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TSW - Port Severn  
Main Dam Mechanization  
Number R.076951.037

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SPECIFICATION TITLE SHEET

Section 00 00 00  
Page 1  
2020-07-17

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PROJECT TITLE Port Severn Main Dam - Mechanization  
Main Dam Gates & Hoist System

PROJECT NUMBER R.076951.037

PROJECT DATE 2020-07-17 (Issued for Tender)

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General Drawing

Title

000 COVER SHEET - LIST OF DRAWINGS

Mechanical Drawing Number

Title

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101 GENERAL ARRANGEMENT - SECTIONS  
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203 ELECTRICAL BURIED AND SURFACE GROUNDING  
204 GATE AND GAIN HEATING  
205 BASIC DIAGRAM - GATE HOIST CONTROL  
206 ELECTRICAL CABLE ROUTING - CABLE TRAYS/SECTIONS  
207 600 V RECEPTACLES GROUND FAULT PROTECTION  
208 ELECTRICAL CABLE SCHEDULE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Title and description of Work.
- .2 Contract Method.
- .3 Work by others.
- .4 Work sequence.
- .5 Contractor use of premises.
- .6 Owner occupancy.

1.2 PRECEDENCE

- .1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.
- .2 This document references various OPSS documents. Where not stated, the Municipal version of the OPSS shall be used.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- .1 This detailed specification covers requirements for furnishing of labour, materials, tools, equipment, power plant, systems, transportation and supervision and quality control necessary to completely perform work, as described by the drawings and specifications for the supply and installation of the Trent-Severn Waterway, Port Severn, Main Dam gates and hoists and electrical modifications and connections to Hydro One network.
- .2 The Contractor shall retain qualified personnel to perform work.
- .3 Contract Work of this Contract comprises the manufacturing of the equipment and installation on site, all located at Port Severn, Ontario; and further identified as PSPC Project Number R.076951.037037.
- .4 Work of this Contract also includes traffic management, supply of contractor facilities including sanitation facilities, construction

signage, environmental works, supply and operation of barges, and other tasks related to the management and administration of the work.

- .5 The Contractor shall be responsible for acquiring road occupancy permits, detour signage, and traffic control if a road closure is required on Port Severn Road North at the Main Dam to facilitate the erection of the gates. Road closures shall be scheduled to be as short as possible, maximum 1 day.

#### 1.4 CONTRACT SCHEDULE

- .1 Commence work in accordance with notification of acceptance of contract offer and complete the work within the dates outlined in the contract.
- .2 Work on this project is scheduled from October of 2020 to October of 2021.
- .3 Contractor shall have entirely installed the dam gate equipment before October 1, 2021.

#### 1.5 CONTRACT METHOD

- .1 Construct work under Lump Sum and Unit Rate contract.
- .2 For all intents and purposes in the attached technical specifications, please note the following:
  - .1 Departmental Representative (DR) is interchangeable with Contract Administrator (CA).
  - .2 The Bidder should read "Contractor" and/or "Vendor" as their own firm.
  - .3 Public Works (PSPC) and Parks Canada (PCA) is designated as the "Owner".
  - .4 The Contractor shall be responsible for all work on the Contractor's work site and must cooperate with the Contract Administrator (CA), Public Works (PSPC) and Parks Canada (PCA) personnel.

#### 1.6 LOCATION OF WORK

- .1 The Main Dam is part of the Trent-Severn Waterway (TSW) in the Municipality of Port Severn. The dam is accessed from Port Severn Road North. The swing bridge is load rated, the contractor is permitted to use the swing bridge to access the site provided vehicles are within the load limit. Construction materials may also be transported to

the dam by barge or dropped off at the road on the east side of the dam. Note that the service deck shall not be used as a laydown area and there is no laydown area on the east side of the bridge.

#### 1.7 OTHER FEES, PERMITS and CERTIFICATES

- .1 The "Historic Canal Regulations" (SOR/93-220) apply to and govern the work of this Contract. Copies may be obtained from the Justice laws Website: <http://laws-lois.justice.gc.ca/en/regulations/sor-93-220/>.
- .2 Pay all fees and obtain permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.
- .3 Payment to be included in the Lump Sum Price under Mobilization/Demobilization.
- .4 Contractor shall not begin any work on site until Parks Canada issues work permit under Historical Canals Regulation. Permit will not be issued before the following are submitted and approved:
  - .1 Environmental Management Plan
  - .2 Dewatering Plan (for installation of gates).
  - .3 Health and Safety Plan
  - .4 Site Layout Plan & Preconstruction Survey
  - .5 Traffic Control Plan
  - .6 Protection Plan for Heritage Structure
- .5 The Contractor is responsible for acquiring road occupancy permits required.

#### 1.8 ARCHAEOLOGICAL, CULTURAL AND ENVIRONMENTAL PROTECTION

- .1 The Trent Severn Waterway is a National Historic Site.
- .2 Client Department, Parks Canada Agency, is the Environmental Authority for Trent Severn Waterway Projects.
- .3 Contract Administrator will seek and obtain acceptance of Client Department and PCA Environmental Authority of submittals or changes in scope of work or methodologies that may affect archaeological resources, cultural resources or environment prior to providing direction to Contractor. Allow for a minimum of 15 working days for acceptance of these changes.
- .4 Comply with mitigation measures outlined in site-specific Detailed Impact Assessment (DIA) and other federal, provincial, territorial

or municipal act or regulation applying to the National Parks and Historic Sites of Canada.

- .5 Changes to project scope of work not assessed under site-specific DIA will require review and acceptance by Client Department and may require issuing revised permit.
- .7 Employ minimal intervention approach for all work.
- .8 Damage to heritage elements will not be tolerated.
- .9 All work to be in accordance with requirements of Section 01 35 43 ENVIRONMENTAL PROCEDURES.

#### 1.9 RELICS AND ANTIQUITIES

- .1 Corner stones and their contents, buried artifacts, the remains and evidence of ancient persons and peoples, commemorative plaques and other objects of historic value and worth remain the property of the Crown. Any and all such objects shall be protected and immediately brought to the attention of the Contract Administrator.
  - .1 Should historic objects be uncovered during the work, stop work immediately and notify the Contract Administrator immediately. Work is to only resume after such time as directed by the Contract Administrator. If evidence of historic objects are validated;
    - .1 Contractor will allow time for Contract Administrator to conduct proper heritage recording of the work site asset prior to start of work. Additional recordings may be required after dewatering prior to demolition work.
    - .2 Contractor to ensure float time within schedule for such occurrences.

#### 1.10 COST BREAKDOWN

- .1 Within 48 hours of notification of acceptance of bid, furnish a cost breakdown by Section aggregating contract price.
- .2 Show separately cost of equipment purchased exempt from Sales Tax under your Ontario Sales Tax license number.
- .3 Submit a list of subcontractors.

#### 1.11 TAXES

- .1 Pay all applicable taxes properly levied by law (including Federal,

Provincial and Municipal).

### 1.12 EXISTING SITE CONDITIONS

- .1 Main Dam:
  - .1 Port Severn's Main Dam was originally built in 1916 and founded on bedrock. The existing dam is a concrete gravity structure with an overall length of 71.32 m. In 2019 the existing dam was demolished and reconstructed in 2020.
  - .2 It is located between Lock 45 and Dam D.
  - .3 The reconstructed Main Dam will comprise of nine (9) sluiceways: four (4) sluiceways will be equipped with mechanized gates and hoists and five (5) sluiceways will have timber stop logs that will be operated with a hydraulic log lifter.
  - .4 At the top of the Main Dam, a reinforced concrete slab over reinforced concrete piers serves as both a service deck (upstream) and a roadway deck (downstream). Cast-in-place concrete barriers separate the two decks.
  - .5 All nine (9) sluiceways will comprise upstream service gains for timber stop logs that will be operated with manual log lifters.
  
- .2 Fixed Bridge or roadway deck:
  - .1 The downstream section of the Main Dam's deck acts as a bridge of the Port Severn Road North. The roadway deck and barriers are reinforced concrete.

### 1.13 ACCESS TO THE SITE

- .1 The site can be accessed by road from Exit 156 of Hwy 400 and travel east on Port Severn Road North for 1 km or from Exit 153 of Hwy 400 and travel north on Port Severn Road for 1 km. The site can also be accessed by barge from the Trent Severn Waterway System.
- .2 All Contractor traffic shall access the site from the East Side of the Fixed Bridge; access from the West side of the Fixed Bridge is limited by the load rating of the swing bridge.
- .3 For the portion of the access by public roads, make all arrangements, obtain any required permits if applicable and confine activities to such routes and load limits of the authorities having jurisdiction.
- .4 Secure the work area in an approved manner. This includes minimum 1.8 m high welded wire construction fencing around the designated work site to prevent public access to any areas where construction activities

occur and construction materials are stored. Provide secure coverings to all openings to prevent public access to the work areas at all times during construction.

- .5 Where work involves disruption to and rerouting of vehicular traffic, provide Contract Administrator with a Traffic Control Plan to the requirement of the local authorities and the standards set out in the Ontario Traffic Manual Book 7, Temporary Conditions.
- .6 Half-load season on Port Severn Road, usually runs from March 1st to April 30th. The municipality reserve the right to adjust those dates pending weather and road conditions.
- .7 No oversized vehicles or track equipment used by the Contractor's workforce are permitted to use the swing bridge at any time. Rubber tire equipment meeting the load limit of the swing bridge and personal vehicles used by the Contractor's workforce may cross the swing bridge, if deemed safe by the Contract Administrator.

#### 1.14 MINIMUM STANDARDS

- .1 Use new materials and work to at least all applicable minimum standards of; Canadian General Standards Board, Canadian Standards Association, National Building Code of Canada 2015 (NBC), ASTM, applicable Provincial and Municipal codes, and all other national and international.
- .2 In case of conflict or discrepancy, most stringent requirement will apply.

#### 1.15 ABBREVIATIONS

- .1 Abbreviations used are:
  - .1 ASTM - American Society for Testing and Materials.
  - .2 ACI - American Concrete Institute.
  - .3 ANSI - American National Standards Institute.
  - .4 CSA - Canadian Standards Association.
  - .5 CWB - Canadian Welding Bureau.
  - .6 NBC - National Building Code of Canada.
  - .7 CPM - Critical Path Method.
  - .8 CGSB - Canadian General Standards Board.
  - .9 GC - General Conditions.
  - .10 MNR - Ministry of Natural Resources.
  - .11 MOE - Ministry of the Environment.
  - .12 NCC - National Capital Commission.
  - .13 OPSS - Ontario Provincial Standard Specifications.
  - .14 PSPC - Public Services and Procurement Canada, formerly Public

- Works and Government Services Canada (PSPC).  
.15 PCA - Parks Canada Agency.

