS .1 Fertilizer:
- .1 Fertility: major soil nutrients present in

following amounts:

- .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
 - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
 - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
 - .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
 - .6 Ph value: 6.5 to 8.0.
- .2 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: [5] mm.
 - .3 Sand: washed coarse silica sand, medium to coarse textured.
 - .4 Organic matter: compost Category A, in accordance with [CCME PN1340], unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
 - .5 Use composts meeting Category B requirements for land fill reclamation and large scale industrial applications.
 - .6 Limestone:
 - .1 Ground agricultural limestone.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
 - .7 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.
- 2.3 SOURCE QUALITY CONTROL
- .1 Grubbed and stockpiled local soil from the project site is preferred over importing any soil from off site in order to reduce the risk of importing invasive plant species.
 - .2 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.
 - .3 Contractor is responsible for amendments to supply topsoil as specified.
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- .4 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .5 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.
 - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION
AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to depths as directed by Departmental Representative.
 - .1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .3 Stockpile in locations as directed by Departmental Representative.
 - .1 Stockpile height not to exceed 2 m.
- .4 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill as directed by Departmental Representative.
- .5 Protect stockpiles from contamination and compaction.

3.3 PREPARATION OF
EXISTING GRADE

- .1 Verify that grades are correct.
 - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.

- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
 - .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes more than [75] mm above surface.
 - .3 Dispose of removed material off site.
 - .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
 - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.
- 3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL
- .1 Place topsoil after Departmental Representative has accepted subgrade.
 - .2 Spread topsoil in uniform layers not exceeding 150 mm.
 - .3 For sodded areas keep topsoil 15 mm below finished grade.
 - .4 Spread topsoil to following minimum depths after settlement.
 - .1 150 mm for seeded areas.
 - .2 135 mm for sodded areas.
 - .3 300 mm for flower beds.
 - .4 500 mm for shrub beds.
 - .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.
- 3.5 SOIL AMENDMENTS
- .1 For turf: apply and thoroughly mix soil amendments into full specified depth of topsoil as directed by Departmental Representative.
- 3.6 FINISH GRADING
- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
 - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
 - .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
 - .1 Leave surfaces smooth, uniform and firm against deep footprinting.
- 3.7 ACCEPTANCE
- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.
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- 3.8 SURPLUS MATERIAL .1 Dispose of materials except topsoil not required off site in accordance with Section 01 74 21 -Waste Management and Disposal.
- 3.9 CLEANING .1 Proceed 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 RELATED REQUIREMENTS .1 Section 32 91 19.13 - Topsoil Placement
- 1.2 MEASUREMENT AND PAYMENT .1 In accordance with Section 01 22 01 - Measurement and Payment
- .2 There will be no measurement of work included in this Section.
- .3 Payment shall be included in the Lump Sum Price for Site Restoration.
- 1.3 ADMINISTRATIVE REQUIREMENTS .1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.
- .2 Scheduling:
.1 Schedule hydraulic seeding to coincide with preparation of soil surface.
.2 Schedule hydraulic seeding using grass mixtures between dates recommended by Provincial Agricultural Department.
- 1.4 REFERENCES .1 Not used.
- 1.5 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.
.2 Submit 2 copies of WHMIS MSDS in accordance with Sections 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.
- .3 Submit in writing 7 days prior to commencing work:
.1 Volume capacity of hydraulic seeder in litres.
.2 Amount of material to be used per tank based on volume.
.3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.
- 1.6 QUALITY ASSURANCE .1 Qualifications:
.1 Landscape Contractor: to be a Member in Good Standing of Ontario Horticultural Trades Association.
.2 Landscape Planting Supervisor: Landscape
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Industry Certified Technician with Softscape Installation designation.

Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Turf Maintenance designation.

- 1.7 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions Trefoil.
 - .2 Delivery and Acceptance Requirements:
 - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
 - .2 Inoculant containers to be tagged with expiry date.
 - .3 Storage and Handling Requirements:
 - .1 Store fertilizer off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
 - .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .5 Packaging Waste Management: remove for recycling packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- 1.8 WARRANTY
- .1 For seeding, 12 months warranty period is extended to 24 months.
 - .2 End-of-warranty inspection will be conducted by Departmental Representative.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
 - .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
 - .2 Seed mixtures shall be suited to the climate, soil conditions and type, orientation, sun exposure, terrain, establishment and maintenance conditions under which they are to be grown. See section 32 94 00 -General Landscaping for requirements.

- .3 Seed shall have a minimum germination rate of 85% and minimum purity of 97%, except where otherwise required by the specification of the seed mixture.
- .4 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, free of germination and growth inhibiting factors with following properties:
 - .1 Type I mulch:
 - .1 Made from wood cellulose fibre.
 - .2 Organic matter content: 95% plus or minus 0.5%.
 - .3 Value of pH: 6.0.
 - .4 Potential water absorption: 900%.
 - .2 Type II mulch:
 - .1 Made from raw cotton fiber and straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.
- .5 Tackifier: water soluble vegetable carbohydrate powder.
- .6 Water: free of impurities that would inhibit germination and growth.
- .7 Fertilizer:
 - .1 To Canada "Fertilizers Act" and Regulations.
 - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.
- .8 Inoculants: inoculant containers to be tagged with expiry date.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for hydraulic seeding in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLERS

- .1 Use installers which are members in Good Standing of Ontario Horticultural Trades Association.

- 3.3 PROTECTION OF EXISTING CONDITIONS
- .1 Protect structures, signs, guide rails, fences, plant material, utilities and all other surfaces not intended for spray.
 - .2 Immediately remove any material sprayed where not intended as directed by Departmental Representative.
- 3.4 PREPARATION OF SURFACES
- .1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
 - .2 Fine grade areas to be seeded free of humps and hollows.
 - .1 Ensure areas are free of deleterious and refuse materials.
 - .3 Cultivated areas identified as requiring cultivation to depth of 25 mm.
 - .4 Ensure areas to be seeded are moist to depth of 100 mm before seeding.
 - .5 Obtain Departmental Representative's approval of grade and topsoil depth before starting to seed.
- 3.5 FERTILIZING PROGRAM
- .1 Rates of application of fertilizers, seed mixtures, mulch and other components shall be based on an analysis of the season, climate, terrain, soil, and establishment and maintenance conditions affecting the project.
- 3.6 PREPARATION OF SLURRY
- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
 - .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
 - .3 After materials are in seeder and well mixed, charge tackifier, if applicable, into seeder and mix thoroughly to complete slurry.
- 3.7 SLURRY APPLICATION
- .1 Ensure seed is placed under supervision of certified Landscape Planting Supervisor.
 - .2 Hydraulic seeding equipment:
 - .1 Slurry tank.
 - .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of
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- .3 slurry and/or mechanical agitation method.
- .3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
- .4 Tank volume to be certified by certifying authority and identified by authorities "Volume Certification Plate".

- .3 Slurry mixtures shall be suited to the seed mixture, climate, soil conditions and terrain, to which they are to be applied.
- .4 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
 - .1 Using correct nozzle for application.
 - .2 Using hoses for surfaces difficult to reach and to control application.
- .5 Blend application 300 mm into adjacent grass areas or previous applications to form uniform surfaces.
- .6 Re-apply where application is not uniform.
- .7 Remove slurry from items and areas not designated to be sprayed.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Clean and reinstate areas affected by Work.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.

3.9 PROTECTION

- .1 Protect seeded areas from trespass until plants are established.
- .2 Remove protection devices as directed by Departmental Representative.

- 3.10 MAINTENANCE DURING ESTABLISHMENT PERIOD
- .1 Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.
 - .2 Perform following operations from time of seed application until acceptance by Departmental Representative.
 - .3 Grass Mixture:
 - .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
 - .2 Fertilize seeded areas after 8 weeks after germination provided plants have mature true leaves. Spread half of required amount of fertilizer in one direction and remainder at right angles.
 - .3 Control weeds by mechanical utilizing acceptable integrated pest management practices.
- 3.11 ACCEPTANCE
- .1 Seeded areas will be accepted by Departmental Representative provided that:
 - .1 Seeded areas are free of rutted, eroded, bare or dead spots.
 - .2 Areas have been fertilized.
 - .2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.
- 3.12 MAINTENANCE DURING WARRANTY PERIOD
- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.
 - .2 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles.

END OF SECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION .1 This section specifies the requirements for reinstating damaged landscaped areas within the work and staging areas, access route and areas disturbed by the work and consists of:
- .1 Supplying, placing, and finish grading of a topsoil bed and nursery sod.
 - .2 Restoring natural grassed areas by seeding with native species grass and wildflower mix.
 - .3 Maintaining sodded and seeded areas until acceptance.
- .2 All disturbed sodded areas to be covered with topsoil, smoothed to the finish grade, and re-sodded at Contractor's expense, or to be covered with topsoil, smoothed to the finish grade, and restored by seeding at Contractor's expense.
- 1.2 MEASUREMENT AND PAYMENT PROCEDURES .1 There will be no measurement of General Landscaping of General Site Work and Site Restoration.
- .2 Payment of General Landscaping shall be included in the Lump Sum Price.
- 1.3 RELATED SECTIONS .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 35 43 - Environmental Procedures.
- 1.4 PRELIMINARY INSPECTION .1 Establish the condition of sodded areas in conjunction with Departmental Representative before starting work.
- 1.5 SOURCE QUALITY CONTROL .1 At least 2 weeks before starting final work, advise Departmental Representative of proposed sources of all materials. Provide Departmental Representative with access to the sources for inspection, sampling and testing.
- .2 When proposed sources are approved, use no other sources without written authorization from Departmental Representative.
- 1.6 DELIVERY AND STORAGE .1 Schedule deliveries in order to keep storage at the job site to a minimum without causing delays.
- .2 Deliver, unload and store rolled sod on pallets only.
- .3 Deliver sod to site within 24 hours of being lifted

and lay sod within 36 hours of being lifted.

- .4 Do not deliver small, irregular, or broken pieces of sod. Departmental Representative will reject these.
- .5 During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling.
- .6 During dry weather, protect sod and from drying. Water sod as necessary to ensure its vitality and prevent dropping soil in handling. The Departmental Representative will reject dried-out sod.

1.7 SCHEDULING OF
SODDING AND SEEDING WORK

- .1 Schedule sod laying and seeding to coincide with final topsoil operations.
- .2 Obtain Departmental Representative's approval of the schedule for seeding before proceeding.

PART 2 - PRODUCTS

2.1 TOPSOIL

- .1 New topsoil to be a friable sandy-clayish loam of good humus content, suitable for supporting sod growth, 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 Departmental Representative. Departmental Representative will pay for cost of tests.

2.2 SOD

- .1 Nursery sod: Quality and source to comply with standards outlined in "Guide Specification for Nursery Stock", Section 17, 1978 edition, published by Canadian Nursery Trades Association.

2.3 SEEDS

- .1 Number 1 Kentucky Bluegrass/Fescue seeds to produce sod with minimum 40% Kentucky Bluegrass, 30% Creeping Red Fescue.
- .2 Native species mix to be approved by Departmental Representative.

PART 3 - EXECUTION

3.1 PREPARATION OF
TOPSOIL SUB-GRADE

- .1 Verify that grades are correct. If discrepancies occur, notify Departmental Representative and do not start other landscape work in that area until instructed to do so in writing by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring that new sodded surface will be faired-off to the existing sodded areas with no sharp transition.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.
- .4 Coarse cultivate entire area which is to receive topsoil to depth of 100 mm. Coarse cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.2 PLACING AND
SPREADING OF TOPSOIL

- .1 Place topsoil after Departmental Representative has accepted sub-grade.
- .2 Spread topsoil to 150 mm minimum depth after settlement and 80% compaction. Keep final elevation 15 mm below finished grade to allow room for sod.
- .3 Manually spread topsoil around trees, shrubs and obstacles.
- .4 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .5 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative. Leave surfaces smooth, uniform and firm enough to resist deep footprints.

3.3 ACCEPTANCE OF
TOPSOIL GRADING

- .1 Departmental Representative will inspect topsoil in place and determine acceptance of depth of topsoil and finish grading.

3.4 SURPLUS TOPSOIL
MATERIALS

- .1 Dispose of materials not required off site.

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- 3.5 SODDING AND SEEDING .1 Obtain Departmental Representative's approval of topsoil grade and depth before starting sodding and seeding lawn.
- .2 Loosen surface of topsoil where it has become compacted.
- .3 Protect all sodded and seeded areas against any damage until sod has been fully established. Supply and install required established protective apparatus.
- 3.6 SOD PLACEMENT .1 Lay sod within 18 hours of being lifted if air temperature exceeds 20 degrees C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.
- 3.7 MAINTENANCE OF SODDED AND SEEDED AREAS .1 Maintain sodded and seeded areas until accepted by Departmental Representative.
- .2 Apply water to ensure establishment and continuous growth of grass. Apply sufficient water to ensure moisture penetration of 200 mm into soil below sod.
- .1 Use clean water from river with a fish screen installed on pump intakes; or
- .2 Use potable water within 5 degrees C of river temperature.
- .3 Cut grass when it reaches a height of 80 mm. Cut grass thereafter frequently enough to be kept at a height of 80 to 100 mm. Allow clippings to remain.
- 3.8 ACCEPTANCE OF SODDED AND SEEDED AREAS .1 Approval of material at its source does not prevent subsequent rejection on job site.
- .2 Sodded and seeded lawn will be approved when:
- .1 Growth of sodded and seeded areas has been properly established;
- .2 Turf is free of bare and dead spots;
- .3 No surface soil is visible when grass has been mowed to a height of 80 mm.
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3.9 SODDING ON SLOPES
GREATER THAN THREE TO ONE

- .1 Lay sod sections perpendicular to slopes greater than 3:1 (run/rise) and secure with stakes. Place 3 stakes per m², 100 mm below top edge to prevent shifting of sod and drive stakes flush with top of sod soil.

END OF SECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION .1 This section specifies requirements for dewatering work described by drawings and specifications.
- .2 The work includes but is not limited to:
- .1 The design, construction, maintenance and operation methods of the systems used to remove water from the work spaces.
- .1 Existing stoplogs will be left in place for use by PCA staff for operation of the dam during construction, including for dewatering and diversion purposes.
- .2 New stoplogs for the new dam will be supplied for use by PCA staff for operation of the dam during construction, including for dewatering and diversion purposes.
- .2 Provision and maintenance of dewatering systems for removal of water from the work spaces.
- .3 Removal of water from the work spaces and the continued maintenance of these spaces in the dry state for the duration of the work to meet work requirements and environmental regulations.
- .4 Supply of standby equipment to replace dewatering equipment which malfunctions.
- .5 The removal of the materials used for the dewatering structure, in accordance with the restriction window for in-water work described in Section 01 14 00 -Work Restrictions. See also Item 1.8.
- 1.2 MEASUREMENT AND PAYMENT PROCEDURES .1 There will be no measurement of Dewatering.
- .2 Payment of Dewatering work shall be included in the Lump Sum Price for Cofferdam and Dewatering Works.
- 1.3 RELATED WORK .1 Section 01 35 43 - ENVIRONMENTAL PROCEDURES.
- 1.4 REGULATORY REQUIREMENT .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 dewatering enclosure: to Section 01 35 43 - Environmental Procedures.
- .3 Obtain and pay costs of all required permits

- 1.5 SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Shop drawings presenting methodology of water-tight dewatering systems and additional components are to be submitted before dewatering systems are installed.
 - .3 Submit detail drawings to Regulatory Agencies, as required to satisfy conditions for granting of permits.
- 1.6 DESIGN CRITERIA
- .1 Ensure maintenance of work spaces in a dry state for duration of work.
 - .2 Plan dewatering systems considering:
 - .1 Initial cofferdam dewatering: Ensure 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.
 - .2 Access to dewatering systems and access to reach any portion of Work dewatered areas. Sequence of Work.
 - .3 Space required for crews to work in dewatered areas
 - .4 Sequence of Work.
 - .5 Water levels.
 - .6 Potential groundwater inflows. Sealing of rock faults and fractures to maintain dry work area.
 - .7 Riverbed conditions.
 - .8 Geotechnical information.
 - .9 Drainage areas and patterns based on pre-construction topography and construction design.
 - .10 The direction of sediment-laden run-off to detention or retention facilities on-site.
 - .11 Adherence to water quality standards.
 - .12 Environmental regulations and requirements.
 - .13 The potential for high turbidity water and the possible need to pre-filter water prior to discharge to settling basins.
 - .14 The potential to manage pH levels, especially concrete pours where the work site is nor free from water.
 - .15 Seasonal fluctuations in water levels and flow.
 - .3 At all times, maintain environmental quality of water to Section 01 35 43 - ENVIRONMENTAL PROCEDURES.
-

- .4 Ensure that no phase of Work threatens safe performance of stoplogs and additional dewatering systems.
- .5 Cofferdams to be designed in reference to crest elevations provided in drawings.

1.7 WATER LEVELS

- .1 Refer to Section 01 11 00 - SUMMARY OF WORK.
- .2 There may be considerable ponding in low areas, particularly in depressions in the bedrock.
- .3 The work spaces are to be dewatered and maintained in the dewatered condition as part of the work of this section.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Dispose of water so that it does not create a safety or health hazard; or cause damage to environment, to adjacent property or to any portion of Work.
- .2 Refer to Section 01 35 43 - ENVIRONMENTAL PROCEDURES.
- .3 Do not release any sediment or other materials into watercourse during construction or removal of cofferdams.
- .4 Check "Permit to Take Water" requirements. If the permit is required, it must be obtained from the Ontario Ministry of the Environment by the contractor.
 - .1 If cofferdam installation is required beyond the date stipulated in Section 01 14 00 - Work Restrictions, a request for changes to timing windows for in-water work must be submitted to PCA, if not previously approved.
 - .2 PCA will submit preliminary plans to MOECC on behalf of contractor; however, contractor shall submit detailed plans regarding staging, installation and removal dates of cofferdams, diversion plan, and mitigating measures to prevent sediment from entering the watercourse.
- .5 Provide settling facilities as per approved Environmental Management Plan (EMP) to remove suspended solids before discharging water into storm sewers, water courses or drainage areas. In the event that space restrictions make settling facility size inadequate, the contractor must provide alternate means of filtering/treating water prior to discharge.

- .6 Monitoring and reporting of discharge water from dewatering is required by the contractor.
 - .1 Suspended Solids: The total suspended solids concentration at the discharge point into the watercourse should contain:
 - .1 <25 mg/L of suspended solids above background levels of the receiving waters during any short-term exposure period (e.g., 24-h).
 - .2 <5 mg/L of suspended solids above background levels of the receiving waters during longer term exposure (e.g., 30 days or more).
 - .3 If elevated turbidity beyond 25 mg/L from background levels for a short-term exposure is observed, Parks Canada will assess potential impact to the aquatic environment and additional mitigation measures may be required.
 - .2 pH Standards: At the discharge point into the watercourse, pH will be maintained between 6.5 and 9.0.
 - .1 Water with pH > 9 cannot be released directly back into the watercourse, but must be treated prior to release.
 - .2 Water with a pH > 12.5 is considered toxic and treated as a hazardous waste under Ontario Regulation 347 of the Environmental Protection Act and wastewater in this condition must be removed from the site.
 - .3 Turbidity Standards: At the discharge point into the watercourse, water should have a turbidity:
 - .1 <8 Nephelometric Turbidity Units (NTU) above background turbidity during short-term exposure periods not to exceed 24 hours.
 - .2 <2 Nephelometric Turbidity Units (NTU) above average background turbidity levels for long term exposure periods averaged over not more than 30 days.
 - .3 Monitoring of background turbidity levels will be required to assess turbidity increases due to construction activities.
 - .4 Water with turbidity values higher than limits indicated must be treated prior to re-entering the river.
- .7 Remove all debris from the worksite upon completion of construction.
- .8 Protect and monitor the water quality and minimize

the undesirable impacts of the construction upon the environment in accordance with the Canadian Water Quality Guidelines for the Protection of Aquatic Life.

- .9 Additionally, since there are cottages in the vicinity, potentially with drinking water intakes, Ontario drinking water quality guidelines cannot be exceeded (beyond parameters that currently exist) due to project activities.

1.9 PROTECTION

- .1 Protect dewatered work spaces from damage due to floods, rain, ice, snow or other adverse climatic conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 In good condition, approved by Departmental Representative 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.
- .3 Materials and methods proposed for use in the dewatering structure improvements, and the dewatering systems, must be approved by PCA.
- .4 If using sandbags, sealed sandbags must be washed of fines before placing in water.
- .5 Earth or granular materials are not acceptable for improving the water-tightness of the existing stoplog dewatering structures.
- .6 Note that PCA prefers caissons, rubber dams, sheet piling, bolted pre-engineered frame-type structures, or other types of cofferdams which do not generate turbidity.
- .7 Refer to Section 01 14 00 - Work Restrictions.

PART 3 - EXECUTION

- 3.1 GENERAL .1 Evaluate, plan and execute work in an expert 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.
 - .3 Safety of work and of adjacent property.
 - .4 Safety of removals.
 - .5 Environmental requirements.
 - .6 Clearance requirements for work.
 - .7 Changes in water levels.
- 3.2 DEWATERING .1 Stoplogs to be installed to coping elevation.
- .2 When existing structures are incorporated into the dewatering system, the Departmental Representative does not guarantee the water-tightness of the structures. Contractor shall take additional measures to increase the water-tightness of existing structures.
- .3 Design, supply and install any additional methods and materials required to maintain the site in dry condition.
- .4 The contractor may improve the water-tightness of the stoplogs in the dewatering structure with plastic sheeting, burlap bags or similar material.
- .5 Dewater work spaces and maintain them in a fully dewatered state until work is finished.
- .6 Continue dewatering operations, to enable work to proceed in the dry, for duration of work.
- .7 Ensure that any drawdown of the water surface due to pumping does not affect:
- .1 Climatic conditions which may occur at work location during period of doing work in its entirety.
 - .2 The safety or quality of the work.
 - .3 Neighbouring property in an adverse manner.
 - .4 The stability of soils.
- .8 Intersect water draining from adjacent soil and bedrock due to lowering of the water table. Remove it from the work spaces. Prevent the loss of fines from adjacent soil. The dewatering systems must

prevent seepage pressure on foundation soils which would disturb the soil and reduce the bearing capacity.

- .9 Repeat entire dewatering procedure as often as may be necessary if flooding or other damage occurs before completion of work.

3.3 WATCHKEEPERS

- .1 Ensure continuity of dewatering by designating a watchkeeper to make periodic checks 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 refuelling of generators normally performed during any shift.
 - .2 Emergency repairs of minor complexity.
 - .3 Placing standby items in service.
 - .4 Action emergency call-out, if necessary.

3.4 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.
- .2 Standard and Performance:
 - .1 Provide equipment of such quality and in such quantity as to provide sufficient capability to perform essential functions of work.
 - .2 Provide standby replacement for pumps and other essential dewatering equipment which may break down during work.
 - .3 Keep this replacement equipment available on site for immediate use.

3.5 DEWATERING REMOVAL

- .1 At approved stages in work remove all materials, temporary structures, and dewatering systems used to improve the water tightness of the stoplogs in the dewatering structure; any additional temporary structures; and dewatering systems.

3.6 CLEAN UP AND RECTIFICATION

- .1 Clean the sill excavation of accumulated sediment, debris and other materials deposited as a result of the contract activities.
- .2 Dispose of all unwanted materials in an approved manner off site.
- .3 Do not dispose of any materials into the surrounding forest or water courses.

- .4 All waste described as subject to Regulation 347, Environmental Protection Act, must be transported with a valid "Certificate of Approval for a Waste Management System" to a site approved by the Ontario M.O.E. to accept the waste.
- .5 Ensure all activities are in accordance with the BIA and Section 01 14 00 - Work Restrictions.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 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 - 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 Design and construct temporary construction access roads to minimize environmental impact to watercourse.
.3 Ensure construction activities do not impact downstream spawning beds.
.4 Dumping excavated fill, waste material, or debris in watercourse is prohibited.
.5 Underwater blasting is prohibited.
.6 Carry out work to requirements of work permits.
.7 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.
.8 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 Departmental Representative.
.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 Departmental Representative 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 Departmental Representative.
.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 SECTION INCLUDES Installation of a turbidity curtain as part of the preservation of the watercourse.
- 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 - 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 The supply, installation and maintenance of a Turbidity Curtain within a watercourse shall be paid at the contract unit price per linear meter.
 - .2 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 (ASTM)
 - .1 ASTM D4491-17, 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 D4716-08, 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 D4751-16, 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 Geosynthetics.
 - .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 2006, Turbidity Curtain, Seam Detail.
- .5 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS 577 November 2010, Construction Specification for Temporary Erosion and Sediment Control Measures.

1.5 SUBMITTALS

- .1 Submit details of the temporary turbidity curtain system to the Departmental Representative prior to the start of the Work.
- .2 Submit to Departmental Representative 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 Departmental Representative 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 Departmental Representative.
 - .2 Length: as specified on contract Drawings.
 - .3 Composed of: minimum 85% by mass of polypropylene 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 D4595.
 - .1 Tensile strength: minimum 1350N, 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 4000N, 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 Departmental Representative. Where directed by the Departmental Representative, 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 Departmental Representative.
 - .3 Monitoring of water turbidity outside the silt curtain will be carried out by the Contractor as set out in Section 01 48 00. Maximum allowable increase of turbidity above background levels is 8 NTUs (Nephelometric Turbidity Units).

- 3.2 INSTALLATION .1 Maintain existing flow pattern in natural watercourse systems.
- 3.3 SITE CLEARING AND PLANT PROTECTION .1 Turbidity curtains shall consist of turbidity curtain geosynthetic, load line, flotation, ballast, anchors, mooring buoys, mooring lines, adjustment lines, and tie-downs.
- .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 Departmental Representative.
- .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 Section 31 23 16 Rock Removal
- .2 Section 35 20 22 Dewatering
- .3 Section 35 42 19 Preservation of Watercourse
- .4 Section 35 49 25 Turbidity Curtain (Sediment Curtain)
- 1.2 GENERAL REQUIREMENTS .1 Acknowledge all laws, regulations, guidelines and safety codes applicable to work involved in this section and comply strictly.
- 1.3 REGULATIONS .1 Construction to be in accordance with the latest edition of the applicable Ontario and National codes. The above to govern except where other applicable codes or provided notes are more restrictive.
- .2 The cofferdam construction, operation, surveillance and demolition must comply with all applicable laws, especially and not limited to:
- .1 Ministry of Labour, Ontario - Occupational Health and Safety Act and Regulations for Construction Projects.
- .2 Environmental Protection for Construction in Waterbodies and on Waterbody Banks (OPSS 182).
- 1.4 PERMITTING .1 The Contractor is responsible to obtain all required permits and approvals necessary to construct, operate and demolish cofferdams.
- 1.5 SCOPE OF WORK .1 Cofferdams will be required to allow construction of concrete structures and the excavation of rock in the dry.
- .2 The work described in this section includes:
- .1 Construction of Phase 1, 2 and 3 cofferdam supporting elements (e.g. H-Piles, anchor plates etc.) outside of restriction period.
- .2 Phase 1 Upstream Cofferdam
- .3 Phase 1 Downstream Cofferdam
- .4 Phase 2 Upstream Cofferdam Transfer
- .5 Phase 2 Downstream Cofferdam Transfer
- .6 Phase 3 Upstream Cofferdam Transfer
- .7 Phase 3 Downstream Cofferdam Transfer
- .8 Construction, maintenance, and demolition of the cofferdams.

.3 Work to be in accordance with the latest editions of all government laws and regulations.

1.6 DESIGN REQUIREMENTS

.1 The cofferdams shall be designed for **the minimum** of one in twenty year flood and 500 mm freeboard allowance. In no case shall the minimum crest elevation of the cofferdam be less. The expected flow for the 1:20 year flood is 71 m³/s.

.2 Cofferdam is subject to dynamic hydraulic loads due to the staged construction, which includes operation of the existing dam. Dynamic loads to be included in the design of the cofferdam. Stoppage of flows during the construction work will not be permitted. Two sluiceways must be maintained operational at all times, this includes during the installation, transfer and removal of cofferdams.

.3 The proposed crest elevation of the cofferdams are:
.1 Upstream cofferdam: EL. 309.3 m
.2 Downstream cofferdam: EL. 308.16 m

.4 The Contractor shall become familiar with the historical minimums, maximums, averages and daily levels for this year found at: http://www.pc.gc.ca/lhn-nhs/on/trentsevern/visit/ne-wl/trent_e.asp. If the Contractor believes the proposed minimum cofferdam crest elevations are not adequate, they shall budget at the time of the tender any necessary modifications to raising and strengthening the cofferdams. No claims will be considered at the time of construction for inadequacy of cofferdams to maintain the work area dry.

.5 The Contractor shall submit, at least 14 days prior to commencement of construction activities, the approved final drawings of the cofferdams for construction signed and sealed by a licensed Professional Engineer of Ontario.

.6 The Contractor is responsible for the stability and water tightness of the cofferdams under all loading conditions.

.7 The contract drawings only provide a schematic of the proposed construction staging and shall not be used by the Contractor in any manner for the design of the cofferdams. Cofferdams must be within the work area and limits of construction.