#### 1.16 DEFINITIONS

- .1 Unless context clearly indicates otherwise, these definitions apply:
- .1 Lock - Lock 45.
  - .2 Dam - Port Severn Main Dam.
  - .3 Bridge: Port Severn Fixed Bridge.
  - .4 Plans - Drawings listed in "List of Drawings".
  - .5 Specifications - the subject matter listed in the "List of Contents", addenda to the specifications, and all relative written communications sent by Contract Administrator to the Contractor in connection with the Work.
  - .6 Contract Administrator: AECOM.
  - .7 Construction Inspector: AECOM.
  - .8 Consultant: AECOM

#### 1.17 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy of each document as follows:
- .1 Valid and Approved Work Permits.
  - .2 Contract Drawings.
  - .3 Specifications.
  - .4 Addendum.
  - .5 Change Orders.
  - .6 Other Modifications to Contract.
  - .7 Field Test Reports.
  - .8 Copy of reviewed Work Schedule (to be kept up to date).
  - .9 PCA - accepted Environmental Management Plan (EMP).
  - .10 PCA Historical Canals Regulations Permit.
  - .11 PCA Detailed Impact Analysis (DIA).
  - .12 Health and Safety Plan and Other Safety Related Documents:
    - .1 Other documents as specified.
    - .2 Manufacturer's installation and application instructions.
    - .3 Notice of Project issued by the Ministry of Labour.
    - .4 Site Specific Environmental Management Plan.
    - .5 Waste Management Plan.

#### 1.18 FIRE SAFETY REQUIREMENTS

- .1 Comply with the National Building Code of Canada 2015 (NBCC) for fire safety in construction and the National Fire Code of Canada 2015 (NFC) for fire prevention, firefighting and life safety in building in use. Standards are to be the most recent and updated versions.

### 1.19 UNITS

- .1 Units of Measurement shall be SI Metric units. Present shop drawings, product data and samples in SI Metric units. Where items or information is not produced in SI Metric units, converted values are acceptable.

### 1.20 STANDARDS

- .1 All Materials to be incorporated in the Works and the fabrication of same shall conform to the latest applicable Standards and Specifications as specified in the Contract Documents. Where a particular standard or code is referred to, that standard or code shall, unless otherwise stated, be the edition in effect 30 days prior to the closing date for submission of tenders.
- .2 If the Contractor proposes equivalent Standards and Specifications, or equivalent materials, Contractor shall state the exact nature of the change, and shall submit complete Standards and Specifications, and information and data on the materials for acceptance.

### 1.21 WATER LEVELS

- .1 Information on the control of water levels may be requested through the Contract Administrator.
- .2 Normal navigation period runs from approximately Victoria Day weekend to Thanksgiving weekend.
  - .1 May 21, 2021 to October 11, 2021.
  - .2 Navigation season may be subject to change.
- .3 Operations to drawdown (lower) water levels starts after end of Navigation Season.
  - .1 Drawdown levels will not be reached at this site until November 7, 2021.
  - .2 Water levels will fluctuate, but typically remain at this low level until December 15, 2021.
  - .3 Dates are not firm commitment and approximated based on previous years practice and observations.
  - .4 Information on dewatering and watering schedule and control of water levels may be obtained from Departmental Representative when available from Client Department in September and April
- .4 Water levels for the Trent Severn Waterway are available for reference online at:  
[http://avalanche.pc.gc.ca/lhn-nhs/on/trentsevern/visit/ne-wl/trent\\_e.asp](http://avalanche.pc.gc.ca/lhn-nhs/on/trentsevern/visit/ne-wl/trent_e.asp).

- .5 Expect water levels to fluctuate due to rain, snow, snowmelt, surface run-off, storm drains, evaporation, leakage, spring freshet, and operational requirements.
- .6 Normal Navigation Water Level (NWL), during Navigation Season, in the Gloucester Pool is 180.50 m.
- .7 Normal off-season Low Water Level (LWL), in the Gloucester Pool is 180.20 m.
  - .1 Immediately after drawdown, water levels may be temporarily lower than this normal low water level.
- .8 Maximum expected water levels during Work, in the Gloucester Pool is 180.60 m.
- .9 If water level rises above or drops below these ranges because of precipitation, snow melt, operating problems, or any other cause, it is brought back within normal range as soon as reasonably possible by Client Department.
- .10 Departmental Representative will endeavor to co-ordinate regulation of water levels with Client Department when possible. However, Departmental Representative cannot be held responsible for events, or results of events not under his control.
- .11 Water levels on Georgian Bay (downstream side of dam) is highly variable and fluctuates regularly with the wind direction. Water levels as high as 177.66 m have been observed.
- .12 The Contractor is cautioned that, while the Parks Canada Agency endeavors to control the upstream water levels within the indicated ranges it cannot be held responsible for events or the results of events that are not under its control. Downstream water levels are not controlled and are regularly impacted by seasonal fluctuations, tides, and weather conditions.
- .13 The Contractor shall provide adequate environmental protection as per Section 01 35 43 - ENVIRONMENTAL PROCEDURE.
- .14 The Contractor is solely responsible for making his own interpretation of the data included herein.

#### 1.22 FLOOD ADVISORIES

- .1 The contractor is not permitted to erect gates or perform work that would prevent PCA dam operators from operating the existing sluices during a flood advisory.
- .2 The contractor is required to open a non-functioning gate to allow

passage of water if directed to do so by PCA staff during a flood advisory.

### 1.23 TSW CANAL DATES OF OPERATION

- .1 For the 2021 season, navigation is expected to start on Friday, May 21 and go to Monday, October 11.

### 1.24 SETTING OUT OF THE WORKS

- .1 Reference Survey
  - .1 All survey points in the tender documents and feasibility study have been referenced to the CGVD1928-1978 datum and UTM NAD83(CSRs) coordinates.
  - .2 Should the Contractor find any discrepancy between the original surveys and the new surveys, he shall report it to the Contract Administrator in writing.
- .2 Benchmarks
  - .1 Any control points or benchmarks at the Site are provided to the Contractor for reference. Before using control points and benchmarks for setting-out of the Works, the Contractor shall carry out a check survey thereon and satisfy himself as to their accuracies. The Engineer shall not bear any responsibility for the accuracy of any control points and benchmarks that may be located in the field.
  - .2 The Contractor shall protect the reference points and level benchmarks, and in the event of any damage he shall re-survey and re-establish the points.
- .3 Site Surveys.
  - .1 The Contractor is responsible for setting out and performing surveys and measurements. The Contractor shall render all necessary assistance to the Engineer and shall provide, as required by the Contract Administrator, sufficient quantities of pegs, poles, straight edges, stagings, moulds, templates, profiles and all other requisite items for checking the Contractor's setting-out and the measurement of the Works.
  - .2 Whenever requested by the Contract Administrator (verbally or in writing), the Contractor shall supply three (3) copies of such survey and measurement records.
  - .3 The cost of all labour and materials required by the Contract Administrator for the foregoing purpose shall be borne by the Contractor. No payment will be made for the cost of any such setting-out and quantity measurement work including those to be made with the Contract Administrator's personnel, and no extension of time shall be allowed for any delay that may be occasioned thereby.

## PART 2 - PRODUCTS

### 2.1 RECTIFICATION OF EXISTING SURFACES AND MATERIALS

- .1 Repair, replace and/or refinish, to the Construction Inspector's approval, existing surfaces and damaged/alterd in connection with the work.
- .2 The repaired, replaced and/or refinished items to be at least equal to those that existed immediately before damage occurred.
- .3 The Contractor shall restore, at its expense, all areas which have been disturbed by the Contractor's operations under this contract and which are not covered by other items of the contract. Where disturbance is to be graveled or timber or concrete curb lined areas, completely restore using like materials and to the satisfaction of the Construction Inspector.
- .4 Restoration of the site must occur as soon as possible after construction is completed.

### 2.2 GUARANTEE

- .1 Guarantee the satisfactory operation of all work and apparatus installed under the Contract. Replace immediately any part which may fail or prove defective without cost to the Contract Administrator, provided such failure is not due to improper usage. Guarantee to be extended where applicable when stated elsewhere in this specification.
- .2 Do not construe as acceptance of defective work or of improper materials, any certificate given, payment made or partial or entire use of the equipment by the Contract Administrator. Make good at once all such defective work or materials, and the consequences therefrom, within twelve months of the date of the final certificate of completion.
- .3 Do not consider this general guarantee as a waiver of any specified guarantee for any other greater length of time normally extended by manufacturers of equipment.
- .4 Remain responsible for and provide all guarantees required under this specification. All guarantees including guarantees in writing required for specific portions of this contract must be provided by the Contractor prior to final acceptance of the work by the Contract Administrator.
- .5 Before completion of work, collect all manufacturer's guarantees and warranties and deposit with Contract Administrator.

- .6 Unless more stringent warranties are specified, all warranties are to be one year from the date of total performance. If any equipment and/or items are not commissioned at the point of substantial performance their start of warranty will be assessed and commence on the date it is functioning as per the design intentions.
- .7 Guarantees must show:
- .1 Name and address of projects
  - .2 Guarantee commencement date (date of Interim Certificate of Completion).
  - .3 Duration of guarantee.
  - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
  - .5 Signature and seal of Guarantor.
  - .6 Additional material used in project listed under various Sections showing name of manufacturer and source of supply.
- .8 The Contractor shall be responsible for attending all warranty site meetings. The Contract Administrator shall arrange with the Client, and Contractor to determine all deficiencies to be corrected:
- .1 The CA will prepare a deficiency list for issuance to the Contractor
  - .2 The Contractor will provide a schedule indicating when correction of all deficiencies covered under the warranty will be corrected and submit to the CA for review and acceptance
  - .3 The Contractor will arrange for and correct all identified deficiencies in accordance with the schedule and advise when all deficiencies have been properly corrected;
  - .4 The Contractor is to ensure that all warranty deficiencies are properly corrected in a timely manner.

### PART 3 - EXECUTION

#### 3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 ACCESS AND EGRESS

- .1 Contractor is to design, construct, and maintain temporary "access to" and "egress from" work areas, including roadways, stairs, runways, ramps, or ladders, independent of finished surfaces and in accordance with relevant municipal, provincial, and other regulations. Protect existing structure at all times and repair any damage to structure after completion of works.
- .2 Prior to commencement of work, prepare and provide site plan indicating location and dimensions of areas to be fenced and used by Contractor, trailer locations, avenues to ingress/egress to fenced areas, vehicle turnarounds, parking, etc.
- .3

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Contract Administrator to facilitate work as stated.
- .2 Maintain existing services to adjacent buildings and provide for personnel and vehicle access.
- .3 No sanitary facilities will be available for use by Contractor's personnel. Contractor to provide his own facilities.
- .4 Parking may be available in the parking lot west of the Main Dam at the discretion of the Contract Administrator.
- .5 The limits of PCA property are shown on the reference survey provided for tender. These areas may be used for laydown at the discretion of the CA, no other areas will be available for laydown. The Contract Administrator assumes no responsibility for material and equipment stored overnight.

1.3 EXISTING SERVICES

- .1 Notify Contract Administrator and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services,

give Contract Administrator 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum.

- .3 Construct temporary barriers for both public safety and worker safety and to ensure complete separation from PCA operations at all times.
- .4 The Contractor will need to implement his Lock Out Tag Out (LOTO) procedure during the whole project.

#### 1.4 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedule - Bar (GANNT) Chart.
- .2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic, and security regulations as well as PCA's environmental orientation.
- .3 Keep within limits of work and avenues of ingress and egress.
- .4 Comply with all municipal by-laws including noise by-laws and traffic by-laws.
- .5 In-water work is permitted between July 15<sup>th</sup> and March 15<sup>th</sup> of the following calendar year in accordance with fisheries requirements.
- .6 Navigation starts on the Friday before Victoria Day weekend. The last day of navigation is the Monday of the Thanksgiving weekend.
  - .1 Work must not disrupt the maintenance period before and after each navigation season on the Trent Severn Waterway.
  - .2 The maintenance period typically lasts a few weeks before and a few weeks after the navigation season on the Trent Severn Waterway.
  - .3 Maintenance activities vary from site to site and may include work to prepare sites for navigation season or for the winter shutdown such as raising/lowering water levels, installing/removing navigation aids and carrying out minor maintenance activities. Upstream water levels at Port Severn are typically maintained year round.
  - .4 PCA to confirm planned start and end of maintenance periods and planned activities for each site during project development.
- .7 Vegetation Removal restriction is in effect from April 1 to August 31 each year.
- .8 In order to comply with the Migratory Bird Convention Act, there will be no removal of trees or other vegetation containing bird nests during the breeding bird window from April 1st to August 31st. This also applies

to the dam and lock structures and buildings with presence of Barn swallow. Mitigation could include exclusion netting placed prior to nesting season.

- .9 Construction shall be avoided in areas of turtle habitat during the turtle nesting season from May 15th to August 15th.
- .10 Restrictions during Half Load season. Construction vehicles shall be allowed to carry only half loads on municipal/public roads during this period.
- .11 No grubbing/stripping if frozen depth exceeds stripping depth.
- .12 Hours of work will be between 8:00 and 17:00 and in accordance with Municipal Bylaws.
  - .1 If there is a request to work overtime, the Contractor should obtain written exemption from the noise bylaws from both the Township of Severn and Township of Georgian Bay prior to requesting PCA approval.
  - .2 The Contractor would be required to restrict noise to 85 dB beyond the limits of PCA property from Monday to Saturday after 9 PM and all-day Sunday.
  - .3 The Contractor shall be required to name 3 competent supervisors to be approved by the CA for afterhours work. At least one of these approved supervisors must be on site when afterhours work is taking place.
  - .4 The Contractor would be responsible for all costs incurred as a result of overtime work. If CA presence is required on site by the Owner on weekends, the Contractor shall pay for the costs incurred by CA, such as but not limited to: supervision, travel, and LOA.
  - .5 Work after hours to be accurately identified on a 2 week look ahead.
  - .6 No inspections unless previously agreed to 48 hrs in advance will be available for Saturday/Sunday work.
- .13 Public safety signs intended to warn watercraft of the construction work shall be installed by May 1st in conformance with navigation requirements.
- .14 Do not block traffic on Port Severn Road North at any time. Do not block access to surrounding business and parking lots at any time.

#### 1.5 EXPLOSIVES

- .1 Do not use explosives.

1.6 FIRES

- .1 Fires and burning of rubbish or any material on site is not permitted.

1.7 ADVERTISING

- .1 No Contractor logos are permitted on any signs on the site.
- .2 No commercial or business advertising will be permitted on this project.
- .3 The Contractor is not allowed to advertise this project on any website, social media, or in publications without permission from PSPC.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of the Contract Administrator.
- .2 Prepare agenda for meetings in collaboration with the Contract Administrator in a format as provided by the CA.
- .3 Distribute written notice of each meeting 4 days in advance of meeting date to Contract Administrator.
- .4 The Contract Administrator shall preside at meetings.
- .5 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties and due dates.
- .6 Reproduce and distribute copies of minutes within three days after meetings and transmit to Contract Administrator, meeting participants and affected parties not in attendance.
- .7 Representative of Contractor, Subcontractor, and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents. Vendor must have a representative available in person from both the field operations and office operations at each meeting to speak to the work in its entirety.
- .8 Provide adequate conference call capabilities for all meetings to ensure that any person invited to a meeting but unable to attend in person but wanting to call in can hear and be heard at the meeting.
- .9 Provide physical space and make arrangements for meetings.

1.2 PRECONSTRUCTION MEETING

- .1 Within 20 days after award of Contract and in collaboration with the Contract Administrator, the CM will organize a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities. This date is to be identified on the Schedule.
- .2 Contract Administrator, Contractor, major Subcontractors, Construction Inspectors, and supervisors will be in attendance.
- .3 The Contractor shall establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

- .4 Agenda to include draft versions of the following documents that are to be provided a minimum 10 days prior to the meeting:
  - .1 Appointment of official representative of participants in the Work.
  - .2 Schedule of Work: in accordance with Section 01 32 16.
  - .3 Schedule of submission of shop drawings. Submit submittals in accordance with Section 01 33 00.
  - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Site Plan, Traffic Plan.
  - .5 Delivery schedule of materials and equipment. Identify long lead items greater than 20 working days.
  - .6 Site security in accordance with Section 01 56 00.
  - .7 Health and safety in accordance with Section 01 35 29.
  - .8 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .9 Record drawings and specifications in accordance with Sections 01 33 00 and 01 78 00.
  - .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
  - .11 Monthly progress claims, administrative procedures, photographs, hold backs.
  - .12 Appointment of inspection and testing agencies or firms.
  - .13 Insurances, transcript of policies.
  - .14 Draft Traffic Management Plan and Site Layout Plan.
  - .15 Environmental Management Plan Implementation by the Contractor
  - .16 Work Procedures by the Contractor

### 1.3 PROGRESS MEETINGS

- .1 During course of Work, schedule bi-weekly progress meetings.
- .2 Contractor's Project Manager and Superintendent, H&S Coordinator, Quality Coordinator, and Environmental Coordinator are to be in attendance.
- .3 Notify parties minimum 3 days prior to meetings.
- .4 Record minutes of meetings in an approved format provided by the CM and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .5 Agenda to include the following (at a minimum):
  - .1 Review and approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Field observations, problems, and conflicts.
  - .4 Problems which impede construction schedule.
  - .5 Review of off-site fabrication delivery schedules.

- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

## PART 1 - GENERAL

### 1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, 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, "0-day activity".
- .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 Contract Administrator to enable monitoring of project work in relation to established milestones.

### 1.2 REQUIREMENTS

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

- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.
- .5 Make allowance for obtaining of regulatory permits, other agency approvals, obtaining of additional lands for staging areas, receiving permission to temporarily relocate utilities, and establishing a waste management and disposal plan.
- .6 Activities to be cash loaded and that shall be the means for progress payment verification.
- .7 No "lag" logic is to be used.
- .8 Durations of Activities that relate to Archeological, Cultural or Environmental procedures which require acceptance by the Client shall include 15 working days for approval time.
- .9 Include minimum two (2) submissions of each submittal.
- .10 Activities are to be resource loaded
- .11 Schedule shall include all non-working periods and appropriate allowances for inclement weather.
- .12 The baseline project calendar should include at a minimum:
  - 1. All work Restriction Periods
  - 2. All statutory holidays and non-working days; and
- .13 Contractor to include for COVID-19 MOL Guidelines. No additional time will be granted to account for guidelines in place at the time of tender close including social distancing.
- .14 Schedules are to be provided in .pdf and native file format. Schedules are to be developed and updated in the latest commercially available Microsoft Project software.

### 1.3 SUBMITTALS

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

- .2 Submit to Contract Administrator within 10 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 Contract Administrator within 5 working days of receipt of acceptance of Master Plan. Approval of the progress of work in the submitted monthly schedule will be a prerequisite for submission of progress payment each month. Progress will be approved by CA prior to submission of progress payment.
- .4 No schedule shall be submitted with a completion milestone date later than the contract requirements. If at any time, it should appear to the Contractor that the actual progress of the Subcontract Work is behind schedule or is likely to become behind schedule, or if the Subcontractor has given notice of such to the Contractor, the Subcontractor shall take appropriate steps to cause the actual progress of the Subcontract Work to conform to the Schedule or minimize the resulting delay, at the Subcontractor's sole cost and expense. The Subcontractor shall produce and present to the Contractor and the Consultant a recovery plan demonstrating how the Subcontractor will achieve the recovery of the Schedule.

#### 1.4 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Contract Administrator will review and return revised schedules within 10 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

#### 1.5 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 Award;
  - .2 Shop Drawings and product data including both submission and approval periods;
  - .3 Design submission including a reasonable amount of required resubmissions;
  - .4 Permits/PCA approvals;

- .5 Mobilization and staging area preparation;
  - .6 Site surveys
  - .7 Holding points for manufacturing of equipments;
  - .8 Shop testings of equipments;
  - .9 Delivery of Primary Anchors;
  - .10 Delivery of Embedded Parts;
  - .11 Delivery of Gate Hoist and Gates;
  - .12 Installation of Embedded Parts;
  - .13 Installation of Gates;
  - .14 Installation of Hoists;
  - .15 Testing of equipments;
  - .16 Demobilization
- .3 The Following Columns must be displayed in Baseline and Progress schedule updates:
- .1 Baseline Start
  - .2 Baseline Finish
  - .3 Planned Start
  - .4 Planed Finish
  - .5 Actual Start
  - .6 Actual Finish
  - .7 Physical % Complete
  - .8 Baseline Cost
  - .9 Actual Cost
- .4 The Top-Level Work Breakdown Structure must include:
- .1 Contract Award and Milestones
  - .2 Submittals and Approvals
  - .3 Procurement
  - .4 Construction Activities
  - .5 Commissioning & Close Out
- .5 Each Detailed Progress Schedule shall record and report data and report actual completion and/or start dates for each completed or in-progress activity, activity percent-complete for in-progress activities, and forecast completion dates for all activities that are not yet complete.
- .6 If it appears that the progress schedule submitted by the Contractor no longer represents the actual sequencing and progress of the Work, the CM may instruct the Contractor to revise the progress schedule.
- .7 In order to further define (beyond the level of detail shown in the Baseline Schedule) critical portions of the Work such as facility shutdowns, the Contractor shall, if requested, develop detailed schedule fragments.
- .8 If, at any time, the Work is behind schedule with respect to the progress schedule currently in force, and if the CA believes there is a risk of the Work not being completed within the Contract Time as a result of such delay, the Contractor shall take all necessary measures to make up for such delay either by increasing staff, plant, or facilities,

or by amending its Work methods, whichever is applicable, with no change to the Contract Price.