.8 Contractor is fully responsible for the design and installation of the cofferdams that can include backfill with sheetpile curtain, cellular

cofferdam, structural steel with drilled post or embedded post, diaphragm cofferdam, prefabricated concrete block with geosynthetic barrier or any other design to be approved by the Departmental Representative.

- .9 Rockfill/backfill with waterproof barrier cofferdam shall not be used for this project due to the restriction period.
- .10 The cofferdam design engineer shall be on site to witness all of the following activities applicable to the project and provide individual signed and sealed letters confirming that they were completed with accordance to the design drawings:
 - .1 Anchor installation
 - .2 Post installation
 - .3 Steel/sheetpile installation
 - .4 Backfill/rock fill installation
 - .5 Membrane installation
 - .6 Sealing of cofferdam bottom
 - .7 Sealing of cofferdam sides
 - .8 Adequacy of cofferdam stability
- .11 No dewatering or demolition work shall commence until all necessary signed and sealed letters in order to certify the cofferdam have been submitted by the Contractors cofferdam design engineer.
- .12 Erosion and sediment control and water quality monitoring shall be in compliance with all regulations.

1.7 INSPECTION

- .1 The Contractor and its engineers shall maintain a quality control program throughout the construction and service life of the cofferdams. The Contractor and its engineers are responsible for all aspects of the cofferdam including but not limited to approval of foundation bedrock conditions, site preparation and construction and materials quality control and monitoring of the cofferdams.
- .2 All observations must be compiled in a daily inspection report, with copies sent on a weekly basis to the Departmental Representative.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

APPENDIX A



RE: HALIBURTON DAMS GEOTECHNICAL PROGRAMS
HALIBURTON SECTOR, TRENT-SEVERN WATERWAY
ONTARIO REGION
GROUP C1 – FINAL REPORT

FOR: Public Works and Government Services Canada
c/o Parks Canada Agency (PCA)
2155 Ashburnham Drive
Peterborough, ON K9L 1P8
Mr. Kyle Jansson
Standing Offer Agreement: EQ754-131106/001/PWL
Contract No.: 5P315-150428/001/PWL
Project No.: 20035222
File No.: PWL-5-38091

REPORT NO.: 2016-10228
DATE: August 2, 2016
DISTRIBUTION: 2 Copies: PCA
PDF Copy: PCA Mr. Kyle Jansson [kyle.jansson@pc.gc.ca]
Original: (File No. 10086-S0069)



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- Appendix A: Site Photographs
- Appendix B: Borehole and Test Pit Logs
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August 2, 2016

REPORT NO.: 2016-10228

FILE NO.: 10086-S0069

1.0 INTRODUCTION

Soil Probe Ltd. (herein "*Soil Probe*") was retained by Parks Canada Agency (herein "*PCA*" and the "*Client*") to carry out geotechnical investigations and provide analyses on the concrete and foundation of multiple dams in the Haliburton Sector (herein "*the site*"), at the Trent-Severn Waterway of Parks Canada Agency.

The scope of work that was carried out can be found in Soil Probe's Proposal No. 2015-2333RR (herein "*Proposal*") dated September 3, 2015. Approval and award of this scope of work along with authorization to proceed was received on September 11, 2015 from Public Works and Government Services Canada (herein "*PWGSC*") on behalf of PCA.

As a result of site conditions an amendment (001) was approved on November 09, 2015 to include crane services for some dam locations and a second amendment (002) was issued on April 12, 2016 to include additional works to be carried out at the Red Pine Dam site.

A third amendment (003) was raised on July 19, 2016 to capture the change in the name of the Vendor referenced in the Call-up to delete Soil Probe Ltd. and insert Sola Engineering Inc. to complete the field works and submit the final pending reports related with this entire mandate initially carried out by Soil Probe Ltd.

As per the terms of reference and the scope of services detailed in Soil Probe's Proposal, the purposes of the geotechnical investigation are:

- To undertake/supervise concrete coring to test the strength and further determine the condition of the existing concrete as required to facilitate the concrete rehabilitation design;
- To test concrete quality and identify any defects, joints or voids;
- To conduct thin wall diamond drill core investigations to obtain bedrock samples; and,
- To sample and test the foundation materials.

The execution of the geotechnical program was divided into three (3) main groups (A, B and C). In addition, Groups B and C were subdivided into B1 and B2, and C1 and C2 respectively as per progress of the field work and directions from the Client. The list of all the dams included in the geotechnical program for each group is presented in Table 1.



Table 1: Dam Sites

GROUP	No.	DAM
GROUP A	1	LONG LAKE
	2	LOON LAKE
	3	CANNING LAKE
	4	WHITE LAKE
GROUP B1	5	ESSON LAKE
	6	EAGLE LAKE
GROUP B2	7	OBLONG LAKE
	8	RED PINE LAKE
	9	PERCY LAKE
GROUP C1	10	TWELVE MILE LAKE
GROUP C2	11	JACK LAKE
	12	GULL LAKE

The first report of the geotechnical program, consisting of the fieldwork and laboratory testing conducted by Soil Probe during the first phase, covered the four (4) dams of Group A (Long Lake Dam, Loon Lake Dam, Canning Lake Dam and White Lake Dam). This report was submitted on January 8, 2016.

Following directions from the Client, a second report was submitted on February 2, 2016 presenting the details of fieldwork and laboratory testing also carried out and completed by Soil Probe during the first phase for Group B1 (Esson Lake Dam and Eagle Lake Dam) before the works were temporarily interrupted due to winter conditions.

As requested by the Client, this third report presents the details of the fieldwork and laboratory testing carried out by Soil Probe for the Twelve Mile Lake Dam which was completed in the second phase of field works and is defined as Group C1 in Table 1 above.

The three (3) dams defined as Group B2 (Oblong Lake Dam, Red Pine Lake Dam and Percy Lake Dam) were completed in the second and final phase of the field works. The field work and laboratory testing results for these three (3) dams will be submitted in a fourth report while the remaining dams defined as Group C2 (Jack Lake Dam and Gull Lake Dam) will be covered in a fifth and final report, to complete the total of twelve (12) dams included in this geotechnical program.

This report has been prepared for the Client, and their nominated engineers and designers. Any Third party use or reproduction, in part or in full, of this report is prohibited without written authorization from Soil Probe. This report is also subject to the *Statement of Limitations* which forms an integral part of this



document.

2.0 SITE SETTING

2.1 SITE LOCATION

The Trent-Severn Waterway (TSW), is a 386 km waterway that extends from the Bay of Quinte, on Lake Ontario at the City of Quinte West (Trenton), in the south to the Georgian Bay (Lake Huron) at Port Severn in the north. The waterway traverses two (2) major watersheds, the Trent River Watershed and the Severn River Watershed. The water levels and flows on the waterway are controlled by 143 dams, 100 of which are in the Trent River Watershed and 43 are in the Severn River Watershed.

The Haliburton Sector of the TSW covers an area of approximately 3,200 km² and includes 47 dams and water retaining structures to control various reservoir lakes and rivers.

A Site Location Plan showing the dam site locations included in this program is presented as Figure 1. Specific site description of the dam site included in this report is presented below and photographs of this site is included in Appendix A.

2.2 SITE DESCRIPTION

The Twelve Mile Lake Dam is located on the outlet of Twelve Mile Lake, south of the town of Carnarvon. The dam is accessed directly off Highway 35. The address is 1034 Taylor Road, Minden Hills. The dam is owned and operated by the Trent-Severn Waterway (TSW) of Parks Canada Agency (PCA). The dam controls water levels on Twelve Mile and Boshkung Lakes releasing flow into Mountain Lake flowing into Horseshoe Lake.

The concrete gravity dam comprises two (2) manually operated stoplog-controlled sluiceways. The dam is approximately 46 m long. The right sluiceway measures 7.62 m wide and is 3.25 m high, sill to top of deck. The left sluiceway measures 7.62 m wide and is 3.26 m high, sill to top of deck. There is a 20 m long left wingwall that acts as an overflow spillway.

The investigated site area is centred at approximate grid reference 681052 E, 4985761 N (UTM 17T coordinates). Geodetic elevations at the site are between approximately 305 m to 308 m. The concrete gravity dam was originally constructed in 1911. No repair work was recorded.



2.3 PUBLISHED GEOLOGY

According to Map No. 1957B, Haliburton-Bancroft Area, Province of Ontario, 1: 126,720 Scale, the bedrock at the site is indicated to comprise Hybrid Granite Gneiss, migmatite, granite permatite. On Map P.3416, Precambrian Geology, Haliburton Area, the bedrock is indicated as Straight and Transposed Gneiss.

3.0 GEOTECHNICAL INVESTIGATION

3.1 FIELD WORKS

Prior to starting the field works, a General Health and Safety (H&S) Plan for the planned field activities and tasks was submitted to the Client. In addition, a specific management H&S plan was developed and implemented according to the individual conditions for the site included in this report. Prior to undertaking field drilling, clearance of existing public utility services to the site was obtained from all applicable agencies. The field geotechnical investigation was carried out on November 16, 2015, from May 3 to 6, 2016 and June 6, 2016 and comprised the drilling of four (4) boreholes, using a track-mounted Geo-Probe and a portable ETR lightweight drilling rigs equipped with NQ and BTW core size drill bits respectively and one (1) test pit excavated to collect additional information to infer the bedrock profile along the dam on the east side, using a Terex TC 16 excavator.

All drilling and excavation equipment was supplied and operated by Determination Drilling & Soil Investigations Inc. (DDSI) of Hamilton, Ontario, and the drilling works were completed under the full time supervision of a qualified Soil Probe Engineer.

Table 2 shows details about the borehole and test pit IDs and depths of drilling for the dam site included in this report.

Table 2: Borehole and Test Pit ID and Depths

No.	DAM	BOREHOLES/TEST PIT PER SITE	BOREHOLE/TEST PIT	
			ID	DEPTH (m)
1	TWELVE MILE LAKE	4	TWM-01	3.60
			TWM-02	6.70
			TWM-03	6.00
			TWM-04	8.85
		1	TP-01	2.00
TOTAL		5		



The locations of the boreholes and test pit were based on the geometry and elements of the dam and access and safety conditions for the drilling crew and equipment. Figure 2 shows the borehole and test pit locations (plan and elevations) for the dam site included in this report.

All soil, concrete and rock samples collected in the drilled boreholes were logged in field and returned to Soil Probe's laboratory in Scarborough for further review and subsequent sampling for laboratory testing.

The exploratory boreholes were located in the field by Soil Probe using a survey tape to measure offsets from existing and adjacent site features. Elevations were established for each borehole on site using as a reference the top of the deck of the dam which was assumed to be at an elevation of 100.0 m (local).

The detailed logs of all boreholes completed, together with their depths and relative elevations to the assumed values, are presented as Appendix B.

The borehole logs give a description of the concrete, rock and/or soils based on a visual examination of the samples, field testing, drilling issues and all additional information related with field work activities.

Recovered cores from boreholes were properly retained in wood boxes to be shipped to Soil Probe's Laboratory in Scarborough, Ontario. All core box photographs from the drilling works are presented in the Appendix C.

Description of the concrete condition includes colour, type of aggregates, recovery, cracks, fractures, and discontinuities in the concrete mass, rebar (if any), depth of interface with rock/soil foundations and any additional information.

Main descriptions for bedrock include rock type, colour, grain size, core recovery, Rock Quality Designation (RQD), Intact Rock Strength (IRS), Weathering Index (WI), Joint Spacing, type of discontinuities, roughness, planarity and infill and/or coating, if any. The core properties and discontinuities are also rated and plotted in the logs as per Coding presented at the end of the Appendix B.

Water level observations were made during and on completion of the drilling of each borehole. The details of water level observations for each borehole are presented on the respective borehole log.

The scope of the investigation also included for the execution of packer tests to assess the



hydraulic conductivity and the condition of rock mass discontinuities associated with Lugeon values. The water level in each borehole was noted prior to carrying out the packer tests.

On the completion of the borehole drilling at the piers of the dam, the walls of the holes were observed and recorded by a video camera. The results from these videos were checked and verified with the recovered cores and logs. Appendix F includes the electronic files for these videos.

On completion of field investigation works all boreholes were backfilled with non-shrink grout. As per directions from the Client and considering that in borehole TWM-04 was found a void at the interface between the dam concrete and foundation rock, and a 3 m steel pin tube was installed as a temporary measure to limit any possible displacement of the pier.

3.2 GEOTECHNICAL FIELD AND LABORATORY TESTING

The most commonly in-situ test used to estimate the hydraulic conductivity of rock masses is the Lugeon test – also called the packer test. In addition, this test provides the condition of rock mass discontinuities associated with Lugeon values. The test, which derives its name from Maurice Lugeon (1933), is a constant head type test that takes place in an isolated portion of a borehole. Water at constant pressure is injected into the rock mass through a pipe bounded by pneumatic packer (single packer). A pneumatic packer is an inflatable rubber sleeve that expands radially to seal the annulus space between the drill rods and the boring walls.

Prior to commencing the test, a maximum test pressure (P_{max}) is defined. P_{max} was chosen such that it does not exceed the confinement stress (σ_3) expected at the depth where the test is being conducted, thus avoiding the development of hydraulic fracturing or hydraulic jacking.

The tests for this program were conducted in five (5) stages, with a particular water pressure magnitude associated with each stage. A single stage consisted of keeping a constant water pressure at the test interval for ten (10) minutes by pumping as much water as required. The first stage is held at a low water pressure, increasing the pressure in each subsequent stage until reaching P_{max} . Once P_{max} was reached, pressures were decreased following the same pressure stages used on the way up, thus describing a “pressure loop”. Table 3 shows the pressure magnitudes customarily used during the five (5) test stages.



Table 3: Pressure Steps for Packer Test

Test Stage	Description	Pressure Step
1 st	Low	0.5 P _{max}
2 nd	Medium	0.75 P _{max}
3 rd	Maximum (peak)	P _{max}
4 th	Medium	0.75 P _{max}
5 th	Low	0.5 P _{max}

During the execution of each stage, both water pressure (P) and flow rate (q) values were recorded every two (2) minutes. Subsequently, average values for P and q were then used to compute the hydraulic conductivity for each stage. The hydraulic conductivity is expressed in terms of the *Lugeon value*, which is empirically defined as the hydraulic conductivity required for achieving a flow rate of 1 liter/minute per meter of test interval under a reference water pressure equal to 1 MPa.

The samples recovered from the drilling program were brought to Soil Probe's laboratory to be reviewed and logged. Selected samples of concrete and rock were collected and shipped to Golder Associates Laboratory for further testing including Unconfined Compression Strength (UCS) for concrete, USC and Point Load Test (PLT) for rock. No suitable interface concrete-rock samples undisturbed sample were recovered from field works to carry out shear strength tests.

Laboratory testing was carried out following the American Society for Testing and Materials (ASTM) and Canadian Standards Association (CSA) standards as follow in Table 4.



Table 4: Laboratory Test and Field Works Standards

SAMPLING AND FIELD TESTING	STANDARD
Standard Test Method for Unconfined Compressive Strength of Intact Rock Core Specimens	ASTM - D7012
Test Methods and Standard Practices for Concrete	CAN-A23.2-14
Standard Test Method for Performing Laboratory Direct Shear Strength Tests of Rock Specimens Under Constant Normal Force	ASTM - D5607-08
Standard Test Method for Determining Rock Quality Designation (RQD) of rock core	ASTM- D6032
Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength classification	ASTM - D5731
Standard Guides for Using Rock-Mass Classification Systems for Engineering	ASTM - D5878

Laboratory test results are presented in Appendix E.

4.0 OBSERVATIONS AND TEST RESULTS

Four (4) boreholes were carried out for this dam site, three (3) on top of the dam at each pier and one (1) on ground close to the west abutment. In addition, a test pit (TP-01) was mechanically excavated close to the end of the east wing wall. Locations are shown in Figure 2. The concrete dam of the Twelve Mile Lake site is founded on bedrock. The geology encountered across the site was as anticipated from review of the available geological information as detailed in Section 2.3.

A detailed description of the concrete and rock conditions encountered in the boreholes completed at the site, including the geotechnical testing results, are presented on the borehole logs in Appendix B. Below is a brief description of the results.

4.1 CONCRETE

The concrete strength of the three (3) piers of the dam ranges between 22.1 MPa to 28.6 MPa and comprises a mix of cement-sand-gravel with cobbles. The type of fracture for the tested samples shows a shear pattern. There is no published information that serves as a guide for interpreting the meaning of the different types of fractures. Normally, a test cylinder should break into two (2) conical end sections with the caps intact. In Soil Probe's experience, the cone, cone-and-split, and cone-shear are fairly typical fracture types for normal concretes. Concretes with high sand contents may fail in the shear mode.

The concrete/cobbles ratio is approximately 1:0.2 for TWM-01, 1:0.18 for TWM-02, 1:0.15 for



TWM-03 and 1:0.14 for TWM-04 measured from the lengths of the recovered cores from boreholes. The Dry Unit Weight ranges between 20.55 kN/m³ to 23.29 kN/m³. Air bubbles were observed in the concrete mix and this may be the reason for this low unit weight of the concrete. Exterior cracks were observed on the walls of the piers (see Figures A of Appendix A), and several internal cracks were observed on the recovered cores and from the video camera records.

As noted above, a void was found at the foundations of the east pier of the dam (borehole TWM-04). In addition, water flow through the dam was observed at this pier (see photo in Appendix A2). These conditions may disturb the stability of the pier and therefore putting in risk the complete stability of the structure.

4.2 BEDROCK

Native bedrock was encountered directly underlying the dam concrete in the three (3) boreholes drilled on top of the dam and comprises a granite gneiss, faintly foliated and banded with black biotite crystals, grey, strong, fine to medium grain, very poor to excellent quality, slightly weathered, close to widely jointed. The Unconfined Compression Strength (UCS) ranges between 72.8 MPa to 119.7 MPa and its Dry Unit Weight ranges between 26.87 kN/m³ to 27.15 kN/m³. Results from Point Load Test (PLT) look higher than those from UCS. This rock was encountered in all boreholes carried out in the area.

The compression laboratory test results for both concrete and rock of the Twelve Mile Lake Dam are plotted and presented in Figure 4.

4.3 WATER LEVELS

Water levels were measured in all boreholes and test pit during the intrusive drilling works. Water was measured at depths of approximately 2.9 m (TWM-02), 2.85 m (TWM-03) and 1.85 (TWM-04) below existing deck top of the dam, and 2.2 m and 2.0 m below ground surface for the borehole TWM-01 and TP-01. The depth at which water level was encountered during drilling works is presented on the respective borehole log in Appendix B.

It should be noted that water was added during drilling works and the water level can vary and is subject to seasonal fluctuations in response to major weather events and dam operations. It is important to review the water level information in conjunction with the concrete/rock profile, i.e. cracks and discontinuities.

4.4 PACKER TEST RESULTS

Three (3) Packer tests were carried out in selected boreholes for the dam site and their results



are presented below in Table 5.

Table 5: Packer Test Results

No.	DAM	BOREHOLE ID	Hydraulic Conductivity (cm/sec)	Lugeon Value (cm/sec)
1	TWELVE MILE LAKE	TWM-01	0.00	0
		TWM-02	0.00	0
		TWM-04	2.8E-03	282.0

As shown in Table 4 above, and also in the Packer test calculations presented in Appendix D, the results for the Twelve Mile Lake Dam show a very tight to open closely spaced or voids conditions of the rock discontinuities with very low to very high hydraulic conductivity. High results for TWM-04 are consistent with the conditions found from recovered cores which show a very closely jointed conditions and fractured rock. These rock conditions should be considered for future designs.

5.0 CLOSURE

This report is subject to the *Statement of Limitations* which forms an integral part of this document. The *Statement of Limitations* is not intended to reduce the level of responsibility accepted by Sola, but rather to ensure that all parties who have been given reliance for this report are aware of the responsibilities each assumes in so doing.

We trust that this report meets your needs. Should you have any queries, please contact the Sola office.

Sincerely

SOLA ENGINEERING INC.

Bill Feng, P. Eng.

Samuel Pena, P. Eng.

Y:\PROJECTS\10086 - PWGSC-Haliburton Dams\TR-Technical Reports\03 Report C1 (2016-10228)\02 Final Report\01 Text



STATEMENT OF LIMITATIONS

Standard of Care and Basis of this Report

Sola Engineering Inc. ("Sola Engineering") has prepared this report in a manner consistent with generally accepted engineering and/or environmental practices in the jurisdiction in which the specified services were provided. The information and conclusions set out in this report reflects Sola Engineering's best professional judgment in light of the information available to Sola Engineering at the time of preparation. Sola Engineering disclaims any and all warranties, express or implied, including without limitation any warranty of merchantability and/or fitness for a particular purpose, and makes no representations concerning the legal effect, interpretation or significance of this report or the information, conclusions or recommendations contained in it.

The conclusions and recommendations provided in this report have been prepared in relation to the specified site (the "Site") and the proposed project (the "Project"), as described by the Client to Sola Engineering. Given the nature of the work undertaken by Sola Engineering as part of this report, the Client acknowledges that ground conditions may vary over distances and may change over time. Should there arise any changes to the conditions of the Site or the Project (as to purpose or design), Sola Engineering is to be notified within a reasonable period of time, and in any event within 24 hours of the Client's learning of such changes, so as to give Sola Engineering an opportunity to review and revise this report in light of such changes. Sola Engineering accepts no liability or responsibility for any use of this report or reliance on this report following any changes to the conditions of the Site or the Project.

The scope of professional services provided by Sola Engineering for the Project are as set out in this report. Should such services be limited to those of a geotechnical nature, Sola Engineering shall not be held liable or responsible for any environmental services that may be required, nor shall this report be interpreted to reflect any environmental aspects of the Project. Alternatively, should such services be limited to those of an environmental nature, Sola Engineering shall not be held liable or responsible for any geotechnical services that may be required, nor shall this report be interpreted to reflect any geotechnical aspects of the Project.

This report is not intended to provide recommendations for possible future conditions or use of the Site or adjoining properties. Should the need arise for such recommendations Sola Engineering may need to conduct further investigations.

Use of this Report

This report is intended to be read and used in its entirety. No reliance may be made upon any individual portion or section of this report without reference to the entire report as a whole. In preparing this report, Sola Engineering has relied on information, instructions and communications given by the Client to Sola Engineering, the applicability, truth and accuracy of which is the sole responsibility of the Client.

This report with the information, sampling data, analysis, conclusions and recommendations contained in it (if any), has been prepared for and may only be used by the Client and only for the specific purpose as specified by the Client to Sola Engineering in connection with the Project. Without prior written consent from Sola Engineering, use of this report or any portion thereof by any person or entity other than the Client, or for any purpose other than as communicated by the Client to Sola Engineering, is strictly prohibited. Sola Engineering accepts no liability or responsibility for the unauthorized use of this report. This report and all documents that form part of it are the sole property of Sola Engineering. Sola Engineering relies on and retains any and all intellectual property rights it has in this report, including any copyright to which it is entitled. The Client shall not give, lend or sell this report, or any portion thereof, to any entity, person or association without the express prior written consent of Sola Engineering. This report and the information contained herein shall be treated as strictly confidential.

The contents of this report, inclusive of Sola Engineering's conclusions and recommendations in relation to the Project, are intended only for the guidance of the Client in carrying out the specified services for the Project, as described by the Client to Sola Engineering. Accordingly, Sola Engineering does not accept any liability or responsibility for any inaccuracy contained in this report arising as a result of or in any way connected with any exclusion, oversight or falsification of the information provided to Sola Engineering by the Client. This report, including the effect of the subsurface conditions as described in this report, is to be interpreted at the risk and discretion of the Client and any contractors or others bidding on or undertaking contractual work to be performed as part of the Project who may come into possession of or learn of this report or its contents. It is exigent that all contractors bidding or undertaking the work are to rely on their own interpretations of the data contained in this report in addition to their own investigations and conclusions. Sola Engineering shall not be held liable or responsible for any interpretation of or conclusions that may be drawn from the data or information contained in this report.

The information, recommendations and conclusions presented in this report are based on Sola Engineering's interpretation of conditions revealed through the limited investigation conducted within a defined scope of services. In no event will Sola Engineering be held responsible or liable to the Client or any other person or entity for any special, indirect, incidental, punitive or consequential loss or damage (including, loss of use, lost profits or expenses incurred) resulting from or in any way related to the independent interpretations, interpolations, conclusions or decisions of the Client or any other person or entity, based on the information contained in this report. The restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Notwithstanding the exclusions of liability contained herein but without in any way limiting their effect or generality, if there is found to be any finding of liability or responsibility whatsoever on the part of Sola Engineering which in any way relates to or arises from this report, or the information, conclusions or recommendations contained in it, such liability and/or responsibility shall cease and forever be extinguished from and after the date which is two (2) years from the date of this report. In no event shall any liability or responsibility of Sola Engineering exceed the fees charged by Sola Engineering to the Client for the preparation of this report (excluding any arms' length disbursements or expenditures made or incurred by Sola Engineering as a result thereof and reimbursed by the Client).

Site Conditions

The material conditions, classifications, conclusions and recommendations contained in this report were based on the site conditions observed or tested by Sola Engineering or otherwise communicated to Sola Engineering by the Client. The description, identification and classification of soils, rocks, chemical contamination and other materials have been made based on limited investigations, sampling and testing of materials performed by Sola Engineering and its qualified representatives in reliance on the use of relevant or applicable equipment, all in accordance with commonly acceptable standards in the geotechnical and/or environmental disciplines. Accordingly, this report may include assumptions of conditions which are based on discrete sample locations and thus some conditions may not have been detected. The Client accepts all liability and risk for the use of this report and the information and data contained in it. Sola Engineering shall not be held liable or responsible for any conditions beyond the scope of tests conducted on samples of the subsurface and soil conditions of the subject property as set out in this report.

For clarity, the Client acknowledges and accepts that unique risks exist whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive sampling and testing program may fail to detect certain conditions. The environmental, geological, geotechnical, geochemical and hydrogeological conditions that Sola Engineering interprets to exist between sampling points may differ from those that actually exist. As a result, the Client acknowledges and accepts that because of the inherent uncertainties in subsurface evaluations, unanticipated underground conditions may occur or become known subsequent to Sola Engineering's investigation that could affect conclusions, recommendations, total Project cost and/or execution.

Indemnification of Risk

Though Sola Engineering adheres to the highest degree of integrity and employs due diligence in limiting the potential release of toxins and hazardous substances, the risk of accidental release of such substances is a possibility when providing geotechnical and environmental services.

In consideration of the provision of services by Sola Engineering, the Client agrees to defend, indemnify and hold Sola Engineering and its employees and agents harmless from and against any and all claims, liabilities, damages, causes of action, judgments, costs or expenses (including reasonable legal fees and disbursements), resulting from or arising by reason of the death or bodily injury to persons, damage to property, or other loss, whether related to an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project or otherwise, and whether or not resulting from Sola Engineering's negligent actions or omissions. This indemnification shall include and extend to any and all third party claims brought or threatened against Sola Engineering under any federal or provincial law or statute as a result of Sola Engineering conducting work on the Project. In addition to and notwithstanding the foregoing, the Client further agrees to unconditionally and irrevocably release Sola Engineering from, and not to bring any claims against Sola Engineering in connection with, any of the aforementioned claims or causes.