#### 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 delays and impact with possible mitigation.
- .3 The Contractor shall provide short interval "look ahead" schedules weekly, identifying Work that has been performed during the past week and activities that are planned for the next four weeks. The short interval schedule shall be consistent with the progress schedule currently in force.
  - .1 Submit the look-ahead schedule in PDF format via email on a weekly basis.
  - .2 The Look-Ahead Schedules shall generally reflect the work associated with the Detailed Progress Schedule. The activities in the Look-Ahead Schedules shall be identified by the same number coding as the Detailed Progress Schedule as revised as necessary.

#### 1.7 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings specified in Section 01 31 19, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

#### 1.8 PROGRESS PAYMENT REQUEST RELEASE

- .1 Project schedule reporting as described above is condition for Progress Payment release by the Contract Administrator.
- .2 Request for Payment must be submitted with updated schedule.

#### PART 2 - PRODUCTS

## 2.1 NOT USED

- .1 Not Used.

## PART 3 - EXECUTION

### 3.1 Mobilization

- .1 The Contractor will not be able to mobilize to site unless a baseline schedule has been approved by the CA. The Contractor will be responsible for all costs associated with the delay in mobilization as a result of not having an approved baseline schedule.

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Contractor is to review the contract documents in its entirety and create a shop drawing submittal schedule. Submit a shop drawings submittal schedule after 10- days of notice to proceed.
- .2 Submit to Contract Administrator 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.
- .3 Do not proceed with Work affected by submittal until review is complete.
- .4 Present shop drawings and product data in SI Metric units.
- .5 Where items or information is not produced in SI Metric units converted values are acceptable.
- .6 Review submittals prior to submission to Contract Administrator. 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 the specific project will be returned without being examined and considered rejected.
- .7 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work are co-ordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .11 Keep one reviewed hardcopy of each submission on site.
- .12 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel, MS Project and AutoCAD dwg files on USB compatible with PSPC encryption requirements or through email or alternate electronic file sharing service such as ftp, as

directed by Contract Administrator.

- .13 Submit pre-construction survey report and photographs prior to commencement of demolition or site preparation work. Original photographs shall be included on a USB drive and each photograph shall include a date stamp and shall be at least 12 Megapixels (4000x3000 pixels) in size. File format for photographs on USB drive to be jpeg.
- .14 The Contractor shall submit to Contract Administrator for review and acceptance relevant drawings, calculation briefs, Environmental Management Plan (EMP), method statements, equipment list, product data sheet including SDS sheets, construction schedule, installation procedures, shop testing procedures, commissioning procedures and shop drawings as indicated in these Specifications.
- .15 EMP at a minimum, is to be reviewed and accepted by PCA as a condition of permit issue.
- .16 When required or applicable, drawings submitted shall bear the stamp and signature of a qualified professional engineer registered in the province of Ontario.
- .17 Submit Daily Job Logs (DJL) in a format to be approved by the CA.
- .18 Submit Weekly Reports in a format to be approved by the CA.
- .19 Submit work procedures as required by the CA.

## 1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawing" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of portions of work, which are specific to project requirements.
- .2 Submit drawings stamped and signed by Professional Engineer registered or licensed in Province of Ontario, Canada.
- .3 Maximum sheet size: 850 X 1050 mm.
- .4 Submit shop drawings as follows:
  - .1 Electronic Format in PDF, JPEG or Word, transmitted on either a USB Stick, on CD/DVD disk, by email or acceptable file sharing service.
- .5 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under

which adjacent items will be supplied and installed. Indicate cross references to design drawings, specifications and/or applicable portions of Contract Documents.

- .6 Allow ten (10) working days for Contract Administrator's review of each submission.
  - .1 Allow 15 working days for submittals related to Archaeological, Cultural, or Environmental procedures which require acceptance by Client Department and co-ordinated through Contract Administrator.
- .7 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of work, state such in writing to Contract Administrator for review, prior to proceeding with work.
- .8 Co-ordinate, each submission, with requirements of work and Contract documents. Individual submissions will not be reviewed until all related and relevant information is available.
- .9 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When re-submitting, notify Contract Administrator in writing of revisions other than those requested.
- .10 Accompany submissions with transmittal letter containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .11 Submissions shall include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents. Note: submissions without a signed Contractor's stamp will not be reviewed and will be returned to the Contractor for re-submission with the required signed stamp.
  - .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 Relationship to adjacent work.
- .12 After Contract Administrator's review, distribute copies to appropriate parties.
- .13 Delete information not applicable to project.
- .14 Supplement standard information to provide details applicable to project.
- .15 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of work may proceed. If shop drawings are rejected, noted copies 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.
- .16 The review of shop drawings by Public Services and Procurement Canada (PSPC) is for the sole purpose of ascertaining conformance with general concepts.
- .1 This review shall not mean that PSPC 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.
- .17 At a minimum, submit shop drawings for the following work:
- .1 Embedded Parts;
  - .2 Gate Hoist (including machinery bridge);
  - .3 Gates;
  - .4 Scaffolding, handrails and metal works;
- .18 Submit a shop drawing log indication of all items to be submitted within ten (10) working days of contract award.
- .19 During site installation phase:  
Submit Daily Job Logs (DJL) in a format to be approved by the CA. DJL to include at a minimum:
- .1 Daily Weather Conditions
  - .2 Extended Weather Forecast
  - .3 Safety / Environmental / Permitting
  - .4 Construction Progress & Site Issues
  - .5 Construction photos - dated & c/w Description of photo taken

- .6 Staff & Equipment on Site in use
  - .7 Water Quality Monitoring
  - .8 Quality;
  - .9 Site health and safety performance;
- .20 During fabrication phase:
- .1 Submit Weekly Reports in a format to be approved by the CA to include a summary of the DJL activities
  - .2 Submit written work procedures for shop fabrication and site installation as required by the CA.

### 1.3 SAMPLES

- .1 Sample: examples of materials, equipment, quality, finishes, workmanship.
- .2 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .3 Where colour, pattern or texture is criterion, submit full range of samples.
- .4 Reviewed and accepted samples will become standard of workmanship and material against which installed work will be verified.

### 1.4 PRODUCT DATA

- .1 Product data: manufacturers catalogue sheets, brochures, literature, performance charts and diagrams used to illustrate standard manufactured products.
- .2 Supplement standard information to provide details applicable to project.
- .3 Cross-reference product data information to applicable sections of Contract Documents.
- .4 Submit, at a minimum, product data for the following items:
  - .1 Concrete mix,
  - .2 Anchor grout,
- .5 Submit copies of all MSDS Sheets

### 1.5 CERTIFICATES AND TRANSCRIPTS

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

- .2 Submit transcription of insurance immediately after award of Contract.
- .3 Submit Form 1000S.
- .4 Submit Certificate of Insurance.

1.4 FEES, PERMITS AND CERTIFICATES

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates and permits required.
- .3 Furnish certificates and permits.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 INTRODUCTION

- .1 Comply with Ontario Occupational Health and Safety Act.
- .2 Develop written Site-Specific Health and Safety Plan based on hazard assessment prior to commencing any site work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .3 Relief from or substitution from any portion or provision of minimum Health and Safety Guidelines specified herein or reviewed site-specific Health and Safety Plan must be submitted to the Contract Administrator in writing. Contract Administrator will respond in writing, either accepting or requesting improvements.
- .4 Contractor to include site specific plan for COVID-19 MOL Guidelines.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA): Canada
  - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 National Building Code 2015 (NBC):
  - .1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .3 National Fire Code 2015 (NFC):
  - .1 NFC 2015, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
- .4 Province of Ontario:
  - .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
  - .2 O. Reg. 490/09, Designated Substances.
  - .3 Workplace Safety and Insurance Act, 1997.
  - .4 Municipal statutes and authorities.
- .5 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](http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316).

### 1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit site-specific Health and Safety Plan: Within 10 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  - .1 Results of site specific safety hazard assessment.
  - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
  - .3 Measures and controls to be implemented to address identified safety hazards and risks.
  - .4 Contractor's and Sub-contractors' Safety Communication Plan.
  - .5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Emergency Response requirements and procedures provided by Contract Administrator.
  - .6 Plan must contain at a minimum:
    - .1 Spill plan,
    - .2 Noise and vibration plan,
    - .3 Traffic Control Plan,
    - .4 Extreme Flood Event Plan,
    - .5 Safe Navigation Plan,
    - .6 Worker Rescue Plan
- .3 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.3 prior to commencement of work. Deliver two copies of the Fire Safety Plan to the Contract Administrator before commencing work.
- .4 Contractor's and Sub-contractors' Safety Communication Plan.
- .5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with PSPC's Emergency Response requirements and procedures provided by Contract Administrator.
- .6 Contract Administrator will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor. Revise plan as appropriate and resubmit plan to Contract Administrator within 5 days after receipt of comments from Contract Administrator.
- .7 Contract Administrator'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.
- .8 Submit names of personnel and alternates responsible for site safety and health.

- .9 Submit records of Contractor's Health and Safety meetings when requested.
- .10 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Contract Administrator.
- .11 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
- .12 Submit copies of incident and accident reports within 24 hours of occurrence.
- .13 Submit Material Safety Data Sheets (MSDS) for all products used on site.
- .14 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report for Province of Ontario.
- .15 Float plan (including boat safety plan) for all works to be completed from a marine vessel.
- .16 Safe Navigation Plan shall detail all signs and markers required to warn boat traffic of the Construction Works.

#### 1.4 FILING OF NOTICE

- .1 The Contractor will file the Notice of Project with Provincial authorities prior to commencement of Work.

#### 1.5 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.
- .2 Provide minutes of weekly safety/toolbox talks.
- .3 Provide Job Hazard Assessments.

#### 1.6 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Contract Administrator prior to commencement of Work.
  - .1 Co-ordinate with other meeting specified in Section 01 31 19.

### 1.7 REGULATORY REQUIREMENTS

- .1 Comply with the Acts and regulations of the Province of Ontario.
- .2 Comply with specified standards and regulations to ensure safe operations at site.