Subconsultants and Contractor Services

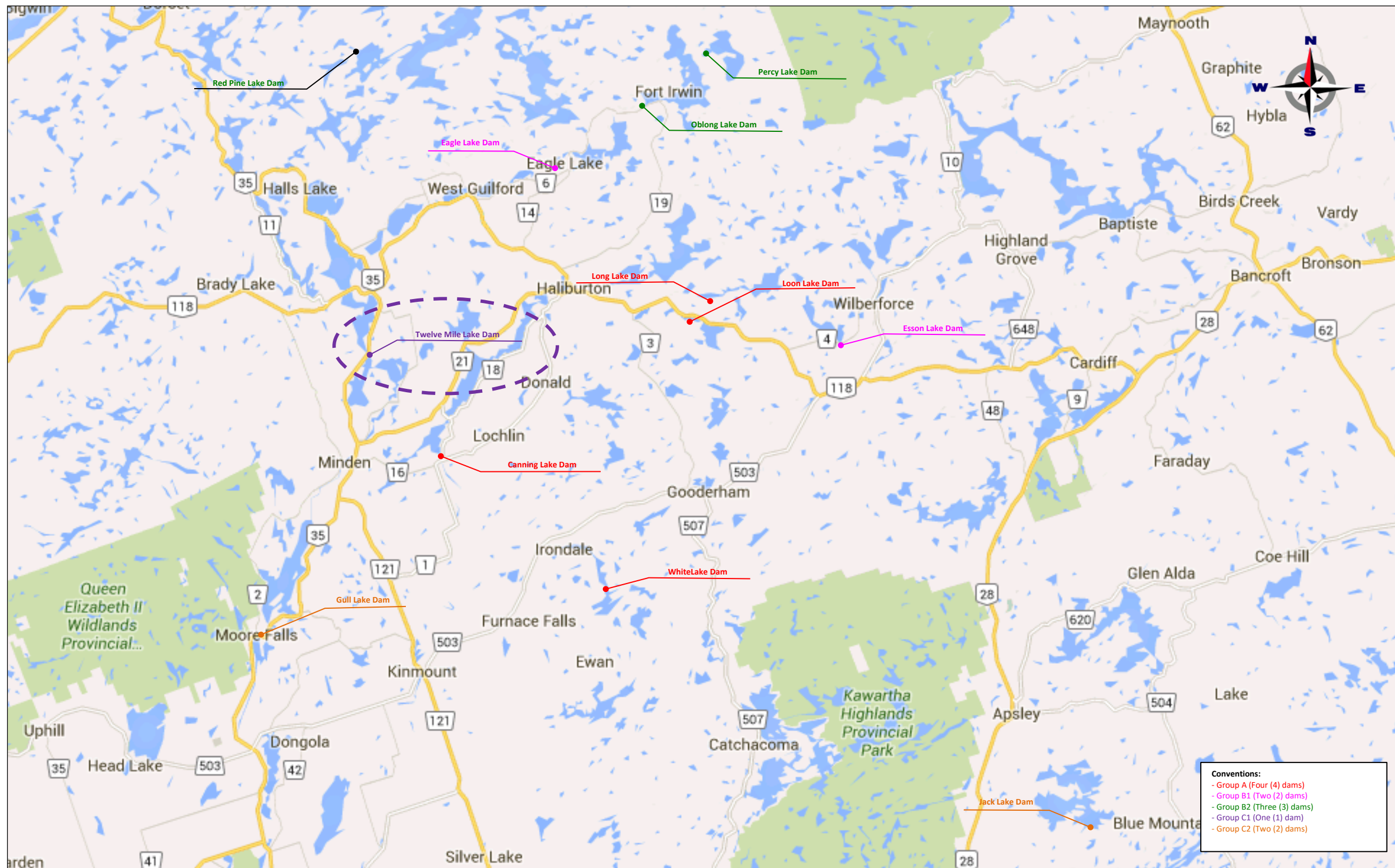
In conjunction with the services provided by Sola Engineering's own employees, external services provided by other persons or entities that are specializing in services other than those offered by Sola Engineering, such as drilling, excavation and laboratory testing, are often employed in order to carry out the defined scope of work. If such external services have been employed for this Project, the Client acknowledges that Sola Engineering is not in any way liable or responsible for any costs, claims or damages in relation to the services rendered by such other persons or entities or payment therefor, nor shall Sola Engineering be liable or responsible for damages for errors, omissions or negligence caused by such other persons or entities while providing such external services.

Work and Job Site Safety

Sola Engineering shall be responsible only for its activities and that of its employees on the Site. Sola Engineering shall not direct any of the fieldwork nor the work of any other person or entity on the Project. The presence of Sola Engineering staff on the Site does not relieve the Client or any contractor on the Site from their responsibilities pertaining to site safety. The Client at all times retains any and all responsibility for the safety of those individuals present on the Site and/or working on the Project, including Sola Engineering's employees.



FIGURES



File No.: 10086-S0069

Report Number:
2016-10228

Date: August 2, 2016

DAM LOCATIONS PLAN

HALIBURTON DAMS GEOTECHNICAL INVESTIGATION
Haliburton Sector, Trent-Severn Waterway, Ontario Region

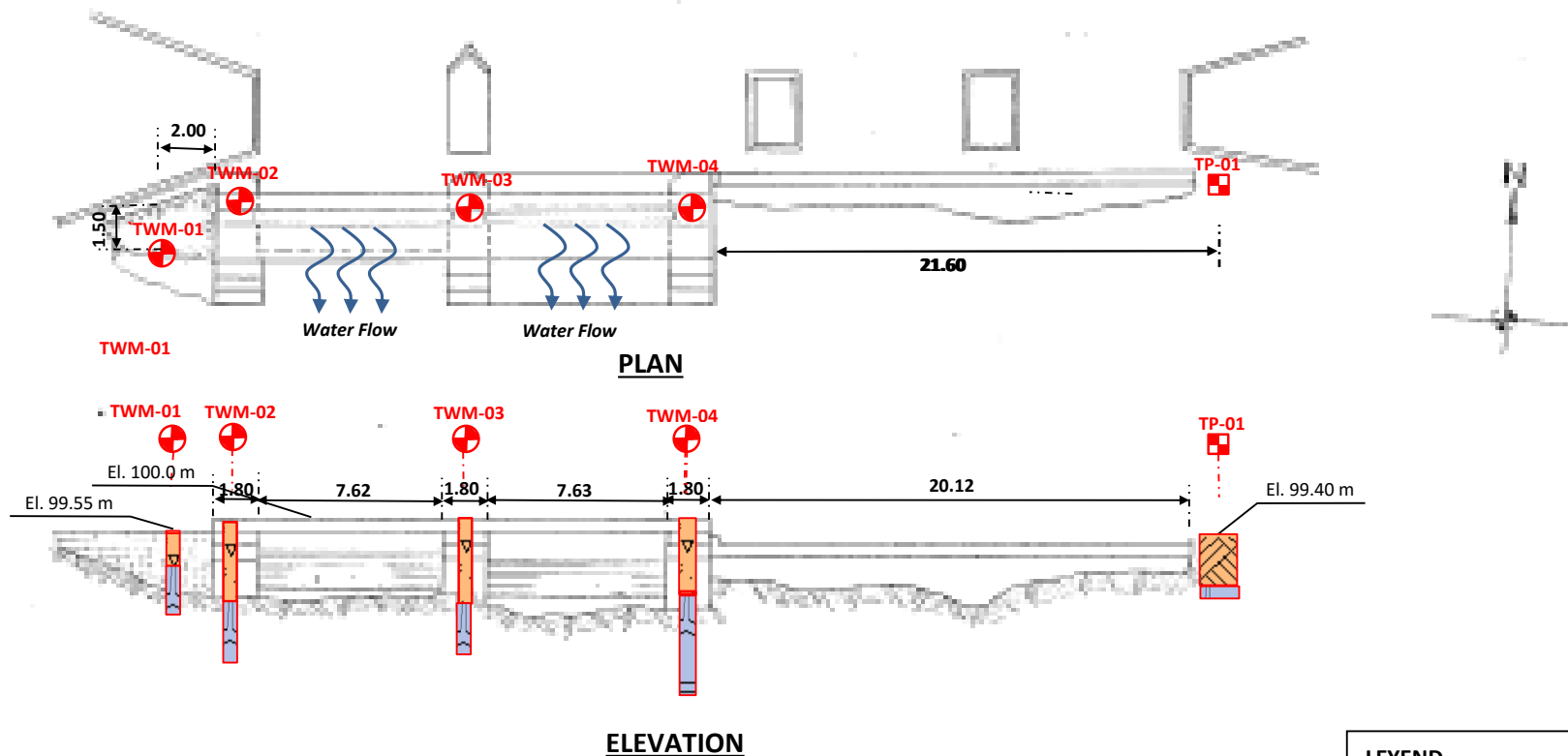
Project: 20035222

Public Works and Government Services Canada

Figure No.:

1

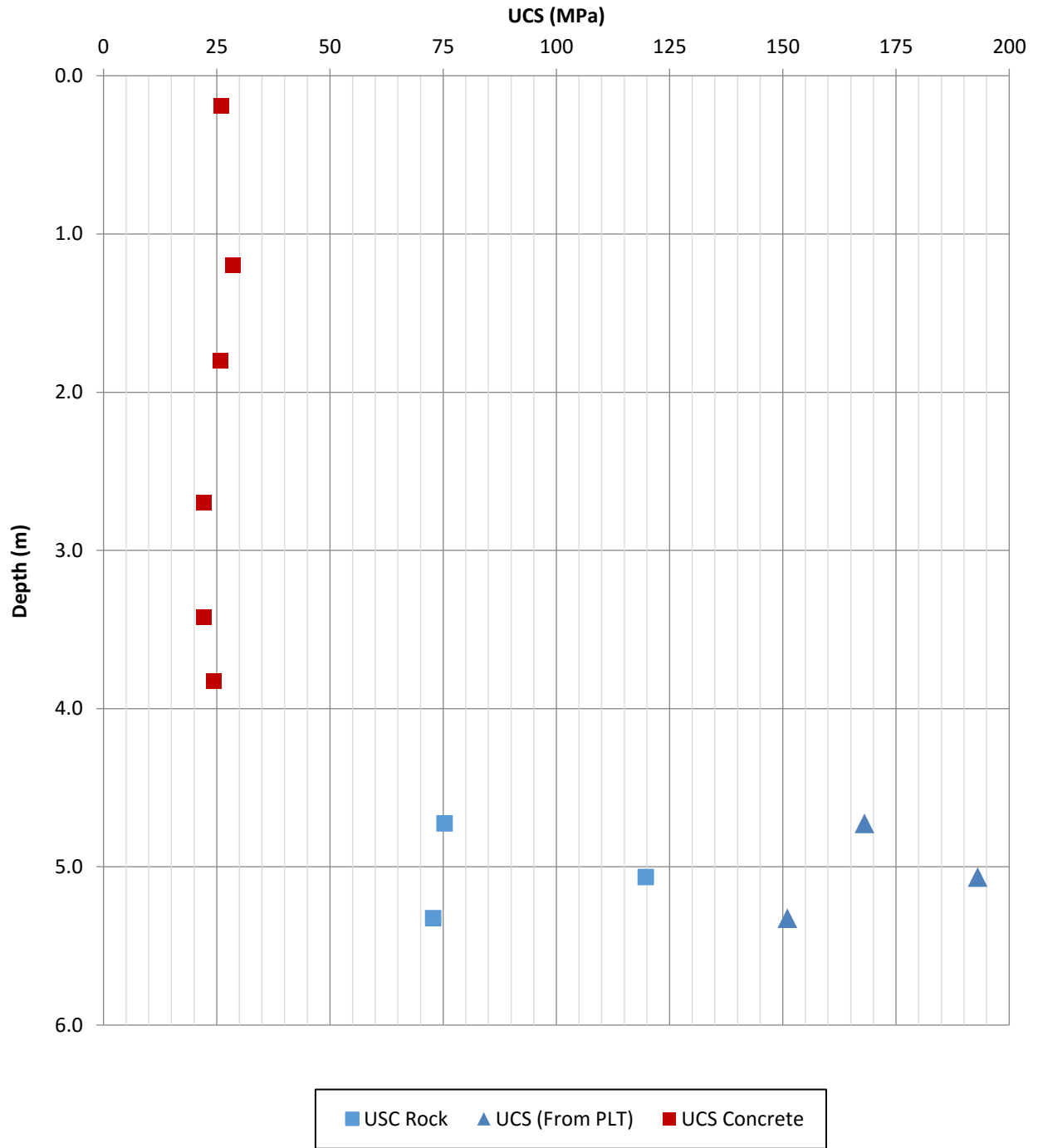
Not to Scale




NOTE: Dimensions in m. All elevations are referenced to the top of the dam assumed as 100.0 m

LEYEND	
	BOREHOLE
	TEST PIT
	CONCRETE
	BEDROCK
	SOIL

	File No.: 10086-S0069	BOREHOLE LOCATIONS PLAN - TWELVE MILE LAKE DAM HALIBURTON DAMS GEOTECHNICAL INVESTIGATION Haliburton Sector, Trent-Severn Waterway, Ontario Region Project: 20035222	The figure provided is for the intended purpose of presenting the approximate borehole locations. This figure should not be used for any other purposes including construction, architecture or for accuracy of dimensions and orientation of objects.	Figure No.:
	Report Number: 2016-10228			Parks Canada Agency
	Date: August 2, 2016	Not to Scale		



	File No.: 10086-S0069	TWELVE MILE LAKE DAM-UCS RESULTS	Figure No.: 3
	Report Number: 2016-10228	HALIBURTON DAMS GEOTECHNICAL INVESTIGATION Haliburton Sector, Trent-Severn Waterway, Ontario Region Project: 20035222	
	Date: August 2, 2016	Parks Canada Agency	



APPENDIX A

Site Photographs



PHOTOGRAPH 1: Downstream Dam View




PHOTOGRAPH 2: Drilling Equipment on Dam



PHOTOGRAPH 3: Borehole TWM-03 Location



PHOTOGRAPH 4: Test Pit Excavation

	File No.: 10086-S0069	TWELVE MILE LAKE DAM-SITE PHOTOGRAPHS HALIBURTON DAMS GEOTECHNICAL INVESTIGATION Haliburton Sector, Trent-Severn Waterway, Ontario Region Project: 20035222 Parks Canada Agency	Figure No.: A-1
	Report Number: 2016-10228		
	Date: August 2, 2016		



PHOTOGRAPH 1: Water flow through the Concrete Dam at East Pier




PHOTOGRAPH 2: Cracks on the East Pier



PHOTOGRAPH 3: Cracks on East Pier Stepping



PHOTOGRAPH 4: Cracks on the Middle Pier

	File No.: 10086-S0069	TWELVE MILE LAKE DAM-SITE PHOTOGRAPHS HALIBURTON DAMS GEOTECHNICAL INVESTIGATION Haliburton Sector, Trent-Severn Waterway, Ontario Region Project: 20035222 Parks Canada Agency	Figure No.:
	Report Number: 2016-10228		
	Date: August 2, 2016	A-2	



APPENDIX B

Borehole Core and Test Pit Logs



BOREHOLE LOG: TWM-01

PROJECT: HALIBURTON DAMS GEOTECH. PROGRAM	PROJECT No.: 10086-S0069	REPORT No.: 2016-10228
CLIENT: PARKS CANADA AGENCY	LOCATION: HALIBURTON SECTOR, TRENT-SEVERN WATERWAY, ONTARIO REGION	
CLIENT PROJECT No.: 20035222	DRILLER: DETERMINATION DRILLING AND SOIL INVESTIGATIONS (DDSI)	
SITE LOCATION: TWELVE MILE LAKE DAM	CORE BARREL: NQ	BORING DATE: November 16, 2015
LOGGED BY: VIDYASAGAR BODDULA	BOREHOLE ELEVATION (m): 99.55	DEPTH TO WATER (m): 2.20

STRATIGRAPHY			CORE PROPERTY				DISCONTINUITY						
ELEV. / DEPTH	GRAPHIC LOG	DESCRIPTION	CORE RUN	CORE RECOVERY (%)	RQD (%)	IRS (0-6)	WI (0-5)	JOINT SPACING (0-6)	TYPE	ROUGHNESS	PLANARITY	INFILL	COATING
99.6 0.0	0.0	FILL, sand and gravel, brown, moist	1	100	100	0	0	0					
98.6 1.0	1.0	CONCRETE, grey, 1-2 mm air voids, varving size aggregates and boulders Cobble Cobble Cobble Boulder	2	100	100	0	0	0					
97.6 2.0	2.0	BEDROCK, granite gneiss, faintly foliated and banded with black biotite crystals, grey, strong, fine to medium coarse grain, thickly laminated, excellent quality, lightly weathered, close to widely jointed.	3	100	100	4	1	0	0	R	I		OX
96.6 3.0	3.0		4	100	100	0	0	0	0	R	I		OX
95.6 4.0	4.0	End of Coring at 3.60 m. Borehole open at completion of drilling											
94.6 5.0	5.0												
93.6 6.0	6.0												
92.6 7.0	7.0												
91.6 8.0	8.0												
90.6 9.0	9.0												
89.6 10.0	10.0												

NOTE: Elevation of the dam top assumed as 100.0 m. Borehole elevation referenced to the top of the dam.



BOREHOLE LOG: TWM-02

PROJECT: HALIBURTON DAMS GEOTECH. PROGRAM	PROJECT No.: 10086-S0069	REPORT No.: 2016-10228
CLIENT: PARKS CANADA AGENCY	LOCATION: HALIBURTON SECTOR, TRENT-SEVERN WATERWAY, ONTARIO REGION	
CLIENT PROJECT No.: 20035222	DRILLER: DETERMINATION DRILLING AND SOIL INVESTIGATIONS (DDSI)	
SITE LOCATION: TWELVE MILE LAKE DAM	CORE BARREL: BTW	BORING DATE: May 5, 2016
LOGGED BY: VIDYASAGAR BODDULA	BOREHOLE ELEVATION (m): 100.00	DEPTH TO WATER (m): 2.90

STRATIGRAPHY		CORE PROPERTY					DISCONTINUITY						
ELEV. / DEPTH	GRAPHIC LOG	DESCRIPTION	CORE RUN	CORE RECOVERY (%)	RQD (%)	IRS (0-6)	WI (0-5)	JOINT SPACING (0-6)	TYPE	ROUGHNESS	PLANARITY	INFILL	COATING
100.0 / 0.0		CONCRETE, grey, 1-2 mm air voids, varying size aggregates and cobbles	1	100	100	0	0	0	0	0	0	0	0
99.0 / 1.0		Cobble											
98.0 / 2.0		Cobble	2	100	100	0	0	0	0	0	0	0	0
97.0 / 3.0		Cobble											
96.0 / 4.0		Open interface Concrete/Rock	3	100	100	0	0	0	0	0	0	0	0
95.0 / 5.0		BEDROCK, gneiss, faintly foliated and banded with black biotite crystals, grey, strong, fine to medium coarse grain, thickly laminated, excellent quality, lightly weathered, close to widely jointed.											
94.0 / 6.0			4	100	100	0	0	0	0	0	0	0	0
93.0 / 7.0													
92.0 / 8.0			5	100	100	0	0	0	0	0	0	0	0
91.0 / 9.0													
90.0 / 10.0			End of Coring at 6.70 m. Borehole open at completion of drilling										

NOTE: Elevation of the dam top assumed as 100.0 m. Borehole elevation referenced to the top of the dam.



BOREHOLE LOG: TWM-03

PROJECT: HALIBURTON DAMS GEOTECH. PROGRAM	PROJECT No.: 10086-S0069	REPORT No.: 2016-10228
CLIENT: PARKS CANADA AGENCY	LOCATION: HALIBURTON SECTOR, TRENT-SEVERN WATERWAY, ONTARIO REGION	
CLIENT PROJECT No.: 20035222	DRILLER: DETERMINATION DRILLING AND SOIL INVESTIGATIONS (DDSI)	
SITE LOCATION: TWELVE MILE LAKE DAM	CORE BARREL: BTW	BORING DATE: May 4, 2016
LOGGED BY: VIDYASAGAR BODDULA	BOREHOLE ELEVATION (m): 100.00	DEPTH TO WATER (m): 2.80

STRATIGRAPHY		CORE PROPERTY					DISCONTINUITY						
ELEV. / DEPTH	GRAPHIC LOG	DESCRIPTION	CORE RUN	CORE RECOVERY (%)	RQD (%)	IRS (0-6)	WI (0-5)	JOINT SPACING (0-6)	TYPE	ROUGHNESS	PLANARITY	INFILL	COATING
100.0 99.0 98.0 97.0 96.0 95.0 94.0 93.0 92.0 91.0 90.0	0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0	CONCRETE, grey, 1-2 mm air voids, varying size aggregates and cobbles Cobble Cobble Cobble BEDROCK, gneiss, granite, faintly foliated and banded with black biotite crystals, grey, strong, fine grain, very poor to good quality, slightly weathered, close to widely jointed. End of Coring at 6.00 m. Borehole open at completion of drilling	1 2 3 4						CRACK CRACK FRACTURE FRACTURE FRACTURE FRACTURE FRACTURE JOINT JOINT	R R R R R R	I I I I I I	OX OX OX OX OX OX	OX OX OX OX OX OX

NOTE: Elevation of the dam top assumed as 100.0 m. Borehole elevation referenced to the top of the dam.



BOREHOLE LOG: TWM-04

PROJECT: HALIBURTON DAMS GEOTECH. PROGRAM	PROJECT No.: 10086-S0069	REPORT No.: 2016-10228
CLIENT: PARKS CANADA AGENCY	LOCATION: HALIBURTON SECTOR, TRENT-SEVERN WATERWAY, ONTARIO REGION	
CLIENT PROJECT No.: 20035222	DRILLER: DETERMINATION DRILLING AND SOIL INVESTIGATIONS (DDSI)	
SITE LOCATION: TWELVE MILE LAKE DAM	CORE BARREL: BTW	BORING DATE: May 3, 2016
LOGGED BY: VIDYASAGAR BODDULA	BOREHOLE ELEVATION (m): 100.00	DEPTH TO WATER (m): 1.80

STRATIGRAPHY		CORE PROPERTY					DISCONTINUITY							
ELEV. / DEPTH	GRAPHIC LOG	DESCRIPTION	CORE RUN	CORE RECOVERY (%)	RQD (%)	IRS (0-6)	WI (0-5)	JOINT SPACING (0-6)	TYPE	ROUGHNESS	PLANARITY	INFILL	COATING	
100.0 / 0.0		CONCRETE, grey, 1-2 mm air voids, varving size aggregates and cobbles Cobble	1	100	100	0	0	0						
99.0 / 1.0														
98.0 / 2.0		06/05/16	Cobble	2	100	100	0	0	0	CRACK				
97.0 / 3.0			Cobble											
96.0 / 4.0			Void at the interface Concrete/Rock	3	100	100	0	0	0	JOINT	R	I		OX
95.0 / 5.0			BEDROCK, gneiss, granite, faintly foliated and banded with black biotite crystals, grey, strong, fine to medium grain, very poor to good quality, slightly weathered, close to widely jointed.	4	100	100	0	0	0	JOINT	R	I		OX
94.0 / 6.0									JOINT	R	I		OX	
93.0 / 7.0			5	100	100	0	0	0	FRACTURE	R	I		OX	
92.0 / 8.0			6	100	100	0	0	0	JOINT	R	I		OX	
91.0 / 9.0		End of Coring at 8.85 m. Borehole open at completion of drilling							JOINT	R	I		OX	
90.0 / 10.0									JOINT	R	I		OX	

NOTE: Elevation of the dam top assumed as 100.0 m. Borehole elevation referenced to the top of the dam.



TEST PIT LOG: TP-01

PROJECT: HALIBURTON DAMS GEOTECH. PROGRAM	PROJECT No.: 10086-S0069	REPORT No.: 2016-10228
CLIENT: PARKS CANADA AGENCY	LOCATION: HALIBURTON SECTOR, TRENT-SEVERN WATERWAY, ONTARIO REGION	
CLIENT PROJECT No.: 20035222	DRILLER: DETERMINATION DRILLING AND SOIL INVESTIGATIONS (DDSI)	
SITE LOCATION: TWELVE MILE LAKE DAM	METHOD: Mech. Excavation (Cat Excavator)	DATE: June 6, 2016
LOGGED BY: VIDYASAGAR BODDULA	TESTPIT ELEVATION (m): 99.40	DEPTH TO WATER (m): 2.00

SAMPLE CONDITION	TYPE OF TEST			
<input checked="" type="checkbox"/> DISTURBED	Wn - Water Content (%)	GR- Gradation	PP - Pocket Penetrometer (kg/cm ²)	BS - Bulk sample
<input checked="" type="checkbox"/> GOOD	γ -Unit Weight (kN/m ³)	MC - Moisture Content (%)	VF - Field Vane (kg/cm ²)	
<input type="checkbox"/> LOST	WL - Liquid Limit (%)	WP - Plastic Limit (%)	TV - Torvane (kg/cm ²)	

STRATIGRAPHY			SAMPLE TESTS		TEST RESULTS
FROM (m)	TO (m)	DESCRIPTION	NUMBER	CONDITION	
0.0	2.00	Sand and Gravel Fill, brown, moist. At 2 m becomes wet.	BS-01	<input checked="" type="checkbox"/>	
		Groundwater and bedrock contact at 2 m depth		<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	

NOTE: Elevation of the dam top assumed as 100.0 m. Testpit elevation referenced to the top of the dam.




LOG CODING FOR ROCK CORE PROPERTIES AND DISCONTINUITIES

CORE PROPERTY						DISCONTINUITY												
ROCK QUALITY DESIGNATION (RQD) %		INTACT ROCK STRENGTH (IRS)			WEATHERING INDEX (WI)		JOINT SPACING			TYPE	ROUGHNESS		PLANARITY		INFILL/COATING			
0 - 25	Very Poor	R0	0.25 - 1 MPa	Extremely weak	0	Unweathered	0	< 0.02 m	Extremely Closely Jointed	Joint	I	Indented	C	Curved	SP	Serpentine	OX	Oxide
25 - 50	Poor	R1	1 - 5 MPa	Very weak	1	Slightly weathered	1	0.02 - 0.06 m	Very closely Jointed	Fault	M	Mirror	F	Flat	CA	Calcite	TO	Trace oxide
50 - 75	Fair	R2	5 - 25 MPa	Weak	2	Moderately weathered	2	0.06 - 0.2 m	Closely Jointed	Bedding	R	Rough	I	Irregular	SN	Sand	HO	Heavy oxide
75 - 90	Good	R3	25 - 50 MPa	Medium strong	3	Highly weathered	3	0.2 - 0.6 m	Moderately Jointed	Mechanical	S	Smooth	U	Undulated	PY	Pyrite	CL	Clay
90 - 100	Excellent	R4	50 - 100 MPa	Strong	4	Completely weathered	4	0.6 - 2.0 m	Widely Jointed	Shear					CP	Chalcopyrite	QZ	Quartz
		R5	100 - 250 MPa	Very strong	5	Residual soil	5	2.0 - 6.0 m	Very Widely Jointed	Fracture					TS	Trace silt	TC	Talc
		R6	> 250 MPa	Extremely strong			6	> 6.0 m	Extremely Widely Jointed	Gouge					GR	Graphite	MI	Mica



APPENDIX C

Core Box Photos

BOREHOLE	COREBOX PHOTOS	
TWM-01		
TWM-02		
SCALE		
 <p>File No.: 10086-S0069</p> <p>Report Number: 2016-10228</p> <p>Date: July 29, 2016</p>	<p>BOREHOLES TWM-01 AND TWM-02 CORE PHOTOS - TWELVE MILE LAKE DAM</p> <p>HALIBURTON DAMS GEOTECHNICAL INVESTIGATION</p> <p>Haliburton Sector, Trent-Severn Waterway, Ontario Region</p> <p>Project: 20035222</p> <p>Parks Canada Agency</p>	
	<p>Figure No.:</p> <p style="font-size: 2em; font-weight: bold;">C-1</p>	

BOREHOLE	COREBOX PHOTOS
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	File No.: 10086-S0069	BOREHOLES TWM-03 AND TWM-04 CORE PHOTOS - TWELVE MILE LAKE DAM HALIBURTON DAMS GEOTECHNICAL INVESTIGATION Haliburton Sector, Trent-Severn Waterway, Ontario Region Project: 20035222	Figure No.: C-2
	Report Number: 2016-10228		
	Date: July 29, 2016	Parks Canada Agency	



APPENDIX D

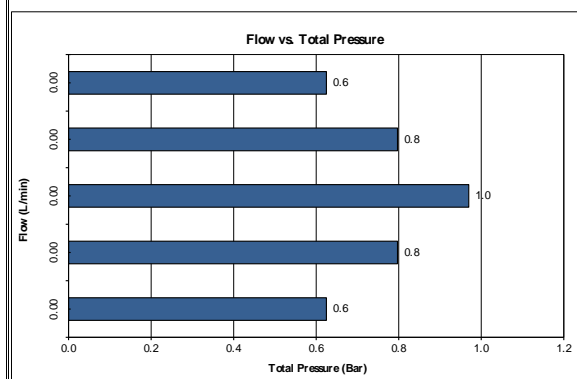
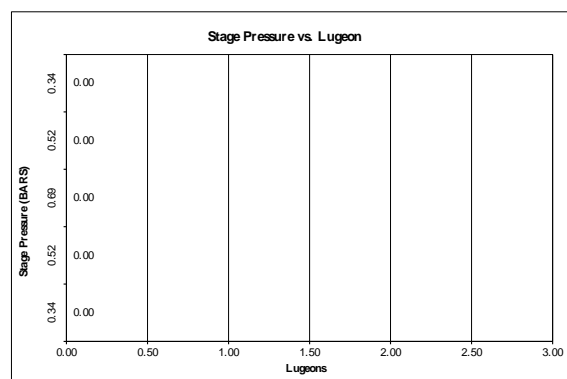
Field Testing-Packer Tests


PACKER TEST RESULTS FOR BOREHOLE No.:
TWM-01
PROJECT: HALIBURTON DAMS GEOTECHNICAL PROGRAM
PROJECT No.: 10086-S0069
REPORT No.: 2016-10228
CLIENT: PARKS CANADA AGENCY
**LOCATION: HALIBURTON SECTOR, TRENT-SEVERN WATERWAY,
ONTARIO REGION**
CLIENT PROJECT No.: 20035222
LOGGED BY: VIDYASAGAR BODDULA
SITE LOCATION: TWELVE MILE LAKE DAM

PACKER INTERVAL:	TOP	2.60	mBGS	BOTTOM	3.60	mBGS	BH SIZE	BTW	BH DIP:	90
DEPTH GROUNDWATER Hw:		2.20	mBGS	GAUGE HEIGHT HT :	0.60	mAGS	DATE TESTED	November 16, 2016		
MAX. EFFECTIVE PRESSURE:	0.6	The least of 0.23 BARS/m or 10 BARS					[(Hw+H)*0.1 BARS]	0.28	BAR	

FIELD DATA

TEST P1/3 (BAR)	ELAPSED TIME min	2	2	2	2	2			STAGE	TAKE (L/min)	LUGEON COEFFICIENT
0.34	METER READING Litres	0	0	0	0	0			1	0.00	0.00
	TAKE L/min	0.00									
0.52	METER READING Litres	0	0	0	0	0			2	0.00	0.00
	TAKE L/min	0.00									
0.69	METER READING Litres	0.000	0.000	0.000	0.000	0.000			3	0.00	0.00
	TAKE L/min	0.00									
0.52	METER READING Litres	0	0	0	0	0			4	0.00	0.00
	TAKE L/min	0.00									
0.34	METER READING Litres	0	0	0	0	0			5	0.00	0.00
	TAKE L/min	0.00									

ABSORPTION (LUGEON) PATTERN

STAGES

SUMMARY

	PRESS. (BAR)	HYD. COND. (cm/s)	LUGEONS (cm/s)
MAX	0.69	0.0E+00	0.000
MIN	0.34	0E+00	0.000
AVG		0.0E+00	0.00

FLOW TYPES

LAMINAR	Absorptions are approximately equal?	No
TURBULENT	Smallest Lugeon corresponds to the highest pressure?	No
EXPANSION	The greatest Lugeon corresponds to the highest pressure?	No
LEACHING	Lugeon coefficients increase independent of pressure?	No
VOID FILLING	Lugeon coefficients decrease independent of pressure?	No

Prepared By: Vidyasagar Boddula **Date:** November 20, 2015

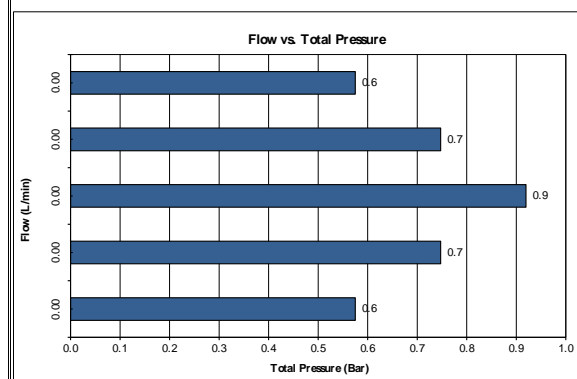
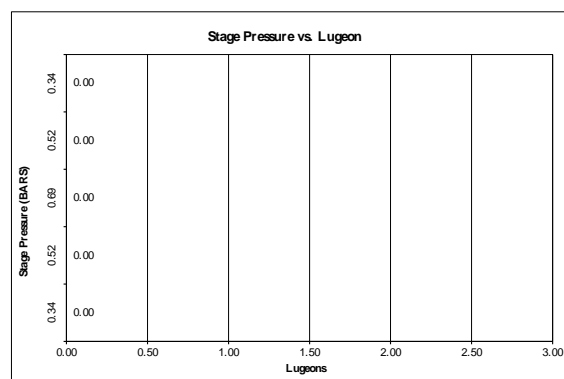
NOTE: Pressure was increased to a maximum pressure of 0.69 bars but no flow was observed.


PACKER TEST RESULTS FOR BOREHOLE No.:
TWM-02
PROJECT: HALIBURTON DAMS GEOTECHNICAL PROGRAM
PROJECT No.: 10086-S0069
REPORT No.: 2016-10228
CLIENT: PARKS CANADA AGENCY
**LOCATION: HALIBURTON SECTOR, TRENT-SEVERN WATERWAY,
ONTARIO REGION**
CLIENT PROJECT No.: 20035222
LOGGED BY: VIDYASAGAR BODDULA
SITE LOCATION: TWELVE MILE LAKE DAM

PACKER INTERVAL:	TOP	5.70	mBGS	BOTTOM	6.70	mBGS	BH SIZE	BTW	BH DIP:	90	
DEPTH GROUNDWATER Hw:		1.80	mBGS	GAUGE HEIGHT HT :	0.50	mAGS	DATE TESTED			May 5, 2016	
MAX. EFFECTIVE PRESSURE:	1.3	The least of 0.23 BARS/m or 10 BARS					[(Hw+Ht)*0.1 BARS]	0.23	BAR		

FIELD DATA

TEST P1/3 (BAR)	ELAPSED TIME min	2	2	2	2	2			STAGE	TAKE (L/min)	LUGEON COEFFICIENT
0.34	METER READING Litres	0	0	0	0	0			1	0.00	0.00
	TAKE L/min	0.00									
0.52	METER READING Litres	0	0	0	0	0			2	0.00	0.00
	TAKE L/min	0.00									
0.69	METER READING Litres	0.000	0.000	0.000	0.000	0.000			3	0.00	0.00
	TAKE L/min	0.00									
0.52	METER READING Litres	0	0	0	0	0			4	0.00	0.00
	TAKE L/min	0.00									
0.34	METER READING Litres	0	0	0	0	0			5	0.00	0.00
	TAKE L/min	0.00									

ABSORPTION (LUGEON) PATTERN

STAGES

SUMMARY

	PRESS. (BAR)	HYD. COND. (cm/s)	LUGEONS (cm/s)
MAX	0.69	0.0E+00	0.000
MIN	0.34	0E+00	0.000
AVG		0.0E+00	0.00

FLOW TYPES

LAMINAR	Absorptions are approximately equal?	No
TURBULENT	Smallest Lugeon corresponds to the highest pressure?	No
EXPANSION	The greatest Lugeon corresponds to the highest pressure?	No
LEACHING	Lugeon coefficients increase independent of pressure?	No
VOID FILLING	Lugeon coefficients decrease independent of pressure?	No

Prepared By: Vidyasagar Boddula **Date:** November 20, 2015

NOTE: Pressure was increased to a maximum pressure of 0.69 bar but no flow was observed.



PACKER TEST RESULTS FOR BOREHOLE No.:

TWM-04

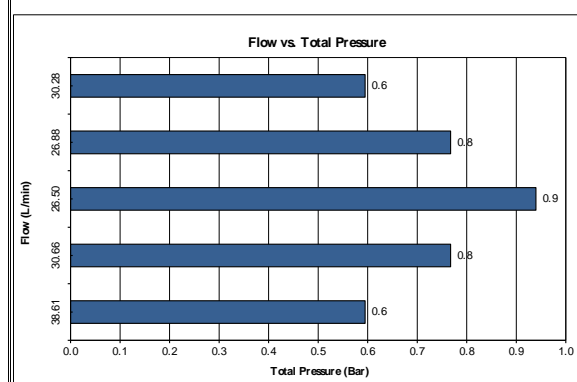
PROJECT: HALIBURTON DAMS GEOTECHNICAL PROGRAM
PROJECT No.: 10086-S0069
REPORT No.: 2016-10228
CLIENT: PARKS CANADA AGENCY
**LOCATION: HALIBURTON SECTOR, TRENT-SEVERN WATERWAY,
ONTARIO REGION**
CLIENT PROJECT No.: 20035222
LOGGED BY: VIDYASAGAR BODDULA
SITE LOCATION: TWELVE MILE LAKE DAM

PACKER INTERVAL:	TOP	7.70	mBGS	BOTTOM	8.70	mBGS	BH SIZE	BTW	BH DIP:	90	
DEPTH GROUNDWATER Hw:		2.00	mBGS	GAUGE HEIGHT Ht:		0.50	mAGS	DATE TESTED		May 3, 2016	
MAX. EFFECTIVE PRESSURE:	1.8	The least of 0.23 BARS/m or 10 BARS					[(Hw+Ht)*0.1 BARS]	0.25	BAR		

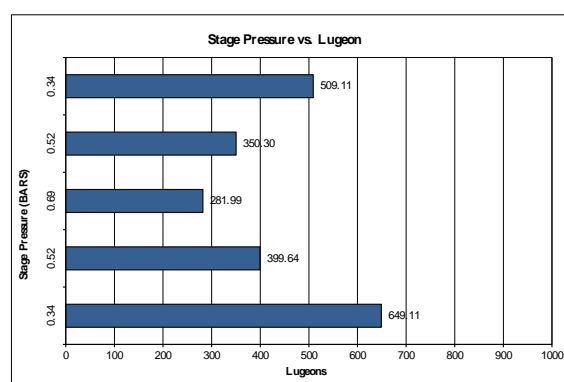
FIELD DATA

TEST P1/3	ELAPSED TIME	min	2	2	2	2	2	STAGE	TAKE	LUGEON
(BAR)	METER READING	Litres	107.8839	66.2445	68	71.9226	71.9226	1	38.61	649.11
0.34	TAKE	L/min	53.94	33.12	34.07	35.96	35.96			
TEST P2/3	ELAPSED TIME	min	2	2	2	2	2			
(BAR)	METER READING	Litres	79.4934	71.9226	41.6394	71.9226	41.6394	2	30.66	399.64
0.52	TAKE	L/min	39.75	35.96	20.82	35.96	20.82			
TEST P	ELAPSED TIME	min	2	2	2	2	2			
(BAR)	METER READING	Litres	41.639	34.069	79.493	34.069	75.708	3	26.50	281.99
0.69	TAKE	L/min	20.82	17.03	39.75	17.03	37.85			
TEST P2/3	ELAPSED TIME	min	2	2	2	2	2			
(BAR)	METER READING	Litres	37.854	75.708	37.854	75.708	41.6394	4	26.88	350.30
0.52	TAKE	L/min	18.93	37.85	18.93	37.85	20.82			
TEST P1/3	ELAPSED TIME	min	2	2	2	2	2			
(BAR)	METER READING	Litres	75.708	41.6394	71.9226	41.6394	71.9226	5	30.28	509.11
0.34	TAKE	L/min	37.85	20.82	35.96	20.82	35.96			

ABSORPTION (LUGEON) PATTERN



STAGES



SUMMARY

	PRESS. (BAR)	HYD. COND. (cm/s)	LUGEONS (cm/s)
MAX	0.69	6.5E-03	649.114
MIN	0.34	3E-03	281.995
AVG		2.8E-03	281.99

FLOW TYPES

LAMINAR	Absorptions are approximately equal?	No
TURBULENT	Smallest Lugeon corresponds to the highest pressure?	Yes
EXPANSION	The greatest Lugeon corresponds to the highest pressure?	No
LEACHING	Lugeon coefficients increase independent of pressure?	No
VOID FILLING	Lugeon coefficients decrease independent of pressure?	No

Prepared By: Vidyasagar Boddula

Date: June 18, 2016



APPENDIX E

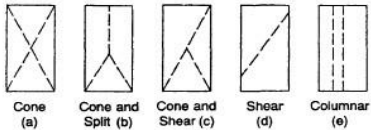
Laboratory Testing Results



CONCRETE AND ROCK LABORATORY RESULTS

No.	Location	Sample ID			Depth (m)		Laboratory Testing							Remarks
		Borehole	Type of Sample	Sample No.	From	To	UCS Rock	Point Load Test I_{s50} (MPa)	UCS Rock from PLT	UCS Concrete	Unit Weight (kN/m^3)	Dry Unit Weight (kN/m^3)	Type of Fracture-Concrete*	
1	Twelve Mile Lake Dam	TWM-02	CC	01	0.08	0.30				26	22.93	22.35	Shear	
	Twelve Mile Lake Dam	TWM-02	RC	01	4.60	4.85	75.3	7.989	168		26.89	26.87		
3	Twelve Mile Lake Dam	TWM-02	CC	02	1.70	1.90				25.7	21.85	21.21	Shear	
4	Twelve Mile Lake Dam	TWM-03	CC	01	2.60	2.80				22.2	23.78	23.29	Cone and Split	
	Twelve Mile Lake Dam	TWM-03	RC	01	4.95	5.18	119.7	9.196	193		26.91	26.88		
5	Twelve Mile Lake Dam	TWM-03	CC	02	3.75	3.90				24.3	22.18	21.45	Cone and Shear	
7	Twelve Mile Lake Dam	TWM-04	CC	01	1.10	1.30				28.6	21.84	21.06	Cone and Shear	
	Twelve Mile Lake Dam	TWM-04	RC	01	5.20	5.45	72.8	7.174	151		27.17	27.15		
8	Twelve Mile Lake Dam	TWM-04	CC	02	3.35	3.50				22.1	21.23	20.55	Shear	

* :Type of Fracture for UCS of Concrete



Type of fracture is considered irregular when does not match with any of the five (5) basic type of fractures

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	01
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	0.08-0.30
BOREHOLE NUMBER	TWM-02	DATE:	06/10/16

TEST CONDITIONS

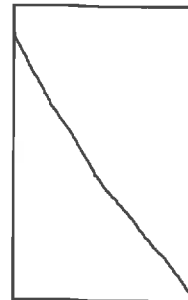
MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Concrete
DURATION OF TEST, min	>2 <15	L/D	2.08

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	8.44	WATER CONTENT, (specimen) %	2.60
SAMPLE DIAMETER, cm	4.07	UNIT WEIGHT, kN/m ³	22.93
SAMPLE AREA, cm ²	12.99	DRY UNIT WT., kN/m ³	22.35
SAMPLE VOLUME, cm ³	109.68	SPECIFIC GRAVITY	-
WET WEIGHT, g	256.61	VOID RATIO	-
DRY WEIGHT, g	250.11		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	26.0
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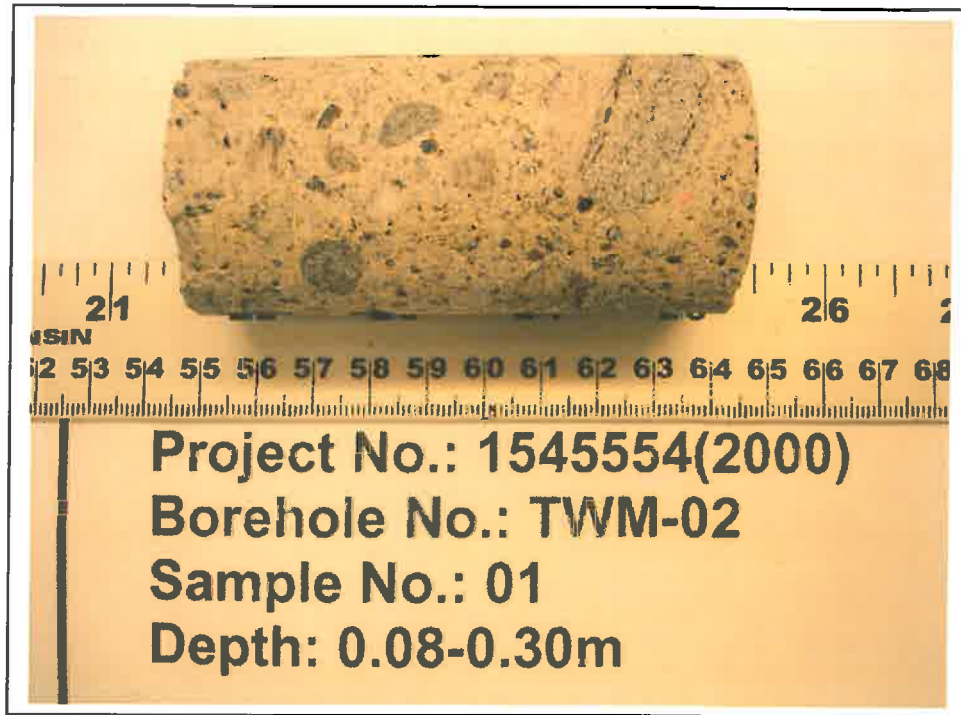
REMARKS:

Checked By: *CAH*

Golder Associates

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE
SPECIMENS
ASTM D7012

FIGURE



BEFORE COMPRESSION



AFTER COMPRESSION

Date June 13, 2016
Project 1545554(2000)

Golder Associates

Drawn Frank
Chkd. GA

UNCONFINED COMPRESSION TEST (UC) OF INTACT ROCK CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	01
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	4.60-4.85
BOREHOLE NUMBER	TWM-02	DATE:	06/10/16

TEST CONDITIONS

MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST, min	>2 <15	L/D	2.28

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.27	WATER CONTENT, (specimen) %	0.10
SAMPLE DIAMETER, cm	4.07	UNIT WEIGHT, kN/m ³	26.89
SAMPLE AREA, cm ²	13.00	DRY UNIT WT., kN/m ³	26.87
SAMPLE VOLUME, cm ³	120.45	SPECIFIC GRAVITY	-
WET WEIGHT, g	330.44	VOID RATIO	-
DRY WEIGHT, g	330.11		

VISUAL INSPECTION

FAILURE SKETCH



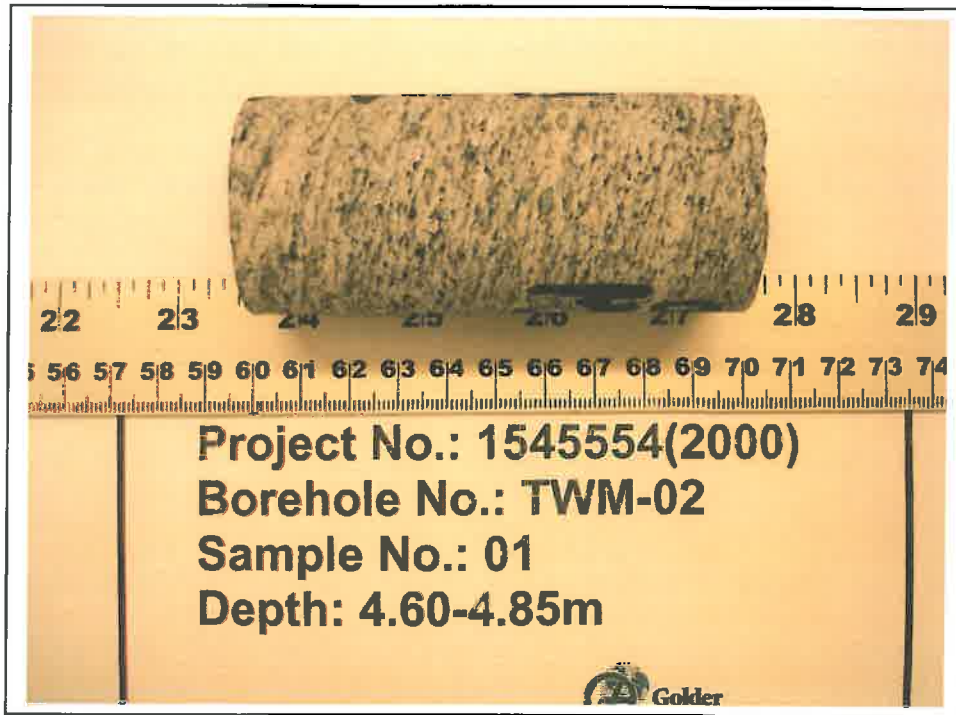
TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	75.3
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REMARKS:

Checked By:

Golder Associates



BEFORE COMPRESSION



AFTER COMPRESSION

Date June 13, 2016
Project 1545554(2000)

Golder Associates

Drawn Frank
Chkd. AK

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	02
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	1.70-1.90
BOREHOLE NUMBER	TWM-02	DATE:	06/10/16

TEST CONDITIONS

MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Concrete
DURATION OF TEST, min	>2 <15	L/D	2.27

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.22	WATER CONTENT, (specimen) %	3.00
SAMPLE DIAMETER, cm	4.06	UNIT WEIGHT, kN/m ³	21.85
SAMPLE AREA, cm ²	12.96	DRY UNIT WT., kN/m ³	21.21
SAMPLE VOLUME, cm ³	119.51	SPECIFIC GRAVITY	-
WET WEIGHT, g	266.34	VOID RATIO	-
DRY WEIGHT, g	258.58		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	25.7
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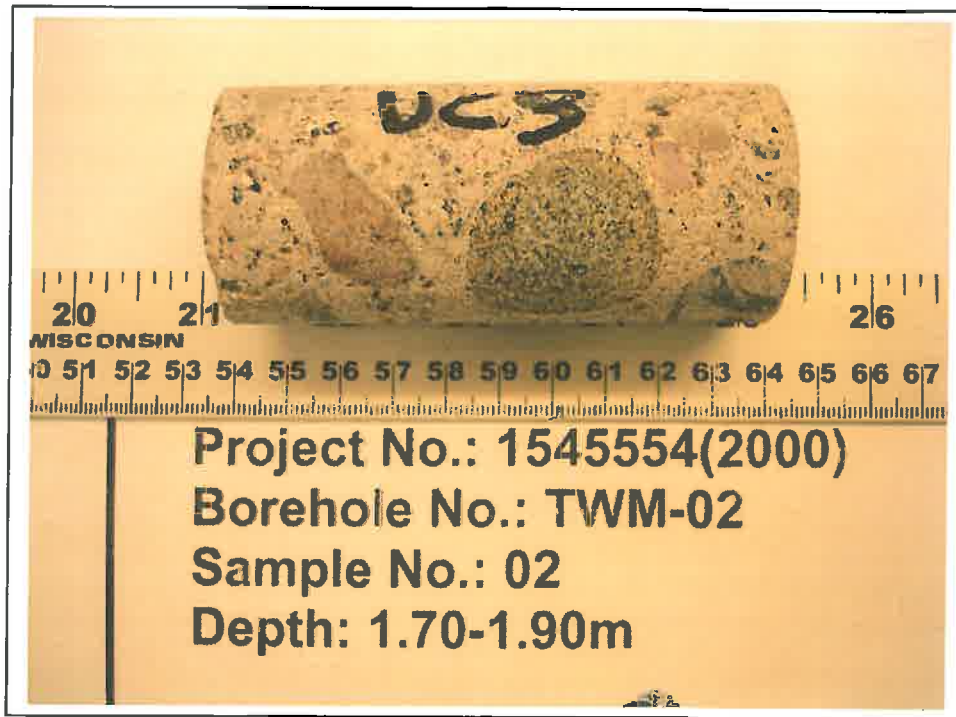
REMARKS:

Checked By:

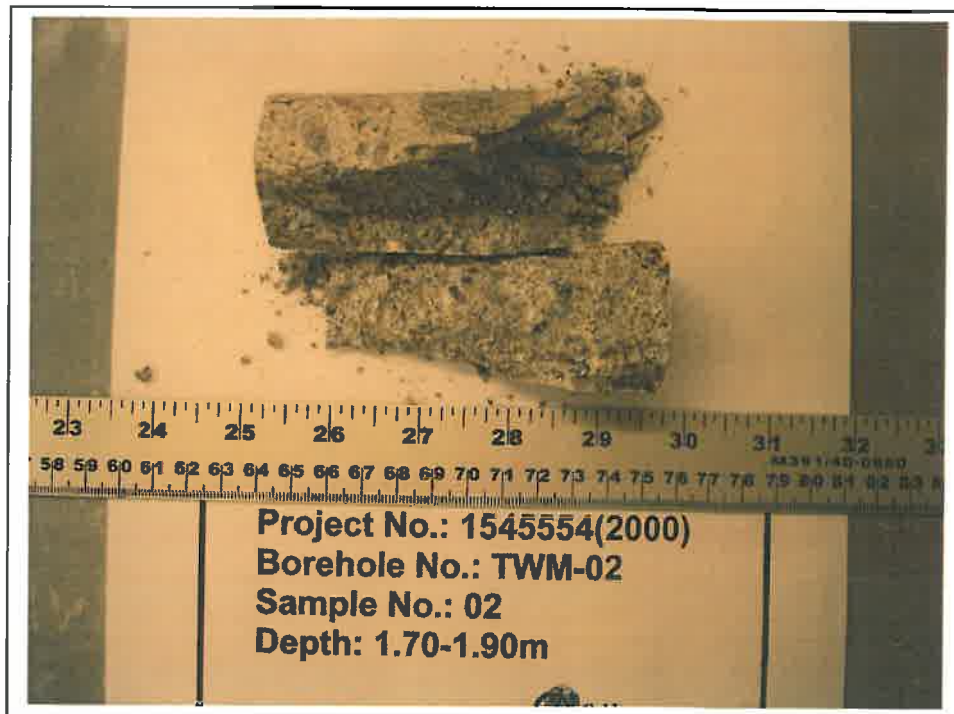
Golder Associates

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS
ASTM D7012

FIGURE



BEFORE COMPRESSION



AFTER COMPRESSION

Date June 13, 2016
Project 1545554(2000)

Golder Associates

Drawn Frank
Chkd. *[Signature]*

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	01
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	2.60-2.80
BOREHOLE NUMBER	TWM-03	DATE:	06/10/16

TEST CONDITIONS

MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Concrete
DURATION OF TEST, min	>2 <15	L/D	2.27

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.18	WATER CONTENT, (specimen) %	2.10
SAMPLE DIAMETER, cm	4.04	UNIT WEIGHT, kN/m ³	23.78
SAMPLE AREA, cm ²	12.83	DRY UNIT WT., kN/m ³	23.29
SAMPLE VOLUME, cm ³	117.76	SPECIFIC GRAVITY	-
WET WEIGHT, g	285.66	VOID RATIO	-
DRY WEIGHT, g	279.78		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	22.2
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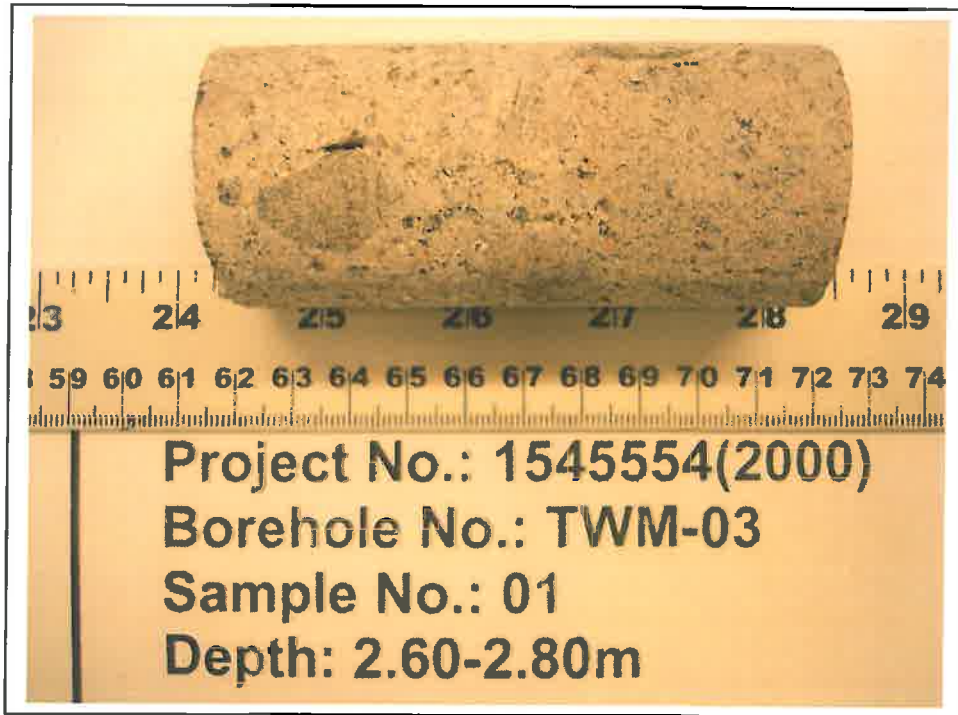
REMARKS:

Checked By:

Golder Associates

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE
SPECIMENS
ASTM D7012

FIGURE



BEFORE COMPRESSION



AFTER COMPRESSION

Date June 13, 2016
Project 1545554(2000)

Golder Associates

Drawn Frank
Chkd. [Signature]

UNCONFINED COMPRESSION TEST (UC) OF INTACT ROCK CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	01
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	4.95-5.18
BOREHOLE NUMBER	TWM-03	DATE:	06/10/16

TEST CONDITIONS

MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST, min	>2 <15	L/D	2.27

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.25	WATER CONTENT, (specimen) %	0.10
SAMPLE DIAMETER, cm	4.07	UNIT WEIGHT, kN/m ³	26.91
SAMPLE AREA, cm ²	13.01	DRY UNIT WT., kN/m ³	26.88
SAMPLE VOLUME, cm ³	120.36	SPECIFIC GRAVITY	-
WET WEIGHT, g	330.36	VOID RATIO	-
DRY WEIGHT, g	330.03		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	119.7
----------------------	-----	---------------------------	-------

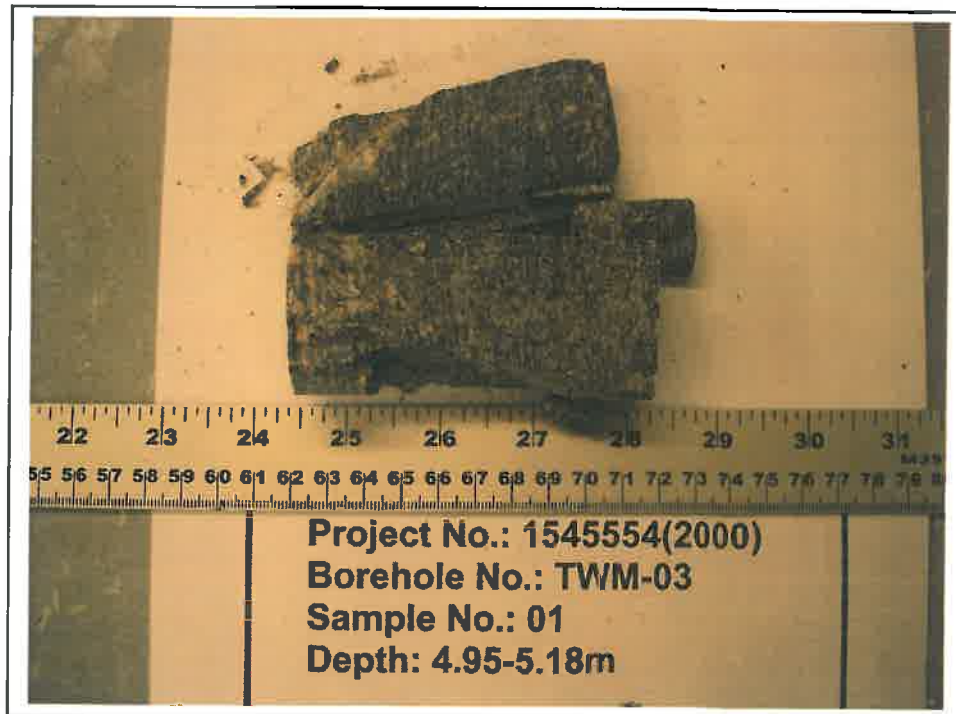
REMARKS:

Checked By:

Golder Associates



BEFORE COMPRESSION



AFTER COMPRESSION

Date June 13, 2016
Project 1545554(2000)

Golder Associates

Drawn Frank
Chkd. [Signature]

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	02
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	3.75-3.90
BOREHOLE NUMBER	TWM-03	DATE:	06/10/16

TEST CONDITIONS

MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Concrete
DURATION OF TEST, min	>2 <15	L/D	2.28

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.25	WATER CONTENT, (specimen) %	3.40
SAMPLE DIAMETER, cm	4.07	UNIT WEIGHT, kN/m ³	22.18
SAMPLE AREA, cm ²	12.98	DRY UNIT WT., kN/m ³	21.45
SAMPLE VOLUME, cm ³	120.07	SPECIFIC GRAVITY	-
WET WEIGHT, g	271.72	VOID RATIO	-
DRY WEIGHT, g	262.79		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	24.3
----------------------	-----	---------------------------	------

REMARKS:

Checked By:

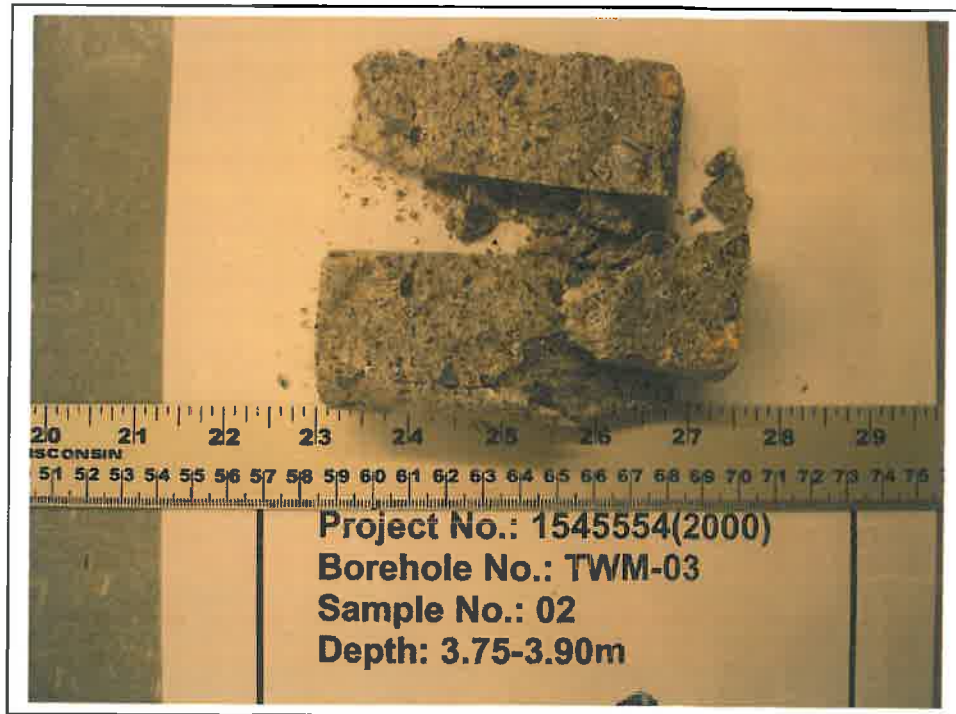
Golder Associates

**UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS
ASTM D7012**

FIGURE



BEFORE COMPRESSION



AFTER COMPRESSION

Date June 13, 2016
Project 1545554(2000)

Golder Associates

Drawn Frank
Chkd. [Signature]

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	01
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	1.10-1.30
BOREHOLE NUMBER	TWM-04	DATE:	06/10/16

TEST CONDITIONS

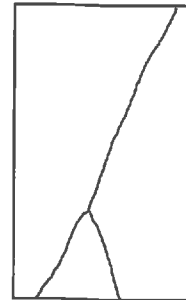
MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Concrete
DURATION OF TEST, min	>2 <15	L/D	2.28

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.31	WATER CONTENT, (specimen) %	3.70
SAMPLE DIAMETER, cm	4.08	UNIT WEIGHT, kN/m ³	21.84
SAMPLE AREA, cm ²	13.05	DRY UNIT WT., kN/m ³	21.06
SAMPLE VOLUME, cm ³	121.50	SPECIFIC GRAVITY	-
WET WEIGHT, g	270.63	VOID RATIO	-
DRY WEIGHT, g	260.97		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	28.6
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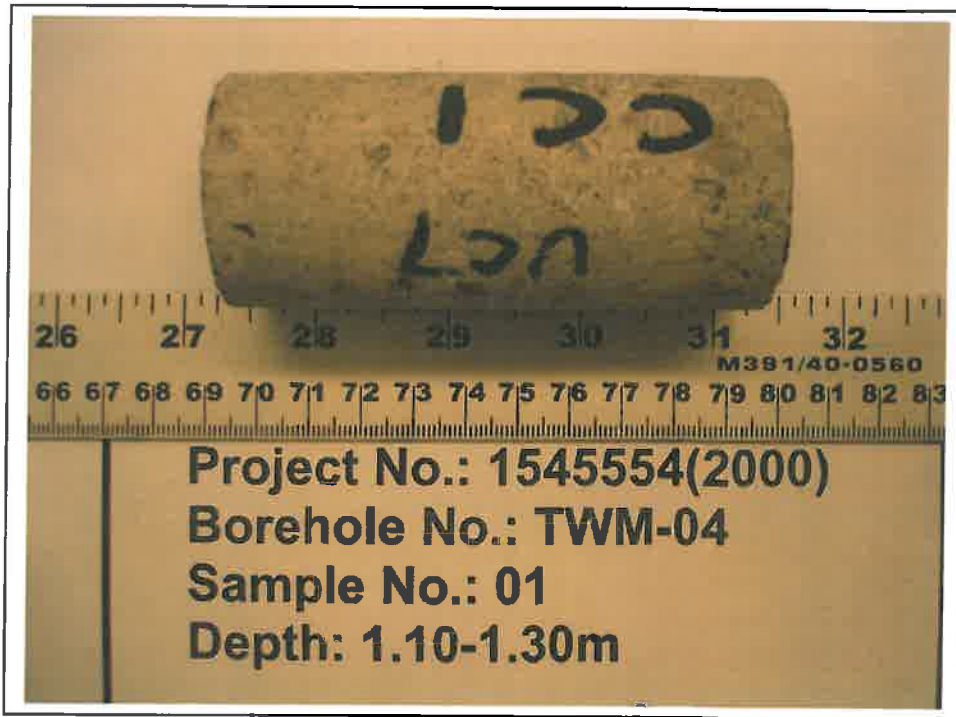
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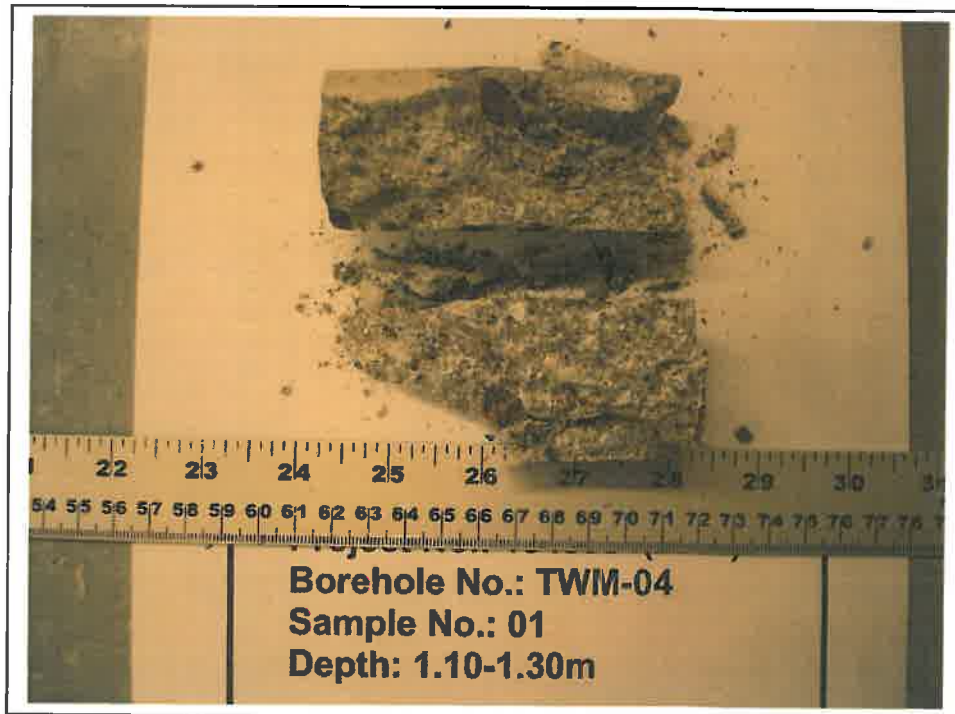
Golder Associates

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE
SPECIMENS
ASTM D7012

FIGURE



BEFORE COMPRESSION



AFTER COMPRESSION

Date June 13, 2016
Project 1545554(2000)

Golder Associates

Drawn Frank
Chkd. [Signature]

UNCONFINED COMPRESSION TEST (UC) OF INTACT ROCK CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	01
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	5.20-5.45
BOREHOLE NUMBER	TWM-04	DATE:	06/10/16

TEST CONDITIONS

MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST, min	>2 <15	L/D	2.30

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.30	WATER CONTENT, (specimen) %	0.10
SAMPLE DIAMETER, cm	4.04	UNIT WEIGHT, kN/m ³	27.17
SAMPLE AREA, cm ²	12.84	DRY UNIT WT., kN/m ³	27.15
SAMPLE VOLUME, cm ³	119.45	SPECIFIC GRAVITY	-
WET WEIGHT, g	331.11	VOID RATIO	-
DRY WEIGHT, g	330.78		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	72.8
----------------------	-----	---------------------------	------

REMARKS:

Checked By:

Golder Associates



BEFORE COMPRESSION



AFTER COMPRESSION

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS

ASTM D7012

SAMPLE IDENTIFICATION

PROJECT NUMBER	1545554 (2000)	SAMPLE NUMBER	02
PROJECT NAME	SoilProbeLtd/Lab Testing/Miss	SAMPLE DEPTH, m	3.35-3.50
BOREHOLE NUMBER	TWM-04	DATE:	06/10/16

TEST CONDITIONS

MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Concrete
DURATION OF TEST, min	>2 <15	L/D	2.26

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.13	WATER CONTENT, (specimen) %	3.30
SAMPLE DIAMETER, cm	4.05	UNIT WEIGHT, kN/m ³	21.23
SAMPLE AREA, cm ²	12.86	DRY UNIT WT., kN/m ³	20.55
SAMPLE VOLUME, cm ³	117.48	SPECIFIC GRAVITY	-
WET WEIGHT, g	254.42	VOID RATIO	-
DRY WEIGHT, g	246.29		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	22.1
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REMARKS:

Checked By:

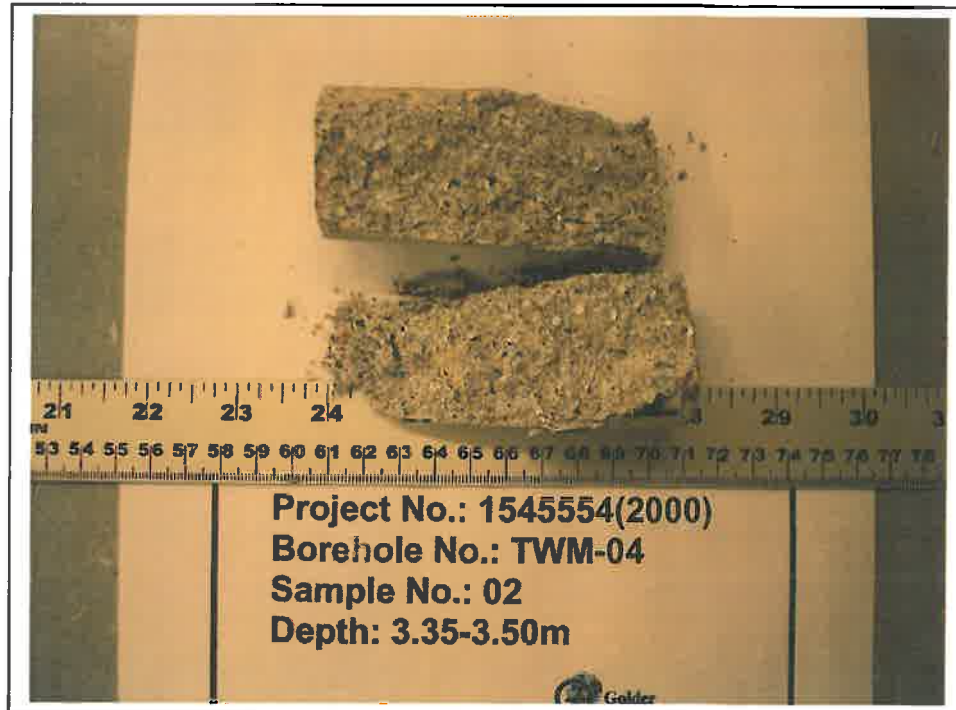
Golder Associates

UNCONFINED COMPRESSION TEST (UC) OF INTACT CONCRETE CORE SPECIMENS
ASTM D7012

FIGURE



BEFORE COMPRESSION



AFTER COMPRESSION

Date June 13, 2016
Project 1545554(2000)

Golder Associates

Drawn Frank
Chkd. [Signature]

POINT LOAD TEST ON ROCK SAMPLES

PROJECT NO. 1545554 (2000)
 TITLE SoilProbeLtd/Lab Testing/Miss
 DATE June 13, 2016

Borehole Number	Sample Number	Sample Depth (m)	Test Type	Core Length (mm)	Core ⁽²⁾ Diameter (mm)	Equivalent Diameter (mm)	Ram Pressure (kPa)	Load (P) (kN)	Is Axial (MPa)	Is Diametral (MPa)	Is (50mm) (MPa)	Approx. (1) UCS (MPa)
TWM-02	01	4.60-4.85	A	22.05	40.68	33.79	11,480.00	10.88	9.529	-	7.989	168
TWM-03	01	4.95-5.18	A	19.51	40.69	31.79	12,020.00	11.39	11.274	-	9.196	193
TWM-04	01	5.20-5.45	A	23.72	40.45	34.95	10,860.00	10.30	8.428	-	7.174	151

⁽¹⁾ $I_{s50} \times C$ (actual value will have to be confirmed by UCS testing), from ISRM ("Suggested Methods for Determining Point Load Strength", International Society for Rock Mechanics Commission on Testing Methods, Int. J. Rock. Mech. Min. Sci. and Geomechanical Abstr., Vol 22, No. 2 1985, pp. 51-60.

⁽²⁾ Actual distance between point load cones at time of failure.

Checked By: 

Golder Associates



APPENDIX F

Video Camera Records



December 9, 2016

Kyle Jansson, P.Eng. PMP
Project Manager
Parks Canada
P.O. Box 657
2155 Ashburnam Drive, Peterborough, ON
K9J 6Z6

**Subject: Supplementary Geotechnical Investigation
Twelve Mile Dam, 1034 Taylor Road, Minden Hills, Ontario
Project Number 161-05116-00**

Dear Mr. Jansson:

WSP Canada Inc. (WSP) was retained by Parks Canada to perform a supplementary geotechnical investigation to support the design and construction of the proposed upgrades and expansion of the existing Twelve Mile Lake Dam. The location of the dam is shown on Figure 1, attached.

This geotechnical investigation provides information on both of surficial and subsurface geological conditions at the Site, specifically east of the existing dam. This area is being considered for expansion and rehabilitation of the existing dam.

A total of four (4) test pits were excavated directly adjacent to the east side of the existing dam, on December 2, 2016 using a track-mounted backhoe operated by Parks Canada staff and hand tools. The approximate location of the test pits is noted on the attached Figure 2 and a photo log is attached; locations of the photos are also noted on Figure 2. Prior to completion of the geotechnical fieldwork, clearance of both private and public utility (e.g. buried natural gas, hydro, telephone and cable) were obtained for the proposed work areas using G-Tel Engineering and Ontario One-Call services. Test pits were supervised by qualified WSP personnel and were logged using tactile and visual methods, sampled and photographed for subsequent review by the Project Team. Groundwater seepage and general excavation sidewall stability was documented, prior to backfilling with the excavated materials.

Depth of Bedrock was confirmed at three of the four test pits and ranged from 0.35 m to at least 1.7 m. The bedrock can be described as highly weathered Granitic material containing Quartz with high degree of weathering; Feldspar and Mica are visible to the bare eye. Generally the area east of the dam consisted of exposed bedrock; however the overburden thickness generally increased easterly towards Highway 35. This thicker overburden is presumed to be fill material associated with the construction of the existing highway embankment. At TP16-1 where the test pit were terminated on inferred blasted bedrock material, it is anticipated that the bedrock surface would be at approximately 306.0 mASL based on the results at the other test pits. Test pit logs are included as

WSP Canada Inc.
294 Rink Street, Suite 103
Peterborough, ON K9J 2K2
www.wspgroup.com

Appendix A and the following Table 1 below summarizes test pit locations, surface elevation and the anticipated depth to bedrock.

Table 1: Test Pit Investigation Data

Test PIT ID	LOCATION COORDINATES	SURFACE ELEVATION (mASL)	DEPTH TO BEDROCK	
			(mBGL)	(mASL)
16-1	4500217 N 7870246 W	309.1	Not Confirmed, refusal at 1.6 mBGL	N/A
16-2	4500209 N 7870243 W	307.7	1.7	306.0
16-3	450012 N 7870250 W	307.2	0.35	306.8
16-4	450022 N 7870237 W	307.1	0.4	306.8


Please contact us if you have any questions about this report or attached information.

Yours truly,
WSP Canada Inc.

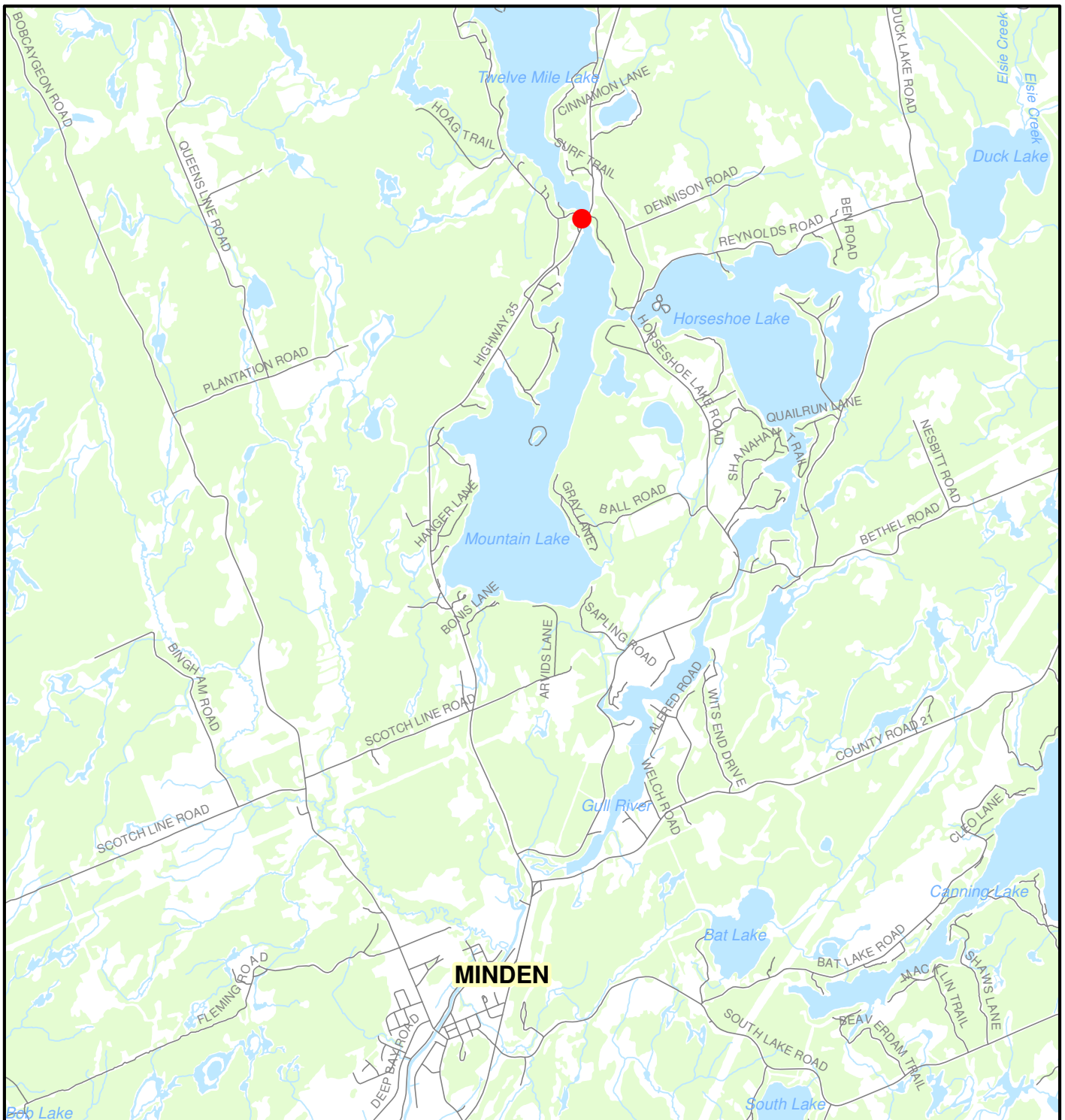
Reviewed by:



Lindsey Chalmers, CTech, rcji.
Project Technologist



Arash Yazdani, P.Eng
Geotechnical Engineer



LEGEND

● APPROXIMATE SITE LOCATION

SITE LOCATION MAP

TWELVE MILE LAKE DAM SUPPLEMENTARY
 GEOTECHNICAL INVESTIGATION
 1034 Taylor Road
 Minden Hills, Ontario

DATE: DECEMBER 2016

SCALE: 1:60000

PROJECT: 161-05116-00

FILE. NO.:161-05116-00 F1

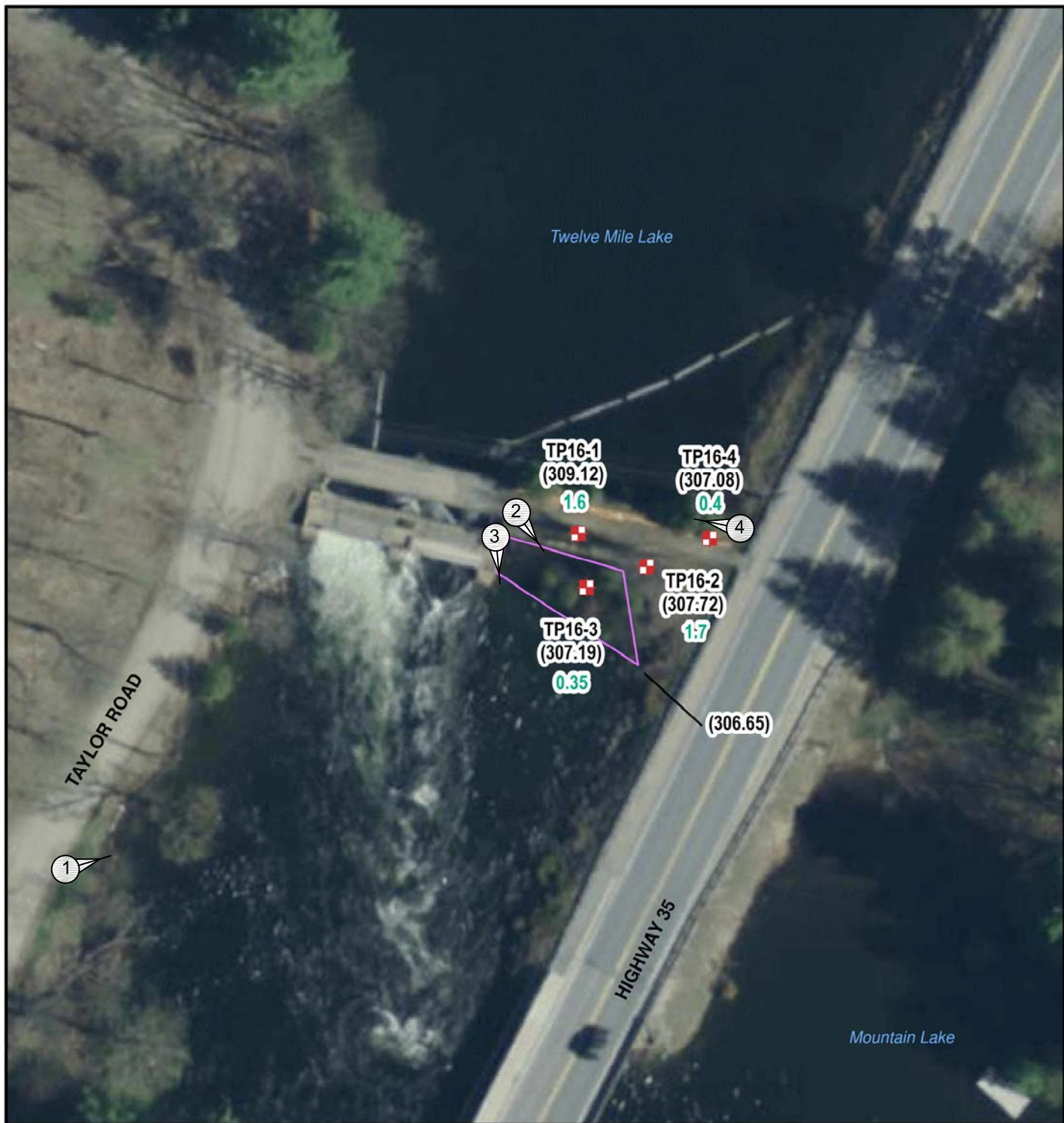


Data Source: Ministry of Natural Resources,
 Ontario Base Mapping, March 2014.



FIGURE

1



LEGEND

- TP16-1 APPROXIMATE TEST PIT LOCATION
- EXPOSED BEDROCK
- (307.72) GROUND SURFACE ELEVATION (mASL)
- 1.6 DEPTH TO BEDROCK IN METRES
- 4 PHOTO LOCATION



Data Source: Ministry of Natural Resources,
Ontario Base Mapping, March 2014.

SITE PLAN

TWELVE MILE LAKE DAM SUPPLEMENTARY
GEOTECHNICAL INVESTIGATION
1034 Taylor Road
Minden Hills, Ontario

DATE: DECEMBER 2016

SCALE: 1:600

PROJECT: 161-05116-00

FILE. NO.:161-05116-00 F2



FIGURE

2

DEPTH	DESCRIPTION
TP16-1	
0.0 – 0.5 mBGL	TOPSOIL: DARK BROWN SILTY SAND TOPSOIL, SOME GRAVEL, ROOTLETS, MOIST
0.5 – 1.2 mBGL	FILL: BROWN COARSE SILTY SAND, SOME GRAVEL, OCCASIONAL COBBLES, MOIST
1.2 – 1.6 mBGL	FILL: BROKEN BLAST ROCK COBBLES AND BOULDERS. EXCAVATOR BUCKET REFUSAL. OPEN & DRY UPON COMPLETION OF TEST PIT EXCAVATION.
TP16-2	
0.0 – 1.0 mBGL	TOPSOIL: DARK BROWN COURSE SAND TOPSOIL, SOME SILT, SOME GRAVEL, ROOTLETS, MOIST
1.0 – 1.6 mBGL	FILL: BROWN COARSE SILTY SAND, SOME GRAVEL, OCCASIONAL COBBLES, MOIST
1.6 – 1.7 mBGL	BEDROCK: WEATHERED GRANITIC MATERIAL WITH IMPURE QUARTZITE, FELDSPAR AND MICA. OPEN & DRY UPON COMPLETION OF TEST PIT EXCAVATION.
TP16-3	
0.0 – 0.35 mBGL	TOPSOIL: DARK BROWN COURSE SAND TOPSOIL, SOME SILT, ROOTLETS, MOIST
0.35 mBGL	BEDROCK: WEATHERED GRANITIC MATERIAL WITH IMPURE QUARTZITE, FELDSPAR AND MICA. GROUNDWATER SEEPAGE AT 0.35 mBGL UPON COMPLETION OF EXCAVATION.
TP16-4	
0.0 – 0.35 mBGL	TOPSOIL: DARK BROWN COURSE SAND TOPSOIL, SOME SILT, ROOTLETS, MOIST, LOOSE.
0.35 mBGL	BEDROCK: WEATHERED GRANITIC MATERIAL WITH IMPURE QUARTZITE, FELDSPAR AND MICA. OPEN & DRY UPON COMPLETION OF TEST PIT EXCAVATION.