### 1.8 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
  - .1 Silica in concrete.
  - .2 Cold water.
  - .3 Benzene in fuel oil, paints and adhesives (for new materials).
  - .4 Arsenic and acrylonitrile in adhesives.
  - .5 Fresh concrete, concrete admixtures and bonding agents.
- .2 Hazards on-site include but are not limited to:
  - .1 Working around moving equipment.
  - .2 Working near excavations and heavy machinery.
  - .3 Working near water.
  - .4 Icy surfaces.
  - .5 Confined spaces in straight culverts and feeding pipes.
  - .6 Working at heights.
  - .7 Working during cold and adverse weather conditions including extreme temperatures.
  - .8 There is no system/anchor point in place for the workers to tie themselves off while working on the dams.
  - .9 Remote location, away from emergency services/hospital.
- .3 A Designated Substance and Hazardous Materials Survey Report - Port Severn Main Dam and Lock 45 has been provided. The Contractor is to familiarize himself with the documents and make all precautions as required to execute the work

### 1.9 GENERAL REQUIREMENTS

- .1 Develop one written site-specific Health and Safety Plan, for work on land and in-water work, 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 Contract Administrator 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 Contract Administrator in writing.

#### 1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.
- .2 Contractor to include for COVID-19 MOL Guidelines.

#### 1.11 RESPONSIBILITY

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

#### 1.12 UNFORSEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Contract Administrator verbally and in writing.
- .2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

#### 1.13 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have site related working experience specific to activities associated with heavy machinery, demolition, soil and concrete excavation, backfilling, concrete forming and placement etc..
  - .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.
- .6 Be responsible for competency/training cards.

#### 1.14 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 Contract Administrator.
  - .1 Contractor's Safety Policy.
  - .2 Constructor's Name.
  - .3 Notice of Project.
  - .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
  - .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 first aider on duty.
  - .12 WSIB "In Case of Injury At Work" poster.
  - .13 Location of toilet and cleanup facilities.

#### 1.15 CORRECTION OF NON-COMPLIANCE

- .1 Address immediately health and safety non-compliance issues identified by authority having jurisdiction or by Contract Administrator.
- .2 Provide Contract Administrator with written report of action taken to correct non-compliance of health and safety issues identified within 2 days of request.
- .3 Contract Administrator may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from Contract Administrator.

1.17 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 Competent Supervisor to stop or start Work when, at Competent Supervisor's discretion, it is necessary or advisable for reasons of health or safety. Contract Administrator may also stop Work for health and safety considerations.

1.18 EQUIPMENT LOCK-OUT/TAG-OUT

- .1 The Contractor shall coordinate and comply with Parks Canada/PSPC lock-out/tag-out procedures for the equipment at the site. The more stringent of the Provincial Safety Regulation shall take precedence. The Parks Canada/PSPC procedure involves a multi lock system.
- .2 Lock-out/tag-out procedures are to be followed when working with PSPC on existing or new installations.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 DESCRIPTION

- .1 This Section describes requirements for protection of the environment that apply to Work. These requirements apply to all Sections of this Specification, without limiting the conditions and approvals imposed by statute.
- .2 Control work to provide effective environmental, waterway, and fish habitat protection. Construction Inspector and Parks Canada Agency (PCA) Environmental Officer will monitor environmental protection measures and will identify whenever such protection is found to be ineffective. Contractor is encouraged to improve the protective measures throughout the work. Change protective measures or work procedures as directed by Contract Administrator to ensure environmental, waterway, and fish habitat protection.

1.2 MEASUREMENT

- .1 No measurement of Environmental procedures.

1.3 RELATED SECTIONS

- .1 Not Used.

1.4 REFERENCES

- .1 Ontario Provincial Standard Specification (OPSS):
  - .1 OPSS 506 (Nov 2011) - Construction Specification for Dust Suppressants.
  - .2 OPSS 805 (Nov 2010) - Construction Specification for Temporary Erosion and Sediment Control Measures.
  - .3 OPSS 1004 (Nov 2006) - Material Specification for Aggregates - Miscellaneous.
  - .4 OPSS 1860 (Apr 2012) - Material Specification for Geotextiles.
  - .5 OPSS 2501 (Nov 2011) - Material Specification for Calcium Chloride and Calcium Chloride Solution.
  - .6 OPSS 2053 (Nov 2011) - Material Specification for Magnesium Chloride Solid and Magnesium Chloride Solution.
- .2 Ontario Water Resources Act R.R.O. 1990, Regulation 903, Wells Amended. O.Reg. 468/10.

- .3 Greater Golden Horseshoe Area Conservation Authorities, Erosion and Sediment Control Guidelines for Urban Construction, December 2006.
- .4 Ontario Regulation 214/01, Compressed Gas Ontario Regulation 220/01 Boilers and Pressure Vessels. Technical Standards and Safety Act, 2000.
- .5 Federal Halocarbon Regulations 2003.
- .6 Canadian Environmental Protection Act 1999.
- .7 Environmental Standards and Guidelines Document for Ontario Waterways (July 2017).
- .8 Trent-Severn Waterway Sediment Assessment in Support of Construction Activities Report.

#### 1.5 DEFINITIONS

- .1 Deleterious Material: substance that, if added to a waterway, could degrade water quality or impact fish, fish habitats, and aquatic wildlife. This includes, but is not limited to:
  - .1 Concrete dust.
  - .2 Soils (clay, silt, sand).
  - .3 Oil, diesel, or gasoline.
  - .4 Chipped or fresh concrete and admixtures.
  - .5 Alkali water resulting from fresh concrete or cementitious grout.
  - .6 Lead.
  - .7 Salt.
  - .8 Solvents.
  - .9 Grout.
  - .10 Paint.
  - .11 Contaminated sediment deposits on the lake bed.
- .2 Dripline: location on ground surface directly beneath a theoretical line described by tips of outermost branches of trees.
- .3 Barrier: fence consisting of approved material, supported by steel posts and being a minimum of 1.2 m high, without breaks or unsupported sections.
- .4 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .5 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

- .6 Reportable Spill: as defined in the Transportation of Dangerous Goods Act and the Classification and Exemption of Spills Regulation (O. Reg. 675/98).

#### 1.6 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - SUBMITTAL PROCEDURES.
- .2 Submit Environmental Management Plan (EMP) to Contract Administrator for submission to PCA Environmental Authority. The contractor is not permitted to begin work until a permit has been granted by PCA Environmental Authority. The permit shall not be granted until the EMP is accepted.
  - .1 Environmental Management Plan should be prepared by qualified environmental professionals.
  - .2 Environmental Management Plan to detail frequency of monitoring and high-risk construction activities requiring environmental professional onsite.
  - .3 Environmental Management Plan to present comprehensive overview of known or potential environmental issues to be addressed during construction.
  - .4 Environmental Management Plan to be prepared in accordance with requirements of Federal, Provincial, and Municipal laws and regulations.
  - .5 Update EMP specifications in accordance with PCA Environmental Standards and Guidelines (ESG) and the Detailed Impact Analysis (DIA).
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

- .4 Environmental Management Plan to include:
  - .1 Names of Responsible Persons: Persons responsible for ensuring adherence to Environmental Management Plan, including CA contacts as identified by the CA.
  - .2 Names of Waste Handlers: Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
  - .3 Names of Instructors: Names and qualifications of persons responsible for training site personnel.
  - .4 Training Program: Description of environmental protection personnel training program.
  - .5 Erosion, Sediment, and Dust Control Plan: Plan which identifies type and location of erosion, sediment, and dust controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion, sediment, and dust control plan, Federal, Provincial, and Municipal laws and regulations.
  - .6 Work Area Plan: showing proposed activities in each portion of work area and identifying areas of limited use or non-use.
    - .1 Work area plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
    - .2 Identify areas for storage of hazardous materials, cleaning hazardous materials, refueling, fuel storage, and other critical areas.
  - .7 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
  - .8 Non-Hazardous Solid Waste Disposal Plan: identifying methods and locations for solid waste disposal including clearing debris.
  - .9 Air pollution Control Plan: detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and are contained on project site.
  - .10 Contaminant Prevention Plan: that identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
  - .11 Waste Water Management Plan that identifies methods and procedures for management and discharge of waste waters which are directly derived from construction activities, such as dewatering of lock, concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
  - .12 Historical, Archaeological, and Cultural Resources that defines procedures for identifying and protecting historical, archaeological, and cultural resources.
  - .13 Water Quality Testing Reports: Test water quality before start of work and during work and immediately after a spill or change in water quality is observed.

- .14 Noise Control Plan: including notifying local residents in advance of potential disruption caused noise inducing activities. There will be no direct communication with the public and all notices to the public shall be undertaken by PCA. Noise exceedances shall be forecasted and requested in advance through the Contract Administrator.
- .15 Waste Disposal Plan identifying methods and procedures for management and disposal of materials directly derived from construction activities, such as disturbed contaminated sediment, concrete waste, construction materials and or hazardous materials.
- .16 The EMP shall be considered a living document that may be amended throughout the construction period to account for changing conditions or revisions to the work plan.
- .5 Submit a Work Plan that outlines how the task will be completed and what mitigation measures will be in place for work activities not clearly covered by the mitigation measures outlined in the EMP.
- .6 The contractor is required to adhere to mitigating measures that are located in the associated DIA tendering documents. If there any changes to project plans and/or scheduling or site conditions outside the assessed Detailed Impact Analysis (DIA) reports, Contractor is to inform Contract Administrator.
  - .1 Changes not addressed by DIA will require additional mitigation measures to be approved by Contract Administrator.
- .7 Meet or exceed the requirements of all environmental legislation and regulations, including all amendments up to the project date provided that in any case of conflict or discrepancy the more stringent requirements shall apply.
- .8 Product Data: Submit manufacturer's instructions, printed product literature, data sheets and WHMIS MSDS sheets.

#### 1.7 EXPLOSIVES

- .1 Use of explosives is not permitted.

#### 1.8 FIRES

- .1 Fires and burning of rubbish on site is not permitted.