Photograph 1: Twelve Mile Dam, south side of structure, facing north.



Photograph 2: Minimal tree and soil cover over bedrock, facing east side of the dam bridge.



Photograph 3: Bedrock exposed, facing south on the east side of the dam bridge.



Photograph 4: Facing south on the north side of the dam.

APPENDIX B

Minimum Measure

Construction Site Stormwater Runoff Control

Subcategory

Good Housekeeping/Materials Management

Description of Concrete Washout at Construction Sites

Concrete and its ingredients

Concrete is a mixture of cement, water, and aggregate material. Portland cement is made by heating a mixture of limestone and clay containing oxides of calcium, aluminum, silicon and other metals in a kiln and then pulverizing the resulting clinker. The fine aggregate particles are usually sand. Coarse aggregate is generally gravel or crushed stone. When cement is mixed with water, a chemical reaction called hydration occurs, which produces glue that binds the aggregates together to make concrete.

Concrete washout

After concrete is poured at a construction site, the chutes of ready mixed concrete trucks and hoppers of concrete pump trucks must be washed out to remove the remaining concrete before it hardens. Equipment such as wheelbarrows and hand tools also need to be washed down. At the end of each work day, the drums of concrete trucks must be washed out. This is customarily done at the ready mixed batch plants, which are usually off-site facilities, however large or rural construction projects may have on-site batch plants. Cementitious (having the properties of cement) washwater and solids also come from using such construction materials as mortar, plaster, stucco, and grout.

Environmental and Human Health Impacts

Concrete washout water (or washwater) is a slurry containing toxic metals. It's also caustic and corrosive, having a pH near 12. In comparison, Drano liquid drain cleaner has a pH of 13.5. Caustic washwater can harm fish gills and eyes and interfere with reproduction. The safe pH ranges for aquatic life habitats are 6.5 – 9 for freshwater and 6.5 – 8.5 for saltwater.

Construction workers should handle wet concrete and washout water with care because it may cause skin irritation and eye damage. If the washwater is dumped on the ground (Fig. 1), it can run off the construction site to adjoining roads and enter roadside storm drains, which discharge to surface waters such as rivers, lakes, or estuaries. The red arrow in Figure 2 points to a ready mixed truck chute that's being washed out into a roll-off bin, which isn't watertight. Leaking washwater, shown in the foreground, will likely follow similar



Figure 1. Chute washwater being dumped on the ground



Figure 2. Chute washwater leaking from a roll-off bin being used as a washout container

paths to nearby surface waters. Rainfall may cause concrete washout containers that are uncovered to overflow and also transport the washwater to surface waters. Rainwater polluted with concrete washwater can percolate down through the soil and alter the soil chemistry, inhibit plant growth, and contaminate the groundwater. Its high pH can increase the toxicity of other substances in the surface waters and soils. Figures 1 and 2 illustrate the need for better washout management practices.

Best Management Practice Objectives

The best management practice objectives for concrete washout are to (a) collect and retain all the concrete washout water and solids in leak proof containers, so that this caustic material does not reach the soil surface and then migrate to surface waters or into the ground water, and (b) recycle 100 percent of the collected concrete washout water and solids. Another

Stormwater Best Management Practice: Concrete Washout

objective is to support the diversion of recyclable materials from landfills. Table 1 shows how concrete washout materials can be recycled and reused.

Table 1 – Recycling concrete washout materials

Uses of Recycled Materials	Concrete Washout Materials					
	Washwater	Cement fines ^a	Fine aggregate	Coarse aggregate	Hardened concrete	Unused wet concrete
Reused to washout additional mixer truck chutes or drums	x					
Reused as a ready mixed concrete ingredient	x	x ^b	x	x		
Reused as an ingredient of precast concrete products, e.g., highway barriers, retaining wall blocks, riprap	x	x	x	x		x
Reused as crushed concrete products, e.g., road base or fill		x	x	x	x	
Reused to pave the yards of ready mixed concrete plants						x
Returned back to a surface water, e.g., river, lake, or estuary	x ^c					

a. Fine particles of cementitious material (e.g., Portland cement, slag cement, fly ash, silica fume)

b. Recyclable, if allowed by the concrete quality specifications

c. Treated to reduce the pH and remove metals, so it can be delivered to a municipal wastewater treatment plant, where it is treated further and then returned to a natural surface water

Washwater recycling, treatment, disposal

Washwater from concrete truck chutes, hand mixers, or other equipment can be passed through a system of weirs or filters to remove solids and then be reused to wash down more chutes and equipment at the construction site or as an ingredient for making additional concrete. A three chamber washout filter is shown in Figure 3. The first stage collects the coarse aggregate. The middle stage filters out the small grit and sand. The third stage has an array of tablets that filter out fines and reduces the pH. The filtered washwater is then discharged through a filter sock. An alternative is to pump the washout water out of the washout container (Fig 4) and treat the washwater off site to remove metals and reduce its pH, so it can be delivered to a publicly owned treatment works (POTW), also known as a municipal wastewater treatment plant, which provides additional treatment allowing the washwater to be discharged to a surface water. The POTW should be



Figure 3. Concrete washout filter

contacted to inquire about any pretreatment requirements, i.e., the National Pretreatment Standards for Prohibited Dischargers (40CFR 403.5) before discharging the washwater to the POTW. The washwater can also be retained in the washout container and allowed to evaporate, leaving only the hardened cementitious solids to be recycled.

Solids recycling

The course aggregate materials that are washed off concrete truck chutes into a washout container can be either separated by a screen and placed in aggregate bins to be reused at the construction site or returned to the ready mixed plant and washed into a reclaimer (Fig. 5). When washed out into a reclaimer, the fine and course aggregates are separated out and placed in different piles or bins to be reused in making fresh concrete. Reclaimers with settling tanks separate cement fines from the washwater, and these fines can also be used in new concrete unless prohibited by the user's concrete quality specifications.



Figure 4. Vacuuming washwater out of a washout container for treatment and reuse



Figure 5. Ready mixed truck washing out into a reclaimer

Hardened concrete recycling

When the washwater in a construction site concrete washout container has been removed or allowed to evaporate, the hardened concrete that remains can be crushed (Fig. 6) and reused as a construction material. It makes an excellent aggregate for road base and can be used as fill at the



Figure 6. Crushed concrete stockpile and crusher

construction site or delivered to a recycler. Concrete recyclers can be found at municipal solid waste disposal facilities, private recycling plants, or large construction sites.

Wet concrete recycling

Builders often order a little more ready mixed concrete than they actually need, so it is common for concrete trucks to have wet concrete remaining in their drum after a delivery. This unused concrete can be returned to the ready mixed plant and either (1) used to pour precast concrete products (e.g., highway barriers, retaining wall blocks, riprap), (2) used to pave the ready mixed plant's yard, (3) washed into a reclaimer, or (4) dumped on an impervious surface and allowed to harden, so it can be crushed and recycled as aggregate. Unused wet concrete should not be dumped on bare ground to harden at construction sites because this can contribute to ground water and surface water contamination.

Washout Containers

Different types of washout containers are available for collecting, retaining, and recycling the washwater and solids from washing down mixed truck chutes and pump truck hoppers at construction sites.

Chute washout box

A chute washout box is mounted on the back of the ready mixed truck. If the truck has three chutes, the following procedure is used to perform the washout from the top down: (1) after the pour is completed, the driver attaches the extension chute to the washout box, (2) the driver then rotates the main chute over the extension chute (Fig. 7) and washes down the hopper first then the main chute, (3) finally the driver washes down the flop down chute and last the extension chute hanging on the box. All washwater and solids are captured in the box.



Figure 7. Chute washout box

After the wash down, washwater and solids are returned to the ready mixed plant for recycling. A filter basket near the top of the washout box separates out the coarse aggregates so they can be placed in a bin for reuse either at the construction site or back at the cement plant.

Chute washout bucket and pump

After delivering ready mixed concrete and scraping the last of the customer's concrete down the chute, the driver hangs a washout bucket shown in Figure 8 (see red arrow) on the end of the truck's chute and secures the hose to insure no leaks. The

driver then washes down the chute into the bucket to remove any cementitious material before it hardens. After washing out the chute, the driver pumps (yellow arrow points to the pump) the washwater, sand, and other fine solids from the bucket up into the truck's drum to be returned to the ready mixed plant, where it can be washed into a reclaimer. A removable screen at the bottom of the washout bucket prevents course aggregate from entering the pump. This course aggregate can also be returned to the plant and added to the coarse aggregate pile to be reused. All the materials are recycled.



Figure 8. Chute washout bucket and pump

Hay bale and plastic washout pit

A washout pit made with hay bales and a plastic lining is shown in Figure 9. Such pits can be dug into the ground or built above grade. The plastic lining should be free of tears or holes that would allow the washwater to escape (Fig. 10). After the pit is used to wash down the chutes of multiple ready mixed trucks and the washwater has evaporated or has been vacuumed off, the remaining hardened solids can be broken up and removed from the pit. This process may damage the hay bales and plastic lining. If damage occurs, the pit will need to be repaired and relined with new plastic. When the hardened solids are removed, they may be bound up with the plastic lining and have to be sent to a landfill, rather than recycled. Recyclers usually accept only unmixed material. If the pit is going to be emptied and repaired more than a few times, the hay bales and plastic will be generating additional solid waste. Ready mixed concrete



Figure 9. Hay bale and plastic washout pit



Figure 10. Leaking washout pit that has not been well maintained

Stormwater Best Management Practice: Concrete Washout

trucks can use hay bale washout pits, but concrete pump trucks have a low hanging hopper in the back that may prevent their being washed out into bale-lined pits.

Vinyl washout container



Figure 11. Vinyl washout pit with filter bag

The vinyl washout container (Fig. 11) is portable, reusable, and easier to install than a hay bale washout pit.

The biodegradable filter bag (Fig. 12) assists in

extracting the concrete solids and prolongs the life of the vinyl container. When the bag is lifted, the water is filtered out and the remaining concrete solids and the bag can be disposed of together in a landfill, or the hardened concrete can be delivered to a recycler. After the solids have been removed several times and the container is full of washwater, the washwater can be allowed to evaporate, so the container can be reused. The washwater can be removed more quickly by placing another filter bag in the container and spreading water gelling granules evenly across the water. In about five minutes, the water in the filter bag will turn into a gel that can be removed with the bag. Then the gel and filter bag can be disposed of together.



Figure 12. Extracting the concrete solids or gelled washwater

Metal washout container

The metal roll-off bin (Fig. 13) is designed to securely contain concrete washwater and solids and is portable and reusable. It also has a ramp that allows concrete pump trucks to wash out their hoppers (Fig. 14). Roll-off providers offer recycling services, such as, picking up the roll-off bins after the washwater has evaporated and the solids have hardened, replacing them with empty washout bins, and delivering the hardened concrete to a recycler (Fig. 15), rather than a landfill. Some providers will vacuum off the washwater, treat it to remove metals and reduce the pH, deliver it to a wastewater treatment plant for additional treatment and



Figure 13. Mixer truck being washed out into a roll-off bin

subsequent discharge to a surface water. Everything is recycled or treated sufficiently to be returned to a natural surface water.



Figure 14. Pump truck using the ramp to wash out into a roll-off bin



Figure 15. Delivering hardened Concrete to a recycler

Another metal, portable, washout container, which has a rain cover to prevent overflowing, is shown in Figure 16. It is accompanied by an onsite washwater treatment unit, which reduces the pH and uses a forced weir tank system to remove the coarse aggregate, fine aggregate, and cement fines. The washwater can then be reused at the construction site to wash out other mixer truck chutes and equipment. The solids are allowed to harden together and can be taken to a concrete recycler (Fig. 17) to be crushed and used as road base or aggregate for making precast products, such as retaining wall blocks. All materials are recycled.



Figure 16. Washout container with a rain cover and onsite washwater treatment



Figure 17. Delivering hardened concrete to a recycler

Siting Washout Facilities

Concrete washout facilities, such as washout pits and vinyl or metal washout containers, should be placed in locations that provide convenient access to concrete trucks, preferably near the area where concrete is being poured. However they

should not be placed within 50 feet of storm drains, open ditches, or waterbodies. Appropriate gravel or rock should cover approaches to concrete washout facilities when they are located on undeveloped property. On large sites with extensive concrete work, washouts should be placed at multiple locations for ease of use by ready mixed truck drivers. If the washout facility is not within view from the pour location, signage will be needed to direct the truck drivers.

Operating and Inspecting Washout Facilities

Concrete washout facilities should be inspected daily and after heavy rains to check for leaks, identify any plastic linings and sidewalls have been damaged by construction activities, and determine whether they have been filled to over 75 percent capacity. When the washout container is filled to over 75 percent of its capacity, the washwater should be vacuumed off or allowed to evaporate to avoid overflows. Then when the remaining cementitious solids have hardened, they should be removed and recycled. Damages to the container should be repaired promptly. Before heavy rains, the washout container's liquid level should be lowered or the container should be covered to avoid an overflow during the rain storm.

Educating Concrete Subcontractors

The construction site superintendent should make ready mixed truck drivers aware of washout facility locations and be watchful for improper dumping of cementitious material. In addition, concrete washout requirements should be included in contracts with concrete delivery companies.

Reference

NRMCA 2009. Environmental Management in the Ready Mixed Concrete Industry, 2PEMRM, 1st edition. By Gary M. Mullins. Silver Springs, MD: National Ready Mixed Concrete Association.

Websites and Videos

Construction Materials Recycling Association
www.concreterecycling.org

National Ready Mixed Concrete Association
www.nrmca.org

National Ready Mixed Concrete Research and Education Foundation
www.rmc-foundation.org

Additional information and videos on concrete washout containers and systems can be found by a web search for "concrete washout."

Photograph Credits

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Figure 7. *Brad Burke, Innovative Concrete Solutions, LLC*

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Figures 9, 10. *Mark Jenkins, Concrete Washout Systems, Inc.*

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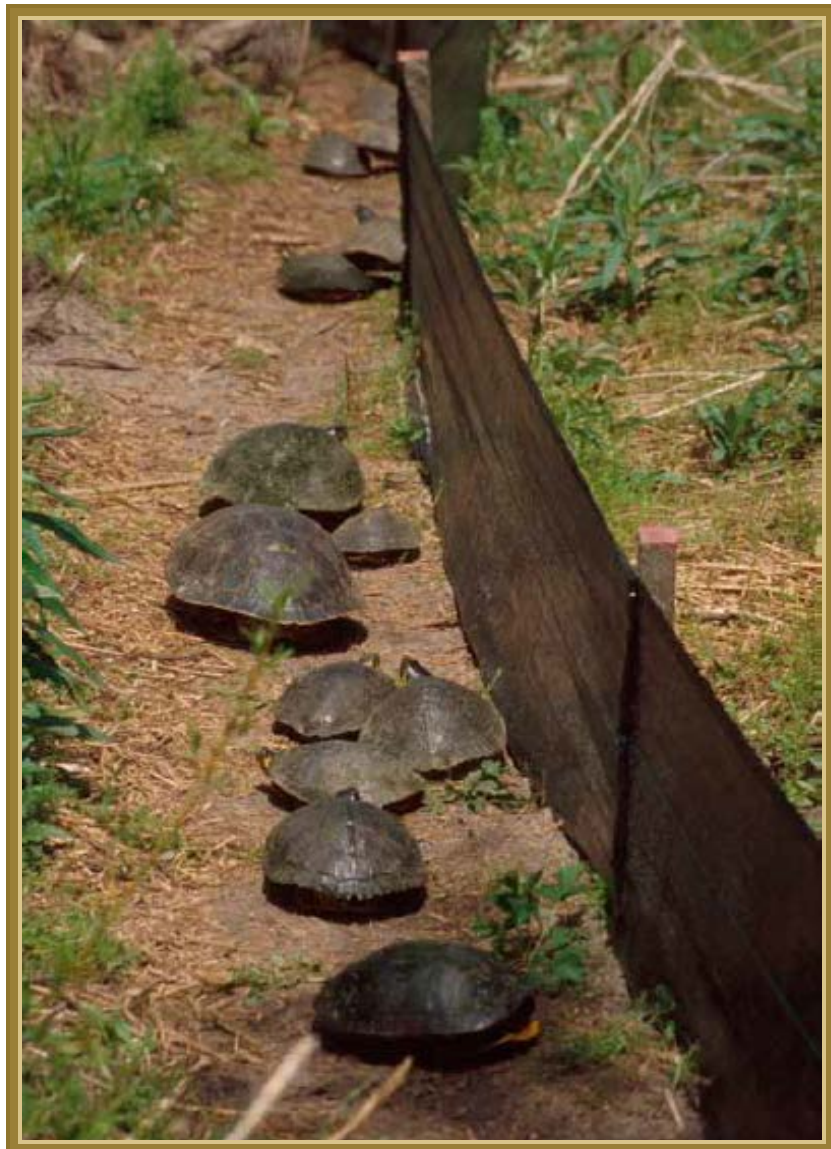
APPENDIX C

SPECIES AT RISK BRANCH BEST PRACTICES TECHNICAL NOTE

REPTILE AND AMPHIBIAN EXCLUSION FENCING

Version 1.1

July 2013



July 2013

Ontario Ministry of Natural Resources
Species at Risk Branch

Recommended Citation:

OMNR. 2013. Reptile and Amphibian Exclusion Fencing: Best Practices, Version 1.0. Species at Risk Branch Technical Note. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. 11 pp.

Cover illustration: Photograph by Matthew J. Aresco, Conservation Director, Nokuse Plantation

Before an activity can be initiated, permissions, approvals or authorizations may be required from MNR (e.g. Endangered Species Act authorization, Wildlife Scientific Collector’s Authorization) or other agencies, levels of government (e.g. a conservation authority, municipality, federal or provincial government), or landowners. It is your responsibility to ensure that all necessary permissions, approvals and authorizations are acquired prior to proceeding with your activity.

This document presents information as of the point in time of publication and is meant to be updated through time as improved information becomes available.

Cette publication hautement spécialisée, Reptile and Amphibian Exclusion Fencing Best Practices n’est disponible qu’en anglais en vertu du Règlement 671/92 qui en exempte l’application de la Loi sur les services en français. Pour obtenir de l’aide en français, veuillez communiquer avec le ministère des Richesses naturelles au Pamela Wesley, 705-755-5217.

Document History

Revision Number	Revision Date	Summary of Changes	Originated	Reviewed	Authorized
1.1	June, 2013	Pre-publishing edits	June, 2013	June, 2013	June, 2013

REPTILE AND AMPHIBIAN EXCLUSION FENCING - BEST PRACTICES -

The purpose of this guidance document is to provide an overview of proven design and installation techniques for reptile and amphibian exclusion fencing. Though this document points to site and species-specific design requirements, it is important to recognize that every situation is different. This guidance is not meant to replace site-specific advice obtained from local MNR staff or experienced exclusion fencing contractors. Moreover, exclusion fences are only effective when well planned, properly constructed, and maintained.

Exclusion fencing seeks to eliminate access to specific areas where activities that could harm animals are occurring (e.g. active aggregate operations, construction sites, and roads). The selection and installation of exclusion fencing can present some challenges, particularly if multiple species are being excluded. For example, some reptiles and amphibians are able to dig under fencing while others can climb over. Some may also take advantage of burrows dug by other animals. To maintain effectiveness, the bottom of the fence should be buried or secured firmly to the ground and minimum height recommendations (Table 1) are considered.

Exclusion fence design should consider the target species as well as those that might be unintentionally impacted. Fencing material should not pose a risk of entanglement or permit individuals to pass underneath or between openings. Landscape features such as topography and substrate need to be considered as they may constrain fencing design.

Including plans for fencing in advance of a project can increase efficiency and fence

effectiveness. For example, long-term road projects that will include a permanent sound barrier could design the sound barrier such that it also meets the specifications of the required exclusion fence.

EFFECTIVE FENCE CHARACTERISTICS

The fence burial and height recommendations listed in Table 1 below have been compiled from scientific literature, established management practices, and practitioner best advice. These are general recommendations and at times other specifications may be more appropriate. For instance, in areas where the substrate does not permit fence burial, weighing down the fence with heavy items (e.g. sand bags) or backfilling may be acceptable. Where needed, speak with your local MNR staff or experienced exclusion fencing contractor to develop site-specific plans.

If multiple species are being excluded from the same area, and the species-specific fencing specifications differ, the uppermost minimum height and greatest depth recommendation should be used (Table 1). If you are excluding both Blanding's Turtle and Gray Ratsnake, for example, the exclusion fence should be a minimum of 2 m tall (see Gray Ratsnake section below for additional details).

Exclusion fences should be installed prior to emergence from hibernation. A survey of the enclosed/secluded area should be conducted immediately following fence installation to ensure that no individuals have been trapped on the wrong side of the fence.

Table 1. Recommended burial depth and height requirements of exclusion fencing for reptiles and amphibians. Recommended height is the height of the fence after it has been installed including the buried components and any installed overhangs or extended lips.

SPECIES	RECOMMENDED DEPTH OF FENCE BURIED (cm) *	RECOMMENDED HEIGHT OF FENCE (cm) **
Turtles – general	10 – 20	60
Eastern Musk Turtle, Wood Turtle	10 – 20	50
Massasauga, Eastern Hog-nosed Snake, Butler’s Gartersnake, Queensnake	10 – 20	60
Gray Ratsnake & Eastern Foxsnake	10 – 20	200
Fowler’s Toad	10 – 20	50
Snakes - general	10 – 20	100
Common Five-lined Skink	10 – 20	unknown
Salamanders	10 – 20	30

* does not include the 10 cm horizontal lip that should extend outward an additional 10 – 20 cm (see Figure 2)

** the height of fencing has been provided as an approximate. Fencing materials may in fact not be available in proportions that would allow for these precise measurements. It is most effective, if the height and burial depth recommendations are met.

DURATION OF ACTIVITIES & DEGREE OF ANTICIPATED DISTURBANCE

The type of disturbance, the proximity to disturbance, and the planned fence longevity are factors that influence which type of exclusion fence is most effective. For short-term activities (i.e. 1 to 6 months) such as minor road repairs, a light-duty geotextile fence is appropriate. Longer term or permanent fencing projects, however, require more durable materials such as – heavy-duty geotextile, wood, concrete, woven-wire, sheet metal, vinyl panels, or galvanized mesh.

GEOTEXTILE FENCES

Geotextile fences (e.g. silt fences) come in many types and qualities. They can be very effective for the temporary exclusion of reptiles and amphibians. For the purposes of this document, temporary use ranges from a few months up to 2-3 years. Winter

weather is generally damaging to geotextile materials and the cost of maintenance over the long-term should be considered during the planning phase. Depending upon the quality, geotextile can be resistant to UV degradation and the bio-chemical soil environment.

Light-duty Geotextile Fencing:

Light-duty geotextile fencing is made of nylon material and is typically purchased with wooden stakes pre-attached at 2 m to 3 m intervals (Plate 1). It can also come without pre-attached stakes. Light-duty geotextiles are largely intended for projects with shorter durations of only a few months in duration and up to one season.

Geotextile fencing with nylon mesh lining should be avoided due to the risk of entanglement by snakes.

To use light-duty geotextile fencing:

- Fencing fabric is effective if attached to wooden, heavy plastic or metal stakes using heavy-duty wire staples or tie-wire (Figure 2).
- Secure the fence on posts that are placed at 2 m to 3 m apart. If using the greater recommended distance between posts, additional maintenance may be required to maintain effectiveness.
- Securely drive the stakes into the ground to a recommended depth of 30 cm. The fencing fabric should be buried to the recommended specifications in Table 1 and back-filled with soil.
- For snakes, supporting posts should be staked on the activity side (e.g. on the side facing the aggregate stock pile or the road - Figure 2).
- Light-duty geotextile fences are not effective where rocks or other hard surfaces prevent proper anchoring of fence posts and burial of the fence fabric.
- Light-duty geotextile fences are not effective where a large amount of concentrated run-off is likely or to cross streams, ditches or waterways without specific modifications.
- Contact your local MNR staff or experienced exclusion fencing contractor for advice and recommendations.
- See general best practices section below for additional details.

Generally, light-duty geotextile fences are not effective if they exceed 1 metre in height unless purposely manufactured for greater height (e.g. stakes placed at closer intervals or cross braces). If greater height is required consider using heavy duty geotextile, hardware cloth or other fencing materials.



Plate 1. Light-duty geotextile fencing with pre-attached wooden stakes used to exclude turtles from a road as seen on a regular maintenance check (photo credit: Brad Steinberg).

Heavy-duty Geotextile Fencing:

Heavy-duty geotextile fencing is typically constructed of a thick felt-like fabric. It may also be called 'double row' or 'trenched' fencing. For support, this fencing uses a woven wire fence (e.g. chain link) or some other structure (Plate 2). It is recommended that a minimum density of 270R or equivalent woven geotextile fabric is used.

Heavy-duty geotextile material can be effective for up to 2 or 3 years with proper maintenance. This type of fencing can be damaged by small mammals chewing through or torn by heavy debris (e.g. tree branches). Therefore, it may be best suited to turtles, which are less likely to take advantage of holes or tears in the fabric. If

used to exclude snakes or other animals, more maintenance may be required.

Heavy-duty geotextile fencing:

- The wire fence should be installed on the activity side to prevent animals from leveraging and climbing into the exclusion area while allowing the animal to escape if they find themselves on the wrong side (Figure 2).
- Geotextile fences across streams, ditches or waterways should have case-specific modifications.
- Contact your local MNR staff or experienced exclusion fencing contractor for advice.
- See light-duty geotextile section above and general best practices below for additional details.



Plate 2. Example of a heavy-duty geotextile fencing used to exclude snake species (photo credit: Jeremy Rouse).

HARDWARE CLOTH FENCES

Hardware cloth (also known as galvanized mesh or Birdscreen) is durable, cost effective and useful for excluding reptiles and amphibians. The fence should be made of heavy galvanized hardware cloth with a ¼ inch mesh. For fences intended to exclude small snakes, a ⅛ inch mesh may be more effective. In contrast, fencing intended to exclude turtle species can have a larger mesh size (e.g. ½ inch). Larger mesh may have a longer lifespan as it is constructed from a thicker material compared to smaller mesh sizes.

To use hardware cloth fencing:

- Secure the fence on posts placed a recommended 2.5 m apart with the stakes on the activity side (Figure 2).
- Pull the mesh taut and staple or secure with screws and a metal stripping to prevent the mesh from being ripped when pressure is applied.
- Installing a top rail or folding the mesh over a taut smooth wire reduces tearing (Plates 3 and 4).
- An outward facing lip installed on the species side ensures that snakes and amphibians are unable to climb or jump over the fence (Figure 2; Plate 4)
- Tears can be mended with 18-gauge galvanized wire.
- See general best practices section below for additional details.



Plate 3. Example of a galvanized mesh fencing used for the long-term exclusion of snakes and turtles from the adjacent highway (photo credit: Megan Bonenfant).



Plate 4. Long-term to permanent exclusion fencing using galvanized mesh with over-hanging lip to prevent animals from climbing or jumping over (photo credit: Megan Bonenfant).

WOOD LATH SNOW FENCING

In certain circumstances, wood lath snow fencing can be effective at excluding turtles. This fencing is typically constructed from soft wood slats that have been woven together with 13-gauge wire and is then attached to steel fence posts which have been driven into the ground.

Wood lath fencing is cost effective and can easily be laid down during the winter to prevent damage. The durability of the material, however, is not meant for very long-term use (e.g. more than 3 years), unless regular maintenance occurs.

To use wood lath snow fencing:

- The fencing should be attached to heavy plastic or metal stakes using heavy-duty wire staples or tie-wire.
- The stakes are recommended to be placed at 2 to 3 m intervals and securely driven into the ground 30 cm or more.
- Wood lath snow fencing across streams, ditches or waterways should have case-specific modifications.
- Wood lath snow fencing lends itself well to being combined with other types of material to ensure complete exclusion.
- See general best practices section below for additional details.



Plate 5. Example of a wood lath snow fencing used to exclude turtles (photo credit: Karine Beriault).

EXCLUSION FENCING FOR GRAY RATSNAKE AND EASTERN FOXSNAKE

Gray Ratsnake and Eastern Foxsnake are the largest snakes in Ontario - reaching nearly 2 m in length. They are also excellent climbers. For this reason, fencing intended to exclude either of these species has additional recommended design specifications.

- The fence should be at least 2 m high.
- The material on the species side (Figure 2) should be smooth to prevent the snakes from climbing into the excluded area.
- Stakes should be on the activity side of the fence (Figure 2).
- Due to the increase in fence height, it is valuable to decrease the distance between posts or install diagonal braces.
- See general best practices section below for additional details.

CONCRETE, SHEET METAL & VINYL WALLS

Concrete, metal or vinyl walls can stand alone or be combined with woven wire or chain link fences. They are durable, require minimal maintenance and are effective in excluding target species from high risk areas and guiding them to crossing structures or other desired locations (Plates 6 and 7). This fence type is comprised of a continuous vertical face of concrete, metal or vinyl sheeting with no gaps. Concrete walls can be installed as either pre-cast sections or pour directly in place.



Plate 6. Stand-alone continuous concrete wall used to exclude salamander species installed as pre-cast forms (photo credit: Steven Roorda).



Plate 7. Pre-formed vinyl sheeting fence intended to exclude salamanders for a construction site (photo credit: Herpetosure Ltd.)

The wall height depends upon the target species, but they are usually between 45 and 60 cm tall and buried 25 cm. Concrete, metal or vinyl exclusion fencing is most appropriate for salamanders, skinks, small snakes, and small turtles. For large turtle species, a chain link fence can be installed directly on top of the concrete wall for complete exclusion.

HABITAT CONNECTIVITY

Habitat connectivity is the connectedness between patches of suitable habitat or the degree to which the landscape facilitates animal movement. Exclusion fencing installed along roads or other large projects can effectively reduce or eliminate habitat connectivity for animals. In these scenarios, exclusion fencing should be considered with eco-passages in order to maintain connectivity. Fencing in isolation should be viewed as a temporary method to reduce mortality until species movement can be restored. Where eco-passages are not feasible they should be identified for consideration with any future road work or development to improve connectivity.

During the installation of fencing with an eco-passage, it is important that the fencing sits flush with the passage to ensure that

there are no gaps where animals can squeeze through.



Plate 7. A wood turtle travelling through a dry eco-passage. Ecopassages such as this help to ensure the long-term connectivity of seasonal habitat for this and other reptile and amphibian species (photo credit: Amy Mui).

GENERAL BEST PRACTICES:

- To deter digging, bury the fence 10 cm down with an additional 10 cm horizontal lip (Figure 2).
- Backfill and compact soil along the entire length on both sides of the fence (Figure 2).
- Once the fence is installed, a survey should be done to ensure that no individuals have been trapped inside (speak with MNR for survey advice).
- Exclusion fencing intended to exclude snakes should have the stakes installed on the activity side (opposite the normal requirement for sediment control fencing) to prevent snakes from using the stakes to maneuver over the fencing.
- For snakes and toads, the fence should have an overhanging lip on the species side (Figure 2).
- Fences should be inspected after spring thaw and at regular intervals throughout the active season, especially following heavy rain events. This is particularly important

for geotextile fences. Any damage that affects the integrity of the fence (e.g. tears, loose edges, collapses, etc.) should be fixed promptly.

- Tall or woody vegetation on the species side of the fence should be managed if there is a risk that it may enable the animals to climb over. This is most important during spring and fall. Proceed cautiously to not harm animals protected plant species during vegetation removal.
- When installing an eco-passage, fencing or exclusion walls should be used as a guiding system to direct animals to passage openings.
- Natural screens such as trees or shrubs can help to reduce road access and can be combined with fencing to provide protection of individuals from predation.
- Install fences with a turn-around at the ends furthest from the wetland habitat and at any access areas to assist in redirecting animals away from any fence openings (Figure 1).
- Curving the ends of the fencing inward (i.e. away from the road or construction site) may help to reduce access to these locations. The ends may also be tied off to natural features on the landscape such as trees or rock cuts.

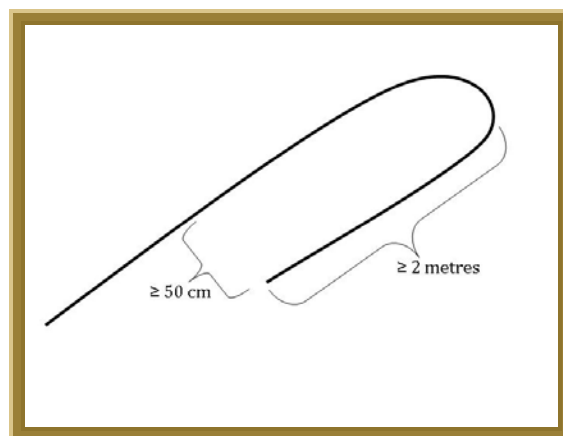


Figure 1. Diagram of the ends of the fence designed to curve inward in order to direct animals away from the area of exclusion.

WATER MOVEMENT & DRAINAGE

- In areas where surface water run-off may erode a soil-based backfill, consider using rocks or sand bags. Ensure these materials cannot be used by animals to climb over the fence.
- Where possible, minimize the number of water crossings: when necessary, it should occur where flow is minimal.
- Fence posts in waterways or areas prone to seasonal flooding should be driven rather than dug – unless following established best practices.
- Fencing should be placed above the high water mark anticipated for high water events such as spring freshet or periods of heavy or continuous rainfall.

TOPOGRAPHY:

- Fence posts should be closer together in undulating topography.
- Fences installed on slopes have a different effective height depending upon whether the animal will be approaching from the up or down slope. The fence height can be adjusted accordingly.

Improvements or questions regarding exclusion fencing can be brought to the local MNR Species at Risk Biologist or other MNR staff.

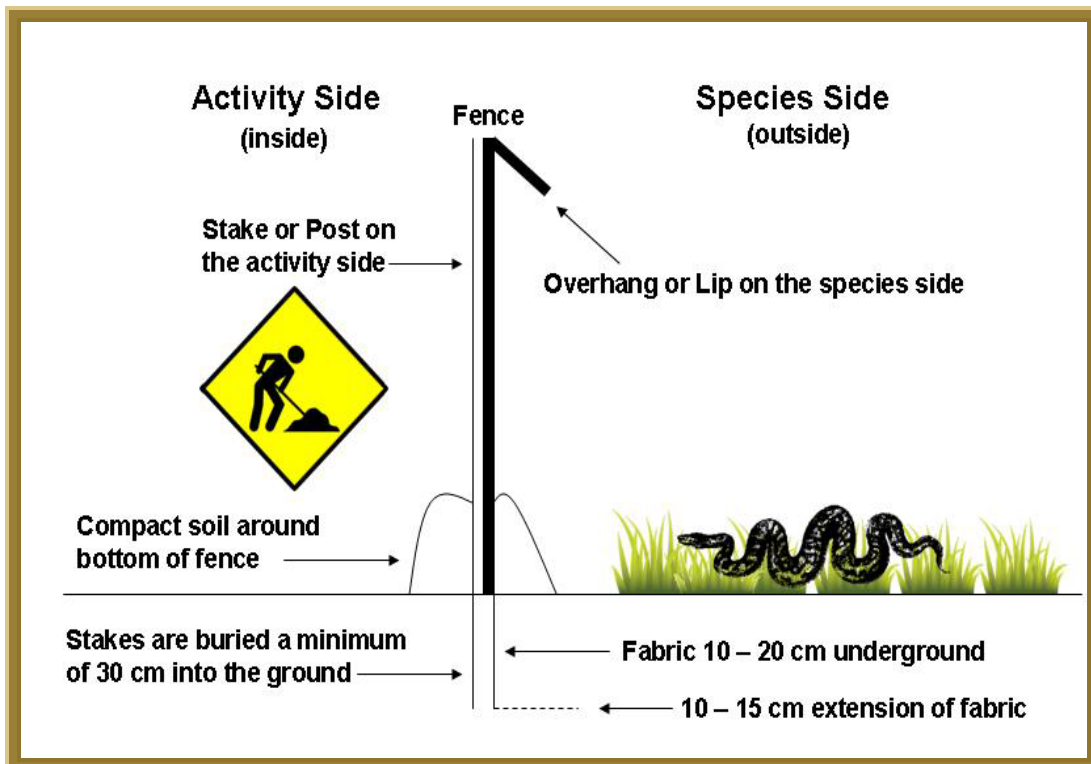


Figure 1. A side view of a basic exclusion fence including an overhang or flexible lip to deter animals from climbing or jumping over the fence. Placement of the stake on the Activity Side or on the inside of excluded area is also illustrated. This is particularly important for snake species which may use the stakes to maneuver over the fence.

RESOURCES:

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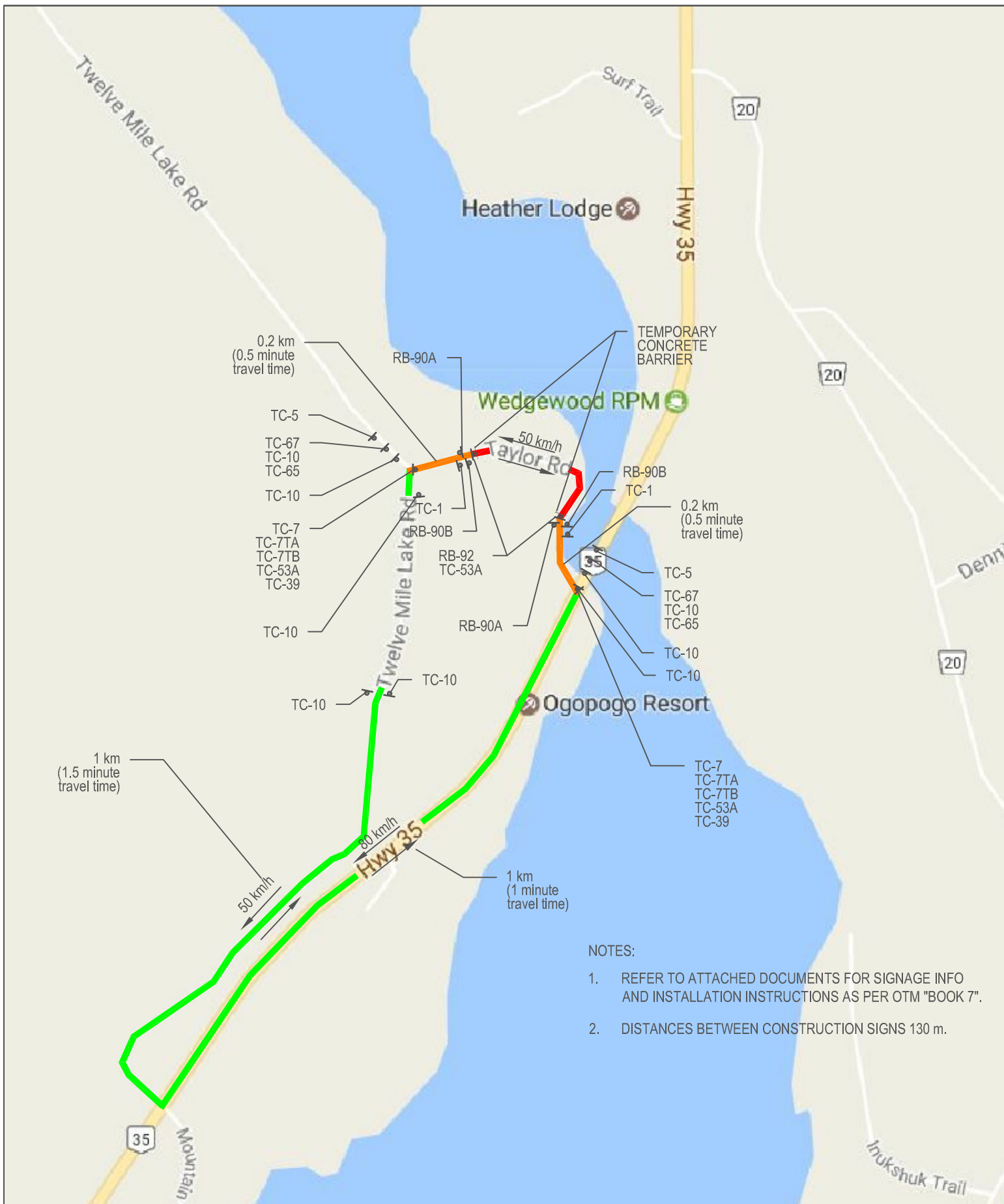
Program. The Land Conservancy of BC, Penticton, BC. 8 pp.

TWP Incorporated, Galvanized Mesh for Snake Control. Accessed July 2012, Available at: <http://www.twpinc.com>.

For additional information:

Visit the species at risk website at
ontario.ca/speciesatrisk
Contact your MNR district office
Contact the Natural Resources
Information Centre
1-800-667-1940
TTY 1-866-686-6072
mnr.nric.mnr@ontario.ca
ontario.ca/mnr

APPENDIX D



NOTES:

1. REFER TO ATTACHED DOCUMENTS FOR SIGNAGE INFO AND INSTALLATION INSTRUCTIONS AS PER OTM "BOOK 7".
2. DISTANCES BETWEEN CONSTRUCTION SIGNS 130 m.



600 COCHRANE DRIVE, 5th FLOOR
 MARKHAM ONTARIO CANADA L3R 5K3
 TEL.: 1-905-475-7270 | FAX: 1-905-475-5994 | WWW.WSPGROUP.COM

TITLE: PROPOSED ROAD DETOUR PLAN

LEGEND:
█ ROAD CLOSURE
█ LOCAL TRAFFIC ONLY
█ DETOUR

Total Detour 2.4 km (3.5 minute travel time)

SCALE:

DATE:
MAY 2017

PROJECT NO:
161-05116-00

REVISION:

DRAWING NO:

APPENDIX E

Recommended Contents of Environmental Management Plans (EMP)



5.0 ENVIRONMENTAL MANAGEMENT PLANS

The Contractor is required to prepare and submit to PCA a site-specific EMP detailing all proposed methods, strategies, structures, facilities, equipment and systems critical to environmental protection; all proposed environmental protection and mitigation measures, monitoring and follow-up activities; all relevant standards and guidelines; and, all performance criteria applicable to the project. The Contractor's EMP must be prepared by a Qualified Professional(s), signed and submitted to PCA, for review and acceptance prior to mobilization to site and the commencement of work. An accepted EMP (accepted by PCA) is required prior to the release of the Historic Canals Regulations Permit issued to the Contractor.

An EMP is a project-specific and site-specific document. The site-specific EMP shall serve as a reference document for all project personnel, so that they are aware of their responsibilities and what is expected of them concerning environmental protection. The requirements included in the EMP will apply to any person, Contractor or subcontractor involved in the project. It is intended to be a "living" document that may require amendments as the project advances from design through construction. These amendments must follow the submittal and acceptance process to PCA, prior to any changes.

For example, a dam commissioning plan may be conceptual during initial stages of construction, but would become highly specific prior to commissioning activities being undertaken. Failure to fully disclose all construction works and activities and phasing, or failure to prepare an acceptable in the EMP may result in project delay.

5.1 Overall EMP Requirements

The over-arching EMP document shall include a description of:

- The purpose and scope of the EMP;
- A project overview;
- A construction plan and schedules;
- The roles and responsibilities of the environmental management team;
- Environmental awareness, training and competency commitments;
- General communications and record keeping commitments;
- Environmental incident reporting procedures;
- Environmental monitoring and adaptive management summary; and
- EMP review and revision procedures.

As necessary, the over-arching EMP document should refer to relevant component plans (see Table 3) and other documents at higher or lower levels in the Contractor's management system. Higher level documents may describe environmental management policies and processes. Lower level documents may describe general procedures, specific operational procedures, activity specific work-procedures and work instructions, equipment manuals, environmental protection procedures.



5.1.1 Purpose and Scope of the EMP

The site-specific EMP shall include statements that describe its purpose and the scope:

- The purpose statements should demonstrate how the Contractor understands the relationship between the EMP, the legal requirements applicable to the Project, and the work to be completed.
- The specific Project works and activities to which the EMP will be applied, including any particular limitations such as Property boundaries (spatial scope); time (temporal scope); or limitations with respect to particular works or activities.

5.1.2 Project Overview

The site-specific EMP shall provide an overview of the project that includes:

- A description of the overall Project and its objectives;
- A location map that references the project location in relation to area municipality(ies), communities, transportation network and other local features (e.g., Provincial parks, conservation areas, etc.);
- A detailed Project site map that provides:
 - Property boundaries for all locations on which Project activities will be undertaken (including any leased properties),
 - Site entrance locations,
 - Locations of all PCA's assets,
 - Key environmental, socio-economic and culturally significant features², and
 - Site contours and expected drainage patterns.

5.1.3 Construction Plan and Schedules

The site-specific EMP shall provide a construction plan and schedules that include:

- A detailed description of all physical works, activities to be undertaken and materials to be used;
- A listing and rationale for any “high-risk” construction activities;
- An overall Project or construction schedule;
- Detailed supporting schedules and/or information that provides the following:
 - time periods / seasons identified as sensitive for environmental reasons (i.e., timing windows for fish, migratory bird nesting, Species at Risk, fire season, winter, etc.),
 - times where noise may be a nuisance to local residents or at a specialized land use (e.g., such as a hospital, school, retirement home) or when construction may create any parking, access and/or traffic problems,

² Key environmental, socio-economic and culturally significant features can be obtained from the Environmental Impact Assessment documentation prepared for the Project.



- the duration of specific physical works and activities (e.g., vegetation clearing, topsoil stripping, coffer dam installation and removal, concrete works, site restoration),
- timing of “high-risk” construction activities, key mitigation measures, including timing regarding the installation of key structures, facilities, equipment and systems critical to environmental protection,
- timing of any special studies or the submission of further EMP component plans,
- the Contractor’s site surveillance schedule by their Qualified Professional(s), linked to “high risk” construction activities, and
- a consultation schedule (if applicable).

5.1.4 Roles and Responsibilities of the Environmental Management Team

A site-specific EMP shall include a description of the organizational structure for the planned work or activities which clearly explains:

- Environmental management team members and their roles;
- Their relationship of each team member to each other;
- Their relationship to PCA personnel; and
- The contact information and position of the person(s) responsible for preparing the EMP and of the key persons responsible for implementing it.

Identifying the position(s) responsible for the EMP includes indicating who within the Contractor’s organization has responsibility and authority for its implementation, ongoing maintenance, performance monitoring and continuous improvement. The EMP shall describe, at an operational level, how the environmental management team and personnel will implement the EMP on a day-to-day basis. Reporting relationships and structures are most easily understood when represented in organization charts. The Contractor is encouraged to use organization charts to explain these relationships.

It is required for the Contractor to hire Qualified Professionals that can provide services thought the life of the project, particularly for monitoring of “high risk” construction activities.

5.1.5 Environmental Awareness, Training and Competency

The site-specific EMP shall refer to the policies, plans and procedures for communicating Project specific environmental protection matters within the Contractor’s organization and to Sub-Contractors entering the worksite. Task specific training will be provided to all Sub-Contractors or suppliers (e.g., Refueling standards and guidelines should be communicated to the supplier entering the site).

The EMP should also summarize and/or reference how environmental awareness training will be provided for all construction personnel, and should summarize and/or reference the procedures to ensure that personnel in environmentally critical roles are qualified and competent. This includes requirements for both training and competency assessments. Records of training must be given to PCA.



5.1.6 General Communications and Record Keeping

A communications protocol is required as part of the site-specific EMP. The EMP shall describe and/or reference:

- The environmental management team members that are authorized to communicate with PCA.
- The communication methods to be used to allow PCA to receive updates throughout the project to reflect changes in project scope, construction methods, scheduling, site conditions, and weather-related contingency measures. PCA must be informed of any proposed changes that may require an amendment to the EIA and/or EMP.
- The procedures for the reporting of all environmental incidents to the PCA Project Manager (or designate) for the investigation of all such incidents to find the underlying or root causes, and for the identifying of remedial actions to prevent future recurrence of the incident or similar incidents in the future.
- The types of records that are to be maintained to demonstrate environmental protection and compliance with the EMP and where to find these records for auditing purposes.

5.1.7 Environmental Incident Reporting

The site-specific EMP shall describe the reporting procedures for environmental incidents. At a minimum, the procedure would include commitments to:

- Report all environmental incidents to PCA's Environmental Authority and the Departmental Representative and any other regulatory authority if required by statute to be reported.
- Provide a written environmental incident investigation report that includes appropriate photo documentation and describes the:
 - Nature of the incident;
 - Approximate magnitude and duration of the incident;
 - Areas, resources or habitats affected;
 - Results of any sample analysis taken in conjunction with the incident (e.g., water samples);
 - Root cause(s) of the incident;
 - Immediate actions taken on-site to mitigate adverse environmental effects;
 - Recommended preventive and corrective actions to control or limit the activity or circumstances causing the incident, including a time frame for implementation;
 - Communications held with the Contractor's employees, PCA's Environmental Authority, the Departmental Representative and other regulatory agencies (if applicable).
- All environmental incidents shall be reported as soon as reasonably possible. Spills must be reported within 24 hours (see Refueling and Spill Management – ESG-13-C).

5.1.8 Environmental Monitoring and Adaptive Management Summary

Each site-specific EMP component plan shall include a description of monitoring and reporting requirements relevant to the specific component plan contents. These component plans shall:



- Define project and site-specific objectives (e.g., performance / compliance monitoring, effectiveness monitoring);
- List the applicable legislative and regulatory requirements;
- Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines;
- Describe the scope of environmental monitoring, including:
 - Monitoring objectives,
 - Location(s) to be monitored,
 - Parameters to be monitored,
 - Methods, and
 - Duration and frequency of monitoring;
- Equipment to be used and its maintenance/calibration schedule;
- Describe reporting requirements (e.g., event reports, monthly reports, annual reports); and
- Provide cross-references to other component plans.

These monitoring plans and approaches to adaptive management shall be summarized within the over-arching EMP document.

Adaptive management is a planned and systematic process for continuously improving environmental management practices by learning about their outcomes. Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of a project. Adaptive management approaches shall be specific to relevant component plans and shall discuss (where appropriate) the following:

- Identification of key indicators that may serve as a gauge of ecological conditions within the area of the project;
- Identification of action thresholds to be used to indicate when environmental performance is approaching and/or below an acceptable level and requires corrective management action.
- Identification of testable predictions or hypotheses to provide a basis for understanding why change might be occurring in the environment and how to select adaptive management measures based on those conclusions.
- Identification of adaptive management options to demonstrate that there are a range of available options to adapt and manage the project should a mitigation measure not function as intended. These options should be technically and economically feasible.
- Conditions that would trigger the need for a revisions to the EMP and/or Historic Canals Regulations Permit.

Further guidance regarding adaptive management is available from the Canadian Environmental Assessment Agency (2009)³.

³ Canadian Environmental Assessment Agency, 2009. Operational Policy Statement- Adaptive Management Measures under the *Canadian Environmental Assessment Act*. Catalogue No.: 978-1-100-12062-1, ISBN: En106-83/2009E-PDF. Available on-line at: https://www.ceaa-acee.gc.ca/Content/5/0/1/50139251-2FE4-4873-B6A1-A190C103333D/Adaptive_Management_Measures_under_the_CEEA.pdf



5.1.9 EMP Review and Revision

The EMP shall specify the procedures for the review and revision of the EMP during Project implementation and have a version control procedure. At a minimum, the site-specific EMP shall be reviewed by the Contractor to determine if an amendment or a major revision is warranted:

- At least once every six (6) months or on a seasonal basis;
- As a result of changes in the project or changes in the anticipated environmental effects of the project;
- After corrective actions have been taken in response to an environmental incident;
- after an adaptive management measure has been proposed by either the Contractor or PCA;
- After a material revision of the EMP has been proposed by either the Contractor or PCA. A material revision is one which would be relevant to the question of whether an adverse environmental effect is more likely to occur, or become more adverse, and be significant;
- After a material revision of the EMP is proposed that changes a commitment such as:
 - a reduction or increase of monitoring or reporting requirements; or
 - making a specification less stringent or more stringent.

Any proposed amendment or revision shall be provided to PCA by the Contractor in writing for acceptance prior to action. Amendments and revisions shall be tracked in accordance with an accepted version control procedure.

PCA may choose to modify its EIA and the Historic Canals Regulations Permit issued to the Contractor on the basis of the proposed amendment or EMP revision.

5.1.10 Component Plan Requirements

Where relevant, the following component plans are to be included in a site-specific EMP. Each component plan will be based on a set of project-specific and site specific objectives. A key requirement of each component plan will be a table that summarizes applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines. The information included in this ESG Document should be used to the extent possible and applicable to the Project. However, the component plans should not be limited to these measures. Contractors will need to augment these standards and guidelines with other measures that are unique to the Project or necessary to address the full range of anticipated Project effects. If there is insufficient detail for a component plan then there should be clear reference as to when the plan will be provided. Work will not commence until PCA acceptance of all relevant component plans.



Component Plan	Primary Objectives
Dust and Air Quality Management	<ul style="list-style-type: none"> To minimize potential effects and disruption to residents, businesses, community facilities, recreational and tourist activities
Noise, Vibration and Ambient Light Management	<ul style="list-style-type: none"> To minimize potential effects and disruption to residents, businesses, community facilities, recreational and tourist activities
Transportation Management	<ul style="list-style-type: none"> To minimize disruption to traffic patterns and access to property.
Blasting	<ul style="list-style-type: none"> To identify blasting procedures and timing, including safety, use, storage, and transportation of explosives.
Demolition	<ul style="list-style-type: none"> To identify demolition procedures and timing.
Site Dewatering and Wastewater	<ul style="list-style-type: none"> To control water takings from watercourses, waterbodies or from the ground from entering the construction site. To prevent contaminated water resulting from the dewatering process and wastewater management from being discharged into the environment. To isolate clean off-site water from contaminated construction water and to minimize the volume contaminated water.
Surface Water Management, Erosion and Sediment Control	<ul style="list-style-type: none"> To control and mandate surface water from off-site and within the project area; To minimize the amount of erosion on-site. To control the amount of sedimentation occurring on-site. To minimize the deposition of deleterious substances to surface waters and minimize sediment input to surface waters.
Dredging and Sediment Removal	<ul style="list-style-type: none"> To identify the dredging and sediment removal procedures, including storage, transport and disposal of dredged materials. To minimize disturbance and protect aquatic and terrestrial resources.
Vegetation Protection	<ul style="list-style-type: none"> To minimize and phase disturbance and protect existing native vegetation
Wildlife Protection and Management	<ul style="list-style-type: none"> To minimize disturbance to wildlife and hazards associated with wildlife.
Aquatic Resources Management	<ul style="list-style-type: none"> To minimize disturbance and protect aquatic resources, including sensitive species and their habitat.
Species at Risk Protection	<ul style="list-style-type: none"> To minimize disturbance and protect aquatic and terrestrial Species at Risk and their habitat.
Invasive Species Management	<ul style="list-style-type: none"> To control the spread of existing invasive plant infestations and prevent new infestations from establishing in the Project area.



Component Plan	Primary Objectives
Waste Management	<ul style="list-style-type: none"> • To minimize the generation and need for disposal of hazardous and non-hazardous wastes. • To minimize risks to worker and public health and safety.
Hazardous Materials Management	<ul style="list-style-type: none"> • To identify the procedures for the transportation, storage and safe use of hazardous materials on-site.
Fuel Management	<ul style="list-style-type: none"> • To minimize the risk of accidents and malfunctions • To minimize risks to worker and public health and safety.
Spills Prevention and Emergency Response	<ul style="list-style-type: none"> • To minimize the risk of accidents and malfunctions. • To minimize risks to worker and public health and safety. • To minimize disturbance and protect aquatic and terrestrial resources. • To effectively respond to spills and other emergencies on-site.
Dam and/or Bypass Channel Commissioning	<ul style="list-style-type: none"> • To sets out the process, expectations and the methodology for successful commissioning of a dam. • To minimize the amount of sediment disturbance/transport and aquatic environments during
Site Restoration	<ul style="list-style-type: none"> • To minimize risks to worker and public health and safety; • To minimize long-term effects on aquatic and terrestrial resources. • To restore site aesthetics and minimize disruption to residents, businesses, community facilities, recreational and tourist activities.

Table 3 provides PCA’s key requirements for each component plan. Table 4 provides links to the potentially applicable standards and guidelines included in [Part 2](#) of this ESG Document that may assist in the preparation of each component plan.



Table 3: EMP Component Plans and Key Requirements

EMP Component Plan	Key Requirements
Dust and Air Quality Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Describe the key sources of dust and air emissions (e.g., equipment, works and activities) associated with the Project. • Identify the locations and provide a description of sensitive receptors. • List the key methods, strategies, structures, facilities, equipment and systems critical to dust and air quality management. • Describe approach to construction site winterization and/or winter operations. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements.
Noise, Vibration and Ambient Light Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Describe the key sources of noise, vibration and light (e.g., equipment, works and activities) associated with the Project. • Identify the locations and provide a description of sensitive receptors. • List the key methods, strategies, structures, facilities, equipment and systems critical to noise, vibration and ambient light management. • Describe approach to construction site winterization and/or winter operations. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements.