1.9 TURBIDITY CONTROL, DEWATERING, AND DRAINAGE

- .1 Refer to Section 35 49 25.
- .2 Control turbidity of water released during work. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with ESCP, Federal, Provincial, and Municipal regulations.
- .3 Mechanical filtration of turbid water is also acceptable.
- .4 Provide sediment control during any in-water work to control turbidity levels. Controls to be implemented prior to commencing work and to remain in place until all suspended sediments have settled.
- .5 In event of significant sedimentation or escape of debris caused by construction activities, contractor to immediately stop work, notify Contract Administrator, and take appropriate measures to confine work and modify Environmental Plan including installation of new environmental measures or additional turbidity curtains.
- .6 Control disposal or runoff of water containing other harmful substances in accordance with local authority requirements.
- .7 Sediment, debris, and erosion control measures to be inspected daily to ensure that they are functioning properly and are maintained and upgraded as required.
- .8 Sediment, debris, and erosion control measures to be left in place until disturbed areas within work area have been stabilized and sediments in water have settled. Removal permitted only after written approval from Contract Administrator.
- .9 Water containing a high level of sediment will be treated by discharging to settling basins or sediment traps prior to release to streams. Water quality downstream of construction activities and turbidity curtain to not exceed recommended DFO and CCME guidelines on water quality for protection of aquatic life.
- .10 Discharge of pumped water must be a manner that does not cause additional erosion.
- .11 Filter material will consider the grain size characteristics of the sediment and shall be designed around the principals of maintaining sufficient hydraulic flow and prevention of particle movement through the material.
- .12 In-water work shall be performed in a manner that minimizes the disturbance of the watercourse bottom and dispersion of sediment.
- .13 Monitor water quality for unacceptable suspended sediment levels during

in water activities.

- .14 Flow dissipaters and/or filter bags, or equivalent, shall be placed at water discharge points to prevent erosion and sediment release.
- .15 If elevated turbidity beyond 8 NTU from background levels for a short-term exposure (e.g., 24 hr. period) is observed Parks Canada will assess potential impact to the aquatic environment. A determination will be made by Parks Canada if additional mitigation measures are required.
- .16 Turbidity at point of discharge less than 8 NTU above background (whichever is less). Exceeding this turbidity level immediately triggers a stop work event. Additional water quality testing is required at 14 NTU and greater as recommended in the Trent-Severn Waterway Sediment Assessment in Support of Construction Activities Report.

#### 1.10 WORK ADJACENT TO WATERWAYS

- .1 Do not release deleterious materials into waterway.
- .2 Do not use salt as de-icer or sand for traction within 30 m of Little Lake or Georgian Bay.
  - .1 Where ice is safety concern, use environmentally acceptable de-icing or traction materials accepted by Contract Administrator.
  - .2 No de-icer or traction materials allowed to enter waterway.
- .3 Ensure equipment and temporary access structures such as scaffolding placed in waterbodies are free of earth material, and excess, loose or leaking fuel, lubricants, coolant, and other deleterious material that could enter waterway.
- .4 Do not dump excavated fill, waste material, or debris in waterways.
- .5 Stockpiles of excavated or fill materials to be stored, stabilized and covered, no closer than 30 m from waterway. Runoff from excavated or fill material to be contained from entering waterway.
- .6 Paint metal and wood surfaces in an environmentally safe way away from the waterway and take appropriate preventative and corrective actions.

#### 1.11 WILDLIFE PROTECTION

- .1 Do not use Synthetic Plastic Erosion Control Mats, including types with back netting, to prevent entrapment hazard for turtles.

- .2 Do not use sediment fence with reinforcing mesh, to prevent entanglement of reptiles in mesh.

#### 1.12 AQUATIC LIFE PROTECTION

- .1 Should suspected species at risk, specifically snakes or turtles, be encountered during project staging, construction, or demobilization, contact Contract Administrator immediately.
- .2 Report invasive species found within project area to Contract Administrator (who will contact PCA Environmental Authority).
- .3 Invasive species to be euthanized rather than returned to water system.

#### 1.13 SPECIES AT RISK

- .1 Potential species at risk in project areas include: Eastern Musk Turtle, Snapping Turtle, Northern Map Turtle, Midland Painted Turtle, Eastern Foxsnake, Massasauga Rattlesnake, Eastern Milksnake, Northern Ribbonsnake, Eastern Hognose Snake, Lake Sturgeon, and Barn Swallow.
- .2 Provide training to all employees before beginning work on site on identifying species at risk and procedures to follow if species at risk is encountered.
- .3 Stop work and contact Contract Administrator and PCA Environmental Officer on how to proceed if a species at risk does not or cannot leave site.
- .4 Perform daily site sweeps before beginning work to ensure that there are no turtles in work area.
- .5 Minimize disturbed areas and clearly mark Work space.
- .6 If a SAR is observed or encountered, the species must not be harmed or harassed. Stand back and allow the animal to leave the site.
- .7 Temporary reptile exclusion fencing, such as polythene/ woven geotextile secured with timber stakes, or material of a similar nature/function, shall be installed to prevent turtles from entering the construction area. Exclusion fencing should also be installed completely around stockpiled material (wood chips, gravel, earth, etc.) to prevent turtle nesting in the project area. For guidance on how to plan and install exclusion fencing, refer to the document titled

Species at Risk Branch, Best Practices Technical Note, Reptile and Amphibian Fencing, Ver. 1.1, developed by the Ontario Ministry of Natural Resources and Forestry:  
[http://files.ontario.ca/environment-and-energy/species-at-risk/mnr\\_sar\\_tx\\_rptl\\_amp\\_fnc\\_en.pdf](http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_tx_rptl_amp_fnc_en.pdf)

- .8 Park on roads or disturbed area only.
- .9 Drivers to watch for wildlife, especially snakes and turtles, maintain reduced driving speeds on the work site.

#### 1.14 INVASIVE SPECIES

- .1 Clean mud, dirt, and vegetation off clothing and footwear before entering work site and before leaving work site.
- .9 All equipment shall be thoroughly cleaned prior to coming to the site. Any machinery that appears to have not been cleaned will not be permitted on site and will be documented in the daily report. For additional information or guidance on how to properly clean equipment, see the Clean Equipment Protocol for Industry developed by the Ontario Invasive Plant Council and found here:  
[http://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/Clean-Equipment-Protocol\\_June2016\\_D3\\_WEB-1.pdf](http://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/Clean-Equipment-Protocol_June2016_D3_WEB-1.pdf)
- .10 Any equipment or vehicles which are to be used in water, should be thoroughly cleaned before and after use of any visible mud, vegetation, mussels, etc.:
  - .1 Vessels/equipment should be drained of standing water.
  - .2 Vessels/equipment should ideally be cleaned with hot water (>50°C) at high pressure water (>250 psi).
  - .3 Vessels/equipment should be dried for 2 - 7 days in sunlight before transported between waterbodies.
  - .4 Cleaning of vessels/equipment should be conducted away from waterbodies at a recommended distance of at least 30 m from the shoreline.
- .11 If removal of invasive species occurs, individuals will be disposed of appropriately, offsite to ensure no further propagation.

#### 1.15 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

#### 1.16 EROSION, SEDIMENT, AND DUST PROTECTION

- .1 Prior to starting work that will create dust or debris, such as improvements to access, concrete sawing, removal, excavation, or backfilling, install effective mitigation techniques for erosion, sediment, dust, and debris control in accordance with Federal, Provincial, and Municipal laws and regulations. Maintain these protective measures at all times, including during shut down periods.
  - .1 Choose appropriate controls based on particle size present in sediment.
- .2 Provide one metre high sediment fence barrier in areas where, due to construction activities, sediment, or debris may enter the waterway. This includes, but is not limited to, sediment barrier installed around staging and work areas, and on waterway bed (or ice surface) parallel to waterway wing walls. Install turbidity curtain approximately 2 m to 3 m from wall for re-pointing work only.
- .3 Maintain standby supply of pre-fabricated sediment fence barrier, or an equivalent ready-to-install sediment control device.
- .4 Maintain effective surface drainage and direct runoff away from work areas and into adequately vegetated areas.
- .5 Excavation to cease during periods of heavy rainfall, unless runoff is contained from entering waterway.
- .6 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- .7 Sediment and erosion control measures shall be implemented prior to work and maintained during the work phase, to prevent entry of sediment into the water where site access or other activities cause exposed soil. The following principles should be considered:
  - .1 Diversions to limit run-on water;
  - .2 Reduction of erosional forces by surface water velocity reduction;
  - .3 Reduction of sediment development through sediment collection or anchoring;
  - .4 Sedimentation of mobilized sediments;
  - .5 Filtration of sediment-carrying flows;
  - .6 Collection of captured or contained sediments;
  - .7 Treatment of pH (hydronium and hydroxide).

- .8 Environmental protection measures shall be checked after each extreme weather event.
- .9 Upon completion of the work all debris shall be completely removed and the area restored to its original state or better. Repair all damages to property due to project activities.
- .10 Sediment control measures and exclusion fencing must be removed in a way that prevents the escape or re-suspension of sediments.
- .11 Avoid activities that could lead to erosion during excessively wet weather conditions; monitor forecasts for heavy rainfall watches and warnings.

#### 1.18 OPERATION AND MAINTENANCE OF EQUIPMENT

- .1 Maintain machinery and equipment to be clean, free of leaks, and in optimal working condition.
  - .1 Ensure measures are in place to minimize impact of spills.
- .2 Provide and use drip trays under all fuel - powered equipment and machinery to prevent discharge of oil, grease, antifreeze, or other materials into ground or waterways including on the access bridge.
- .3 Equipment and heavy machinery to meet or exceed applicable emission requirements.
- .4 Any vehicle or equipment entering waterway to be free of fluid leaks and externally degraded.
- .5 Clean equipment prior to entering waterway in designated area at least 30 m from waterway.
- .6 Do not operate heavy equipment in waterway, except when operated from barge or after dewatering is completed.
- .7 Operate machinery from stable location.
- .8 Only allow working end of machinery to directly enter water. Working end of machinery to be clean and free of leaks.
  - .1 Do not leave equipment in water during breaks.
- .9 Leave machinery running only while in actual use, except where extreme temperatures prohibit shutting machinery down.
- .10 Designate a re-fueling depot with spill management equipment in place.
- .11 Vehicle and equipment maintenance and refueling to be conducted over impermeable/absorptive material situated at a designated area that

is located at least 30 m away from nearest waterway.

- .1 If 30 m is not possible area should be reviewed by Contract Administrator.
- .12 Store oils, lubricants, fuels, and chemicals in secure areas on impermeable pads.
- .13 Fuel heaters are not permitted within 30 m of the waterway (except propane-fueled heaters that are permitted within 30 m provided the equipment is being used as per the manufacturer's specifications). When using fuel heaters more than 30 m away from a waterway, a large drip pan shall be used to contain possible leakage from heater or refueling operations. Absorptive material shall be placed at bottom of drip pan for added measure.
- .14 All materials and equipment used for the purpose of site preparation and project completion shall be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum productions, debris etc.) from entering the water.
- .15 Any stockpiled materials, or concrete debris shall be stored and stabilized a safe distance away from any watercourse, drainage course or swales to prevent erosion and subsequent entry into the waterway OR removed from the site, in accordance with all federal, municipal and provincial regulations.
- .16 There shall be no discharge of chemicals and cleaning agents in or near aquatic habitats; all such substances shall be disposed of at a facility licensed to receive them.
- .17 Vehicles and equipment shall not be stored in dewatered areas or on the access bridge when not in use.