EMP Component Plan	Key Requirements
Transportation Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • List relevant federal, provincial or municipal standards and guidelines related to transportation infrastructure to be affected. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations. • Describe the routes to provide safe and efficient movement of vehicles. • Describe timing of road or bridge closures and detour routes. • Location and capacity of parking for staff and construction vehicles. • List policies for the movement of dangerous goods, oversized and regular loads. • List policies for movement of heavy loads on roadways with load restrictions. • Describe the communication protocols with provincial and municipal government and local police services. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements.
Blasting	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. <ul style="list-style-type: none"> ○ All blasting activities in or near water are required to follow the “Guidelines for the use of Explosives In or Near Canadian Fisheries Waters” (DFO 1998) to reduce particle velocities and pressure changes created by underwater explosives that can result in fish injuries and mortality. • Specify blasters name, company, copy of license, and statement of qualifications. • Describe the magazine type and locations for explosives and detonating caps (if on-site). • Describe typical rock type and geology structure (solid, layered, or fractured). • Specify the locations for blasting and volumes of materials to be removed. • For each location provide the following information: <ul style="list-style-type: none"> ○ Proposed limits for Peak Particle Velocity; ○ Explosive type, product name and size, weight per unit, and density; ○ Delay type, sequence, and delay; ○ Use of non-electrical initiation systems for all blasting operations; ○ Stemming material and tamping method;



EMP Component Plan	Key Requirements
	<ul style="list-style-type: none"> ○ Hole depth, diameter, and pattern; ○ Explosive depth, distribution, and maximum charge and weight per delay; ○ Number of holes per delay; ○ Dates and hours of conducting blasting; ○ Distance and orientation to nearest aboveground and underground structures; ○ Measures for the Protection of aboveground and underground structures. ● Describe the procedures for: <ul style="list-style-type: none"> ○ Storing, handling, transporting, loading, and firing explosives; ○ Fire prevention; ○ Inspections after each blast; ○ Misfires, fly rock, and noise prevention; ○ Stray current accidental-detonation prevention; ○ Signs and flagmen. ● Describe warning signals prior to each blast and notification prior to blasting. ● Plans for disposal of waste blasting material. Procedures for monitoring and reporting on blasting operations. ● Describe approach to construction site winterization and/or winter operations. ● Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection.
Demolition	<p>This component plan shall:</p> <ul style="list-style-type: none"> ● Define project and site-specific objectives. ● List the applicable legislative and regulatory requirements. ● List and describe the buildings and structures to be demolished. ● Provide time schedule for demolition works. ● For each building and structure to be demolished provide the following information: <ul style="list-style-type: none"> ○ Historical and/or heritage status; ○ Presence / absence of Species at Risk (e.g., bats); ○ Demolition waste types and volumes; ○ Presence and volumes of hazardous materials; ● Describe the procedures for: <ul style="list-style-type: none"> ○ Installation and removal of coffer dams; ○ Noise abatement; ○ Fugitive dust control; ○ Treatment of discharge waters; ○ Demolition waste management; ○ Hazardous materials management.



EMP Component Plan	Key Requirements
	<ul style="list-style-type: none"> • Describe the approach to adaptive management (e.g., contingency plan in case of any emergency situation). • Describe approach to construction site winterization and/or winter operations. • Provide cross-references to other component plans. • Describe monitoring and reporting requirements.
Dewatering and Wastewater	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. <ul style="list-style-type: none"> ○ Confirm the need for a Provincial permit to take water (PTTW) in accordance with the <i>Ontario Water Resources Act</i> (OWRA) and the Water Taking Regulation (O. Reg. 387/04) a regulation under the <i>Act</i>. Section 34 of the OWRA requires anyone taking more than a total of 50,000 litres of water in a day, with some exceptions, to obtain a Permit from a Director appointed by the Minister for the purposes of Section 34. The following water takings related to construction site dewatering and road construction may be eligible for registration in the Environmental Activity and Sector Registry (EASR): <ul style="list-style-type: none"> ▪ Surface water takings related to specific road construction purposes; and ▪ Ground water and/or storm water takings of more than 50,000 L/day but less than 400,000 L/day for the purposes of construction site dewatering. • Describe the purpose of dewatering, sources and amount of water taking / removal required. • Describe the proposed dewatering and wastewater management methods, strategies, equipment and materials to be used, including any controls (that is, settling tank, turbidity curtain, etc.) and method of effluent discharge. • Provide at time schedule for dewatering works and activities. • Specify the anticipated dewatering flow rate and total dewatering duration. • Specify the anticipated wastewater volumes. • Specify water quality discharge criteria. <ul style="list-style-type: none"> ○ If dewatering conducted in a contaminated area, engineering specifications for dewatering effluent treatment and details for an analytical monitoring program to ensure that effluent will meet water quality discharge criteria. ○ If wastewater is to be discharged, engineering specifications for treated effluent and details for an analytical monitoring program to ensure that effluent will meet water quality discharge criteria. • Specify the point(s) of discharge. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management (e.g., contingency plan in case of any emergency situation). • Describe approach to construction site winterization and/or winter operations.



EMP Component Plan	Key Requirements
	<ul style="list-style-type: none"> • Provide cross-references to other component plans. • Describe monitoring and reporting requirements.
Surface Water, Erosion and Sediment Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Describe the key sources of emissions or discharges to surface waters (e.g., equipment, works and activities) associated with the Project. • Identify the key point and non-point sources of contaminants (e.g., equipment, material storage areas or stockpiles, waste management facilities, vehicle and equipment maintenance facilities). • Identify need for alternative equipment, material storage or stockpile locations off-site. • Provide at time schedule for in-water works. • Describe the soil types found on-site and their constraints with respect to: <ul style="list-style-type: none"> ○ surface water management; ○ erosion control; and ○ sediment control. • Describe the surface water drainage patterns on the project site as well as coming on to the site and areas sensitive to erosion and sedimentation during each phase of the work. • List the key methods, strategies, structures, facilities, equipment and systems critical to: <ul style="list-style-type: none"> ○ surface water management; ○ erosion control; and ○ sediment control. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations for all structures, facilities, equipment and systems critical to: <ul style="list-style-type: none"> ○ surface water management; ○ erosion control; and ○ sediment control. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements.



EMP Component Plan	Key Requirements
Dredging and Sediment Removal	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Identify the locations and volumes of dredged materials. • Identify locations for storage and/or disposal of dredged materials. • Provide time schedule for in-water works. • Identify the locations and provide a description of sensitive aquatic species and their habitat in vicinity of the dredging and sediment removal operations • List the key methods, strategies, structures, facilities, equipment and systems for dredging and sediment removal. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.
Vegetation Protection	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Describe the key Project works and activities with the potential to adversely affect native vegetation. • Provide a time schedule for vegetation removal and/or ground disturbing activities. • Identify the locations and provide descriptions of areas to be disturbed and areas to be left undisturbed, including sensitive features (e.g., wetlands, woodlands, grasslands, valley lands, areas with Species at Risk). • List the key methods, strategies, structures, facilities, equipment and systems critical to vegetation protection. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.



EMP Component Plan	Key Requirements
Wildlife Protection	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Describe the key Project works and activities with the potential to adversely affect wildlife. • Identify the locations and provide descriptions of any areas to be disturbed and areas to be left undisturbed, including sensitive features (e.g., Bat roosts, snake hibernacula, wildlife dens, bird nests, wildlife crossing areas, salt licks). Describe exclusionary measures (if required). • List the key methods, strategies, structures, facilities, equipment and systems critical to wildlife protection. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe the approach to nuisance wildlife control. • Describe approach to construction site winterization and/or winter operations. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.
Aquatic Resources Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Identify the locations and provide a description of in-water works. • Provide a time schedule for in-water works. • Identify the locations and provide a description of sensitive aquatic species and their habitat. • List the key methods, strategies, structures, facilities, equipment and systems critical to aquatic resources management. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.



EMP Component Plan	Key Requirements
Species at Risk Protection	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Provide a time schedule for vegetation clearing and in-water works. • Identify Species at Risk to be protected. • Identify the locations and provide a description of Species at Risk critical habitat or other habitat areas to be protected. • List the key methods, strategies, structures, facilities, equipment and systems critical to wildlife and aquatic resources management. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.
Invasive Species Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • List the invasive species of concern on the Project site (including area immediately surrounding the Project site). • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe the approach to adaptive management. • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.



EMP Component Plan	Key Requirements
Waste Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Identify the locations and provide descriptions of waste storage, recycling and/or disposal facilities on-site. • Identify all off-site disposal facilities to be utilized and confirm their licensing status. • Describe site house-keeping procedures. • Describe the measures and procedures to minimize wildlife attraction to wastes. • Describe procedures for waste minimization, recycling, storage and disposal of hazardous and non-hazardous wastes, including wastes generated by: <ul style="list-style-type: none"> ○ vegetation removal; ○ earthworks (i.e., overburden stripping); ○ dredging and sediment removal. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document).
Hazardous Materials Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Identify the locations and provide descriptions of hazardous materials storage facilities on-site. • Identify all off-site disposal facilities to be utilized and confirm their licensing status. • Provide an inventory of hazardous materials that will be used on-site. • Provide MSDS for all hazardous materials in use or to be stored on-site. • Provide an inventory and location of spill equipment to be stored on-site. • List the personnel trained to handle hazardous materials. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Provide cross-references to other component plans.



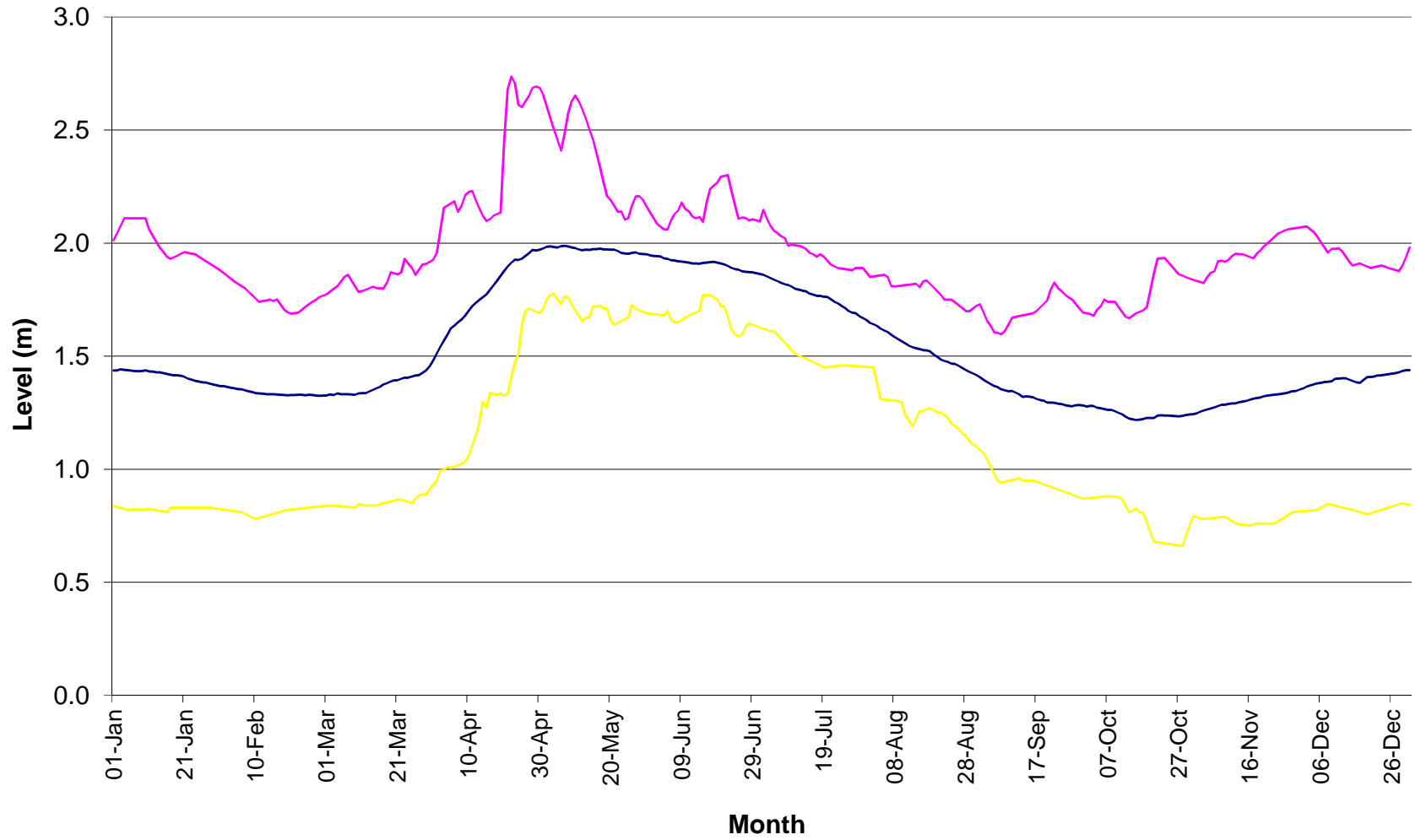
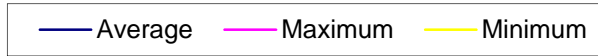
EMP Component Plan	Key Requirements
Fuel Management	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Identify the locations and provide descriptions of facilities for fuel transfer and storage. • Describe the fuel handling, transfer and storage procedures. • Provide equipment refueling plans. • Provide an inventory and location of spill equipment to be stored on-site. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations. • Describe the maintenance program for all structures, facilities, equipment and systems critical to environmental protection. • Provide cross-references to other component plans.
Spills Prevention and Emergency Response	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific objectives. • List the applicable legislative and regulatory requirements. • Describe the on-site roles and responsibilities for spills and emergency response. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document) with respect to spills prevention and emergency response procedures, including procedures for: <ul style="list-style-type: none"> ○ reporting a spill; ○ stopping the spill if possible; ○ containing the spill; ○ protecting the area of the spill; and ○ removing the material to an approved location for storage or disposal. • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.



EMP Component Plan	Key Requirements
Dam / By-pass Channel Commissioning	<p>This component plan shall:</p> <ul style="list-style-type: none"> • Define project and site-specific dam / by-pass channel commissioning objectives. • List the applicable legislative and regulatory requirements. • Describe the structures, systems or operations to be commissioned. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe pre-commissioning activities for each structure, system or operation (e.g., inspections, site/structure preparation, performance or operational testing). • Describe commissioning activities and schedules for each structure, system or operation. • Describe the approach to adaptive management (e.g., contingency plan in case of any emergency situation). • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.
Site Restoration	<p>This component plan shall:</p> <ul style="list-style-type: none"> • List the applicable legislative and regulatory requirements. • Provide a time schedule for site restoration works. • Identify areas to be restored and their respective restoration objectives • Describe the restoration methods, vegetation to be used, etc. • Tabulate applicable EIA commitments, terms and conditions of approval and relevant environmental standards and guidelines (Refer to <u>Part 2</u> of this ESG Document). • Describe approach to construction site winterization and/or winter operations. • Describe the approach to adaptive management. • Describe monitoring and reporting requirements. • Provide cross-references to other component plans.

APPENDIX F

Twelve Mile Lake Levels



**Twelve Mile Lake
Average Daily Water Levels**

Trent-Severn Waterway

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
1	1.437	1.367	1.326	1.512	1.977	1.943	1.863	1.648	1.406	1.277	1.248	1.357
2	1.437	1.365	1.330	1.542	1.984	1.942	1.860	1.641	1.395	1.280	1.254	1.365
3	1.442	1.361	1.329	1.568	1.985	1.941	1.853	1.634	1.386	1.279	1.259	1.370
4	1.440	1.358	1.335	1.595	1.982	1.933	1.845	1.622	1.377	1.272	1.265	1.375
5	1.438	1.355	1.332	1.624	1.980	1.930	1.839	1.614	1.367	1.270	1.268	1.380
6	1.436	1.353	1.331	1.635	1.987	1.925	1.832	1.606	1.363	1.266	1.273	1.381
7	1.434	1.349	1.332	1.650	1.988	1.923	1.824	1.595	1.354	1.263	1.279	1.386
8	1.433	1.345	1.331	1.663	1.985	1.919	1.818	1.584	1.348	1.262	1.285	1.387
9	1.434	1.341	1.330	1.680	1.980	1.919	1.814	1.576	1.345	1.257	1.286	1.389
10	1.436	1.337	1.335	1.700	1.978	1.916	1.807	1.566	1.346	1.249	1.289	1.400
11	1.433	1.335	1.337	1.721	1.972	1.913	1.797	1.556	1.339	1.243	1.292	1.401
12	1.432	1.334	1.336	1.735	1.969	1.910	1.794	1.546	1.332	1.233	1.291	1.402
13	1.429	1.332	1.344	1.748	1.971	1.909	1.789	1.539	1.320	1.224	1.296	1.402
14	1.429	1.331	1.350	1.761	1.970	1.909	1.787	1.535	1.323	1.221	1.300	1.396
15	1.425	1.332	1.358	1.773	1.973	1.912	1.776	1.532	1.321	1.218	1.302	1.390
16	1.421	1.331	1.364	1.794	1.973	1.913	1.771	1.526	1.318	1.220	1.307	1.384
17	1.417	1.329	1.374	1.814	1.975	1.916	1.767	1.525	1.311	1.221	1.311	1.382
18	1.416	1.329	1.381	1.833	1.972	1.917	1.766	1.520	1.306	1.226	1.315	1.395
19	1.415	1.327	1.387	1.854	1.972	1.914	1.762	1.506	1.303	1.227	1.318	1.407
20	1.413	1.328	1.393	1.876	1.971	1.910	1.762	1.497	1.295	1.227	1.322	1.409
21	1.408	1.328	1.394	1.897	1.971	1.905	1.753	1.485	1.294	1.237	1.326	1.410
22	1.399	1.329	1.400	1.913	1.965	1.900	1.741	1.479	1.294	1.238	1.328	1.414
23	1.395	1.329	1.405	1.927	1.957	1.890	1.733	1.474	1.290	1.237	1.329	1.415
24	1.391	1.328	1.405	1.926	1.954	1.885	1.722	1.467	1.288	1.237	1.331	1.418
25	1.388	1.329	1.409	1.931	1.953	1.882	1.712	1.465	1.283	1.237	1.334	1.421
26	1.385	1.328	1.414	1.943	1.956	1.876	1.700	1.457	1.280	1.235	1.337	1.423
27	1.383	1.326	1.416	1.956	1.959	1.872	1.693	1.448	1.278	1.234	1.340	1.425
28	1.378	1.325	1.426	1.969	1.953	1.872	1.690	1.439	1.282	1.236	1.344	1.429
29	1.375	1.326	1.437	1.968	1.952	1.871	1.677	1.430	1.284	1.240	1.346	1.435
30	1.371		1.454	1.971	1.951	1.867	1.669	1.423	1.282	1.242	1.352	1.438
31	1.368		1.480		1.946		1.661	1.417		1.243		1.438

Water Levels based on height off Sill #2 (Sill elevation = 0m)

**Twelve Mile Lake
Average Maximum Water Levels**

Trent-Severn Waterway

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
1	2.013	1.868	1.774	1.958	2.655	2.113	2.095	1.850	1.730	1.690	1.832	2.072
2	2.045	1.855	1.786	2.057	2.605	2.087	2.147	1.853	1.693	1.686	1.828	2.074
3	2.078	1.843	1.798	2.156	2.555	2.072	2.107	1.855	1.656	1.678	1.823	2.061
4	2.110	1.830	1.810	2.166	2.506	2.061	2.076	1.858	1.634	1.706	1.850	2.048
5	2.110	1.820	1.830	2.175	2.458	2.060	2.055	1.860	1.605	1.720	1.869	2.028
6	2.110	1.810	1.850	2.185	2.409	2.101	2.044	1.850	1.603	1.750	1.875	2.005
7	2.110	1.800	1.860	2.138	2.484	2.128	2.030	1.810	1.597	1.740	1.919	1.981
8	2.110	1.785	1.835	2.167	2.573	2.144	2.022	1.808	1.610	1.740	1.922	1.958
9	2.110	1.770	1.810	2.212	2.627	2.179	1.987	1.810	1.640	1.740	1.917	1.974
10	2.110	1.755	1.785	2.225	2.652	2.150	1.993	1.812	1.670	1.718	1.926	1.974
11	2.060	1.740	1.788	2.230	2.628	2.140	1.990	1.814	1.673	1.696	1.943	1.977
12	2.033	1.743	1.794	2.190	2.593	2.118	1.988	1.816	1.677	1.674	1.953	1.964
13	2.007	1.747	1.801	2.155	2.549	2.110	1.983	1.818	1.680	1.668	1.950	1.941
14	1.980	1.750	1.807	2.121	2.501	2.115	1.974	1.820	1.683	1.679	1.950	1.919
15	1.960	1.744	1.801	2.097	2.458	2.094	1.957	1.805	1.687	1.690	1.944	1.900
16	1.940	1.751	1.800	2.106	2.400	2.176	1.950	1.830	1.690	1.697	1.939	1.905
17	1.930	1.729	1.798	2.121	2.335	2.240	1.940	1.835	1.701	1.703	1.933	1.910
18	1.938	1.707	1.827	2.129	2.268	2.254	1.950	1.819	1.717	1.716	1.954	1.903
19	1.945	1.693	1.870	2.134	2.207	2.267	1.940	1.803	1.732	1.790	1.969	1.897
20	1.953	1.688	1.866	2.447	2.190	2.293	1.923	1.786	1.747	1.864	1.986	1.890
21	1.960	1.690	1.861	2.677	2.164	2.297	1.905	1.770	1.796	1.932	2.000	1.893
22	1.957	1.693	1.870	2.736	2.138	2.300	1.897	1.750	1.825	1.933	2.014	1.897
23	1.953	1.705	1.930	2.707	2.139	2.233	1.890	1.750	1.800	1.934	2.028	1.900
24	1.950	1.718	1.910	2.611	2.103	2.166	1.888	1.750	1.787	1.916	2.042	1.895
25	1.940	1.730	1.890	2.602	2.110	2.107	1.885	1.738	1.771	1.898	2.050	1.890
26	1.930	1.740	1.860	2.627	2.163	2.113	1.883	1.725	1.760	1.880	2.057	1.885
27	1.920	1.750	1.882	2.651	2.206	2.111	1.880	1.713	1.750	1.862	2.062	1.880
28	1.910	1.762	1.905	2.686	2.207	2.100	1.890	1.700	1.731	1.856	2.064	1.875
29	1.900	1.768	1.907	2.692	2.192	2.105	1.890	1.699	1.712	1.850	2.067	1.900
30	1.890		1.916	2.686	2.163	2.100	1.890	1.710	1.693	1.843	2.069	1.940
31	1.880		1.926		2.138		1.870	1.722		1.837		1.980

Water Levels based on height off Sill #2 (Sill elevation = 0m)

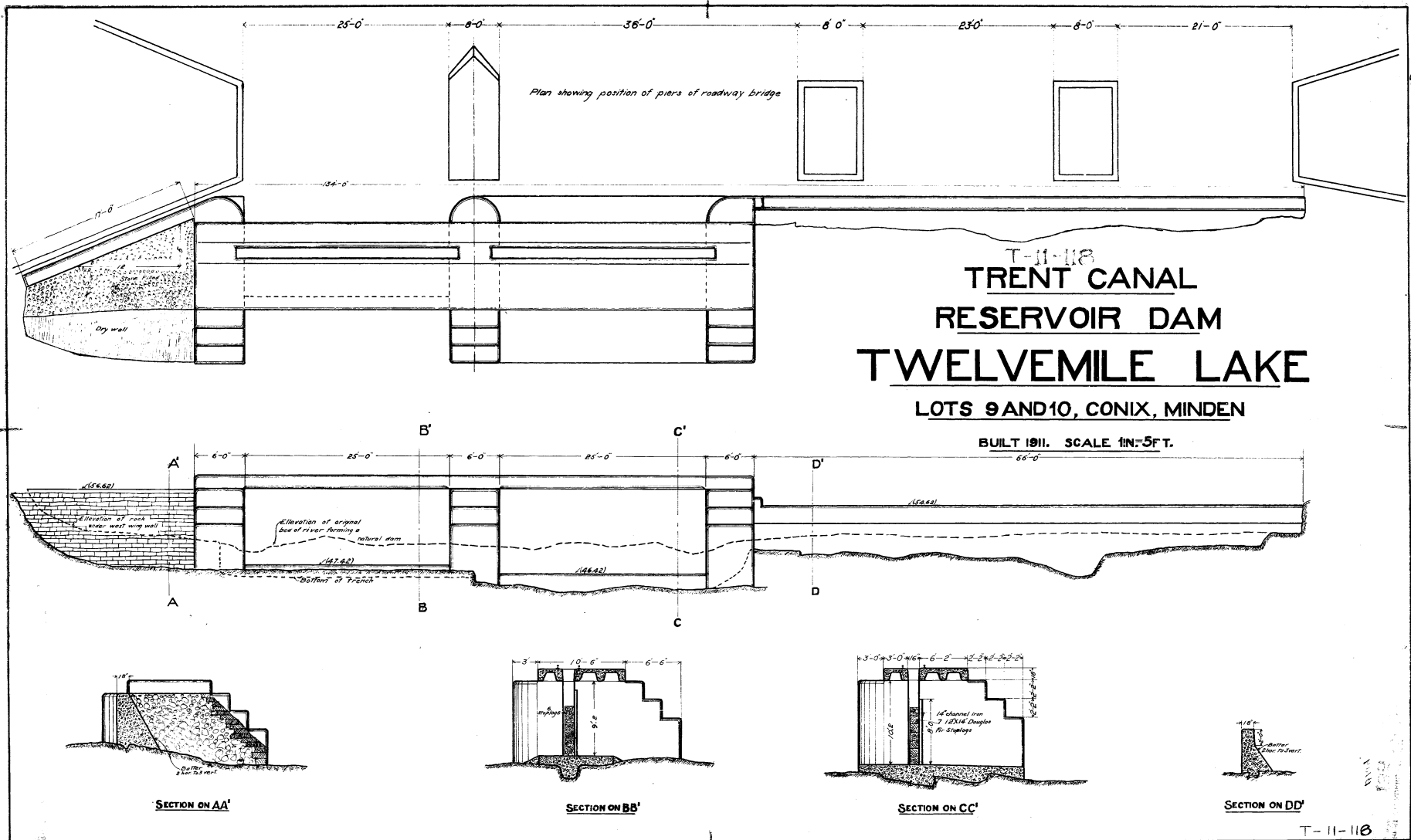
**Twelve Mile Lake
Average Minimum Water Levels**

Trent-Severn Waterway

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
1	0.837	0.821	0.838	0.950	1.710	1.686	1.627	1.451	1.085	0.871	0.788	0.815
2	0.833	0.819	0.840	0.994	1.750	1.684	1.621	1.450	1.070	0.873	0.784	0.816
3	0.829	0.817	0.839	0.997	1.770	1.682	1.616	1.384	1.040	0.874	0.780	0.817
4	0.824	0.814	0.837	1.009	1.775	1.680	1.610	1.310	1.010	0.876	0.782	0.819
5	0.820	0.812	0.836	1.005	1.753	1.700	1.610	1.308	0.980	0.877	0.783	0.820
6	0.821	0.810	0.834	1.012	1.730	1.660	1.593	1.307	0.950	0.879	0.785	0.829
7	0.823	0.803	0.833	1.017	1.765	1.650	1.577	1.305	0.940	0.880	0.787	0.838
8	0.823	0.795	0.831	1.023	1.760	1.650	1.560	1.303	0.944	0.879	0.788	0.847
9	0.820	0.788	0.830	1.034	1.727	1.660	1.543	1.302	0.948	0.878	0.790	0.843
10	0.823	0.780	0.845	1.061	1.703	1.670	1.527	1.295	0.952	0.877	0.780	0.839
11	0.824	0.784	0.843	1.105	1.680	1.680	1.510	1.240	0.956	0.868	0.770	0.834
12	0.821	0.789	0.840	1.149	1.655	1.687	1.503	1.215	0.960	0.839	0.760	0.830
13	0.819	0.793	0.840	1.203	1.670	1.693	1.496	1.190	0.950	0.810	0.758	0.827
14	0.816	0.798	0.840	1.297	1.670	1.700	1.489	1.224	0.950	0.818	0.755	0.823
15	0.813	0.802	0.840	1.273	1.720	1.770	1.481	1.255	0.950	0.825	0.753	0.820
16	0.810	0.807	0.844	1.339	1.719	1.770	1.474	1.257	0.950	0.810	0.750	0.815
17	0.830	0.811	0.849	1.332	1.724	1.770	1.467	1.265	0.944	0.805	0.755	0.810
18	0.830	0.816	0.853	1.329	1.710	1.760	1.460	1.270	0.939	0.763	0.760	0.805
19	0.830	0.820	0.857	1.334	1.711	1.750	1.450	1.261	0.933	0.722	0.760	0.800
20	0.830	0.822	0.861	1.325	1.656	1.720	1.452	1.251	0.927	0.680	0.760	0.805
21	0.830	0.823	0.866	1.333	1.639	1.720	1.453	1.250	0.921	0.678	0.760	0.810
22	0.830	0.825	0.865	1.407	1.647	1.673	1.455	1.240	0.916	0.675	0.760	0.815
23	0.830	0.827	0.860	1.472	1.655	1.619	1.457	1.225	0.910	0.673	0.760	0.820
24	0.830	0.828	0.855	1.512	1.663	1.596	1.458	1.201	0.904	0.670	0.770	0.825
25	0.830	0.830	0.850	1.639	1.671	1.588	1.460	1.192	0.899	0.668	0.780	0.830
26	0.830	0.832	0.870	1.700	1.728	1.595	1.459	1.177	0.893	0.665	0.790	0.835
27	0.830	0.833	0.884	1.710	1.710	1.631	1.458	1.158	0.887	0.663	0.800	0.840
28	0.830	0.835	0.887	1.703	1.703	1.644	1.456	1.147	0.881	0.660	0.810	0.845
29	0.828	0.837	0.890	1.697	1.697	1.639	1.455	1.126	0.876	0.706	0.812	0.849
30	0.826		0.910	1.690	1.690	1.633	1.454	1.110	0.870	0.751	0.813	0.846
31	0.823		0.930		1.688		1.453	1.100		0.791		0.841

Water Levels based on height off Sill #2 (Sill elevation = 0m)

APPENDIX G



S-11-118

T-11-118