#### 1.19 REMOVED MATERIALS

- .1 Unless otherwise specified, materials designated for removal become Contractor's property and removed from site.
- .2 Contaminated sediment that is removed shall be disposed of at a landfill that accepts contaminates. Contractor is responsible for any testing required by the landfill for accepting contaminated material.

#### 1.20 HAZARDOUS MATERIALS

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

- .2 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.
- .3 Store Hazardous Materials in secure areas on impermeable pads, provide berms if necessary.

#### 1.21 CLEAN UP

- .1 Clean up work area continuously as work progresses.
- .2 At end of each work period, and more often if ordered by Contract Administrator, remove debris from site, neatly stack material for use, and clean up generally.
- .3 Permit no amount of debris, trash, or garbage to accumulate on-site.
- .4 Do not bury rubbish on site.
- .5 Separate and recycle materials that can be recycled.
- .6 Dispose of waste or volatile materials, such as mineral spirits, oil, or paint thinner by taking them to special designated waste facility. Do not dump these into waterways, storm, or sanitary sewers.
- .7 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .8 Spills:
  - .1 Have environmental emergency response plan in place, spill kit, and other materials readily available on-site to respond quickly if spills occur.
    - .1 Spill kit to be maintained on site.
    - .2 Contractor to ensure adequate additional resources available
  - .2 Report spills immediately to Contract Administrator (who will contact PCA Environmental Authority) and Ontario Ministry of Environment Spills Action Centre (Telephone No. 1-800-268-6060).
  - .3 Secure source of spill to stop flow of spill and isolate area of spill.
  - .4 Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material, or absorbent pads.
  - .5 Clean-up, remove, and dispose of contaminated materials in accordance with MSDS or as directed by Ontario Ministry of Environment.
  - .6 Be responsible for costs of cleaning up spills to satisfaction

- of Contract Administrator.
- .7 Remediation shall be conducted immediately to contain and clean up in accordance with provincial regulatory requirements AND to the satisfaction of Parks Canada; documentation of remediation, testing and results shall be provided to Parks Canada.
  - .9 Remove scaffolding, temporary protection, surplus materials, tools, plant, rubbish, and debris and dispose of them in an approved manner off-site at following times:
    - .1 At completion date of Work for all other areas.
  - .10 Remove debris on bed and restore area to original state upon completion of Work.
  - .11 Clean areas under contract to condition at least equal to that previously existing and to approval of Contract Administrator.
  - .12 Tools, equipment, temporary structures, used or maintained for purpose of this project must be removed from site after completion of project.

#### 1.22 CLEANING OF CONCRETE EQUIPMENT

- .1 Contractor to designate cleaning area for equipment and tools to limit water use and control runoff to the approval of the CA
- .2 Cleaning area to be at least 30 m from waterway to prevent contamination.
- .3 Contractor shall provide a settling pond for area where equipment is to be cleaned where no safe cleaning area is available.
- .4 Alkaline water, such as concrete wash water, shall be collected and disposed off-site in accordance with Federal, Provincial, and local authority requirements.
- .5 Use only trigger operated spray nozzles for water hoses.
- .6 Wash equipment away from water and provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment.

#### 1.23 DISPOSAL OF WASTE MATERIALS

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

- .2 Obtain and submit Waste Generator Numbers, permits, manifests, and other paperwork necessary to comply.
- .3 Recyclable material and waste shall be removed from site in accordance with all federal, provincial and municipal regulations to licensed disposal facilities.
- .4 Waste generated will be disposed according to regulations (i.e., O. Reg. 102/94 and O. Reg. 558/00, R.R.O. 1990, 347).

#### 1.24 CONCRETE AND GROUTING ACTIVITIES

- .1 Maintain isolation of all cast-in-place concrete and grouting from water for a minimum of 48 hours if ambient air temperature is above 0 °C and for a minimum of 72 hours if ambient air temperature is below 0 °C or until significantly cured with pH reaching neutral levels.
- .2 Ensure use of concrete, sealants, and other compounds in accordance with appropriate Product Technical Data Sheet.
- .3 Ensure that all works involving the use of concrete, cement, mortars, and other Portland cement or lime-containing construction materials (concrete) will not deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse.
- .4 All debris as a result of concrete work including unused aggregate/concrete rubble shall be completely removed and area restored to original state upon completion of work.
- .5 Place concrete debris into watertight container daily, or more frequently as directed.
- .6 Isolate all work from waterway.
- .7 Direct concrete wash water to a collection and treat to effectively remove all suspended solids, dissipate velocity and prevent deleterious substances from entering waterway.
- .8 In event of a release of concrete or grout notify Ontario Spill Action Center and Contract Administrator (who will notify PCA Environmental Authority) and remediate immediately to contain and clean up in accordance with provincial regulatory requirements and to the satisfaction of Parks Canada.
  - .1 Document remediation, testing, results to be submitted to Contract Administrator and PCA Environmental Officer.
- .9 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.

- .10 Control turbidity of all water released to watercourse during work.
- .11 In the event of sediment accumulation or turbidity caused by construction activity, contractor shall stop all work and install additional silt barriers as necessary to ensure watercourse is protected.
- .12 Additional Environmental Mitigation Measures For Placement Of Tremie Concrete:
  - .1 Ensure concrete forms are tight and no flow is occurring.
  - .2 Isolate area with curtain or impermeable material specified for concrete particulates; ensure fish exclusion is followed.
  - .3 Isolated area should be the minimum size required to complete task.
  - .4 For tremie pours, CO<sub>2</sub> 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.
  - .5 Workers shall be trained in the use of the system.
  - .6 Use of neutralizing acids is not permitted.
  - .7 pH monitoring conducted inside and outside the containment area.
- .13 Measures must be taken to prevent the incidence of concrete or concrete leachate from entering the watercourse.

#### 1.25 AIR QUALITY AND NOISE CONTROL

- .1 Minimize noise levels from construction activities by using proper muffling devices, in addition to appropriate timing and location of these activities to reduce or minimize effect of noise on nearby residents, recreationists, and wildlife.
- .2 On- site vehicles to have a Drive Clean Emissions Report in accordance with O. Reg. 361/98: Motor Vehicles under the Environmental Protection Act, R.S.O.
  - .1 Contract Administrator or PCA Environmental Officers may stop a vehicle if they believe vehicle is emitting excessive exhaust smoke or suspect emission control equipment has been tampered with.
- .3 Keep a record of complaints and issues to monitor and mitigate public complaints.
  - .1 Contractor to address issues that arise.

- .4 Comply with Municipal Noise By-Laws.
- .5 Notify public of planned activities that may cause disturbances and schedule them to avoid sensitive time periods.
- .6 Minimize idling of construction equipment and machinery.
- .7 Use well-maintained heavy equipment and machinery, preferably fitted with fully functional emission control systems/muffler/exhaust baffles, engine covers, etc.
- .8 Employ best practices for control of dust during concrete cutting and removal operations.

#### 1.26 WATER QUALITY

- .1 Snow containing salt or sand may not be dumped or allowed to melt into waterway.
- .2 Water quality to be maintained in accordance with Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life. Observe recommendations of Trent-Severn Waterway Sediment Assessment in Support of Construction Activities Report.
- .3 Monitor water quality for unacceptable levels of suspended sediments. Demonstrate that the water is not carrying contaminants/chemicals stirred up by the work and is safe before being discharged into the lake.
- .4 Salt and other road chemicals should be properly stored in designated areas only, preferably in dry sheds to prevent infiltration of leachate to the water table and surface runoff.
- .5 Accumulated snow that may be contaminated with salt should be disposed of only at approved dumpsites or designated areas.

#### 1.27 FLOODS, EXTREME WEATHER, AND ICE FORMATION

- .1 Design project worksite to withstand variable weather conditions.
- .2 Minimize risk of inundation due to wet weather by grading, providing drainage and covering or protecting surfaces.
- .3 Stabilize work area against impact of high flow and heavy rainfall

events at the end of each workday.

- .4 Apply wet weather restrictions on construction activities to reduce surface run-off from exposed work areas and to minimize the risk of inundation.
- .5 Work shall be suspended and the work area stabilized when there is a high probability of a rainfall event.
- .6 Do not place vehicles or equipment in dewatered areas for extended periods of time.

#### 1.28 NOTIFICATION

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

#### 1.29 REGULATORY REQUIREMENTS

- .1 Comply with environmental requirements of Contract Documents, applicable federal, provincial, and local statutes, act, regulations, and ordinances of Agencies having jurisdiction.
- .2 Client Department and Parks Canada Agency are the main Environmental Authorities.
- .3 Client Department will not issue permit to authorize start of Work, under Historical Canal Regulations, before review and acceptance of Environmental Management Plan.
- .4 Comply with and enforce compliance by employees of prescribed environmental mitigation measures outlined in Environmental Management Plan, Detailed Impact Assessment (DIA) and Environmental Standards and Guidelines Document - Ontario Waterways.

- .5 Allow PCA Environmental Authority full access to affected Work area and cooperate to provide reasonable facilities for such access.
- .6 Comply with written orders and directions from PCA Environmental Authority and CA to correct deficiencies or implement additional environmental mitigation measures.
- .7 CA and PCA Environmental Authority may issue written stop Work order if elevated turbidity or suspended sediment concentrations are observed. No additional payment or time will be given for any corrective action required to correct the stop work order.
- .8 Submit copies of environmental orders and directions to Contract Administrator.

## PART 2 - PRODUCTS

### 2.1 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 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.

### 3.2 CORRECTIVE ACTIONS FOR WATER

- .1 When water quality is not in compliance with the required water quality performance criteria limits, stop in-water work and adjust operations to minimize turbidity. Make no claims for delays or adjustment to operations resulting from water quality exceedances.
- .2 Cessation of in-water work:
  - .1 In-water work will cease at the first indication of a significant oil sheen, unplanned release of turbid water, or distressed or dying fish in the vicinity of the work area.
  - .2 Contractor to work in other areas of work within the project limits while issues are investigated.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Provision of Construction Quality Control for all aspects of the Work.
- .2 Inspection and testing, administrative and enforcement requirements.
- .3 Tests and mix designs.
- .4 Mill tests.
- .5 Equipment and system adjust and balance.

1.2 DEFINITIONS

- .1 Certificate of Conformance: document issued by the Quality Verification Engineer (QVE) confirming that specified components of Work are in General Conformance with requirements of Contract Documents.
- .2 General Conformance: means that, in the opinion of a Professional Engineer, the standard of construction work fulfills essential requirements of Contract Documents, and has been done in accordance with normally accepted industry standards, and will perform its intended function.
- .3 Interim Inspection: an inspection confirming that specified components of Work are in General Conformance with Contract Documents. Written confirmation must be submitted to Department Representative before the Contractor can proceed to next stage of work.
- .4 Quality Control: a system or series of activities carried out by Contractor to ensure that the final product and materials supplied to Canada meets the specified requirements.
- .5 Quality Control Administrator (QCA): Contractor's representative responsible for monitoring and ensuring Quality Control compliance.
- .6 Quality Verification Engineer (QVE): one or more Professional Engineer(s) licensed in the Province of Ontario designated by the Contractor to provide the QVE services specified in the Contract Documents. The QVE will be responsible for certifying that the work is in General Conformance with Contract documents and for issuing Certificate(s) of Conformance as required. QVE to have experience directly related to Work for which Certificate of Conformance will be issued.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Develop and submit a Quality Control program for quality control activities in Contract and provide the necessary staff and resources. Program to include:
  - .1 Retain the services of a QVE and QVE delegates as required.
  - .2 Assign a Quality Control Administrator (QCA).
  - .3 Make available and submit all QC documentation upon request by Departmental Representative.
  - .4 Ensure Interim Inspections are completed, and Certificates of Conformance are submitted, where specified, prior to proceeding to the next stage of Work. Use the same QVE for Interim Inspections as for Certificate of Conformance.
- .3 During the course of Work, submit all QC inspection activities and associated records in accordance with the quality control requirements of the Contract Documents. The Contractor should ensure that the following items are in accordance with the Contract Documents:
  - .1 Submission of materials-related documentation, mix designs, mock-ups, etc. prior to proceeding with fabrication and construction of elements of work.
  - .2 Environmental conditions for material placement, including but not limited to, temperature and weather constraints and placement restrictions.
  - .3 Construction methods for material placement and/or removal.
  - .4 Provision of environmental protection of materials and elements of work and/or maintenance of environmental conditions after material placement including but not limited to: curing of concrete, cold weather protection, etc.).
  - .5 Any other relevant information and records requested by CA.

Please note that the above, is not an exhaustive list and that it is the Contractor's responsibility to ensure that all quality control requirements are in accordance with the Contract Documents.
- .4 Use only personnel/firms identified in the submissions, or in other forms of communication when permitted by Contract Documents, for the indicated Certificates of Conformance, Interim Inspections, and other quality control activities.
  - .1 Submit in writing to Departmental Representative revisions to the designated QVE at least two weeks prior to the activity for which the substituted personnel will be required.

#### 1.4 INSPECTION

- .1 The Contractor shall be responsible for all Quality Control (QC) and quality control testing of the works including third party inspection and testing. The Contractor is to submit a Quality Control Plan including each scope of work as well as Inspection and Testing Plan.
- .2 Allow Contract Administrator and Construction Inspector 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.
- .3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator instructions, or law of Place of Work.
- .4 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections, or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed, and make good such Work. Pay costs for uncovering and making good Work that is covered prior to inspection
- .5 Contract Administrator may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Contract Administrator shall pay cost of examination and replacement.
- .6 All Gates & Hoist equipment are subject to shop and site inspection as described in Section 11 10 00 & 11 20 00 of the present document. All demonstrations shall be to the satisfaction of PCA, the Construction Inspector, and the QVE.

#### 1.5 ACCESS TO WORK

- .1 Allow inspection/testing agencies and/or Construction Inspector access to Work, off site manufacturing and fabrication plants. Provide equipment required for access and executing inspection and testing by appointed agencies such as (but not limited to) ladders, lights
- .2 Co-operate to provide reasonable facilities for such access.

#### 1.6 PROCEDURES

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

- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

#### 1.7 TESTING BY CONSTRUCTION INSPECTOR

- .1 Construction Inspector will perform inspection/testing on a random basis for auditing purposes. Correct defects and irregularities as advised by Contract Administrator at no cost. Pay costs for re-testing and re-inspection.
- .2 If Contractor covers or permits to be covered work that has been designated for inspections before these are made, uncover such work, have inspections or tests satisfactorily completed and make good such work.
- .3 Construction Inspector 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, Contract Administrator will authorize payment of the cost of examination and replacement.

#### 1.8 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 Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Contract Administrator may deduct from Contract Amount difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Contract Administrator.

### 1.9 REPORTS

- .1 Submit electronic copies of inspection and test reports to Contract Administrator.
- .2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

### 1.10 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as may be requested.
- .2 Concrete testing of cast-in-place concrete will be completed by the Contract Administrator. Contractor will supply sample concrete material when requested.
- .3 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Contract Administrator and may be authorized as recoverable.

### 1.11 MILL TESTS

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

## PART 2 - PRODUCTS

### 2.1 NOT USED

- .1 Not Used.

## PART 3 - EXECUTION

### 3.1 QUALITY VERIFICATION SERVICES

- .1 The QVE shall:
  - .1 Issue Certificates of Conformance as indicated.
  - .2 Conduct Interim Inspections where required pursuant to the Contract Documents and issue written confirmation of conformance to

the CA following an interim inspection.

.3 Include time, date and components inspected for Interim Inspections.

- .2 Do not delegate any activity that Contract Documents require QVE to "witness". For all other activities, QVE may delegate the function to another person where it is consistent with prudent engineering practice to do so, and function is performed under supervision of QVE.
- .3 Submit Certificates of Conformance, with reference to the applicable Working Drawings and other Contract Documents, to Departmental Representative at the milestones indicated. Submit Certificate(s) of Conformance within 24 hours of completing the Work described in the Certificate of Conformance and prior to commencing subsequent stages of Work. Where Interim Inspections are specified, do not proceed to the next stage of work until a written confirmation as been issued to the CA by the QVE. Make available copies of the written confirmation to CA upon request.
- .4 QVE to seal, sign and date Certificates of Conformance indicating that construction of Work is in General Conformance with the stamped Working Drawings and requirements indicated. Do not include conditions or limitations as part of Certificate of Conformance or written confirmation to proceed following an Interim Inspection. Append any amendments to Contract Documents accepted by CA and related to Certificate of Conformance.
- .5 Seek clarification of requirements from Departmental Representative if QVE is prevented from issuing written confirmation following an Interim Inspection, or a Certificate of Conformance, because of lack of clarity of Contract Documents.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This Section includes requirements for furnishing provision and payment for temporary utilities required to execute the Work.

1.2 RELATED SECTIONS

- .1 Section 01 52 00 - Construction Facilities.
- .2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Heating Plan including heater numbers, types, locations, capacities.
- .3 Fan numbers, types, locations, capacities.
- .4 Number and location of fire extinguishers.
- .5 Location, type and service for sanitation facilities.

1.4 INSTALLATION AND REMOVAL

- .1 The Contractor will not be allowed access to the power services at any building operated by Parks Canada.
- .2 Make all required arrangements with utility providers in order to provide temporary power, light, water, telephone etc., to fulfill the requirements of construction. Pay all costs for installation, maintenance, removal and on-going utilization cost.
  - .1 Provide connections for Contract Administrator and Construction Inspector use as directed.
- .3 Temporary sanitary services shall be provided by the Contractor. Public washrooms shall not be used by the Contractor.
- .5 Provide temporary utilities controls in order to execute work expeditiously.

- .6 Remove from site all such work after use.

#### 1.5 WATER SUPPLY

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

#### 1.6 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of Work.
  - .2 Protect Work and products against dampness and cold.
  - .3 Prevent moisture condensation on surfaces.
  - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
  - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10°C in areas where concrete work is in progress.
- .5 Ventilating:
  - .1 Prevent accumulations of dust, fumes, mists, vapours, or gases in areas occupied during construction.
  - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
  - .4 Ventilate storage spaces containing hazardous or volatile materials.
  - .5 Ventilate temporary sanitary facilities.
  - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
  - .1 Conform with applicable codes and standards.
  - .2 Enforce safe practices.
  - .3 Prevent abuse of services.
  - .4 Prevent damage to finishes.
  - .5 Vent direct-fired combustion units to outside.
- .7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

#### 1.7 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools.
- .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project.

#### 1.8 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone, fax, data hook up, lines, and equipment necessary for own use and use of Departmental Representative.

#### 1.9 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

#### PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Construction aids.
- .2 Office and sheds.
- .3 Parking.
- .4 Project identification/signage.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
- .2 Canadian Standards Association (CSA International)
  - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CCOHS and Techstreet.
- .3 U.S. Environmental Protection Agency (EPA)/ Office of Water
  - .1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - SUBMITTAL PROCEDURES.

1.4 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation including gate locations.
- .2 Identify areas which have to be gravelled c/w geotextile 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 Observe and enforce all construction safety measures required by authorities having jurisdiction.
- .6 Provide and maintain necessary scaffolding, ladders and platforms to Canadian Construction Safety Code by NRCC.
- .7 Provide and maintain all necessary enclosures, guards, guardrails, hoardings, barricades, warning signs, flashing warning lights (for night) and similar items.
- .8 Provide sufficient chemical toilet conveniences in a sanitary condition for use of all persons at the site in a location approved by the Contract Administrator.
- .9 Photograph staging and work areas prior to starting work and submit the record to Contract Administrator for verification.
- .10 Remove from site all such work after use and return work and staging areas to a condition which existed prior to starting work.

#### 1.5 SCAFFOLDING

- .1 Scaffolding in accordance with CSA-Z797-09 (R2014).
- .2 Provide and maintain scaffolding, ramps, ladders, platforms, temporary stairs.
- .3 Design, install, and inspect scaffolds and work platforms as required for work in accordance with relevant municipal, provincial and other regulations.
- .4 Provide design drawings, signed and sealed by qualified Professional Engineer licensed in the province of Ontario, where prescribed.
- .5 Additions or modifications to scaffolding must be approved by a licensed Professional Engineer in the province of Ontario in writing.

#### 1.6 HOISTING

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

### 1.7 SITE STORAGE/LOADING

- .1 Confine work and operations of employees to areas designated by the CA. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.
- .3 Contractor is responsible for the procurement and use of laydown areas.

### 1.8 CONSTRUCTION PARKING

- .1 Contractor is to assume no parking on site.
- .2 Provide and maintain adequate access to project site.
- .3 Where using existing roads for access to project site, maintain such roads for duration of Contract, including snow removal, and make good damage resulting from Contractors' use of roads.
- .4 Build and maintain temporary roads where indicated or as required.
- .5 Clean public roads, construction runways, and taxi areas regularly and to the satisfaction of the CA where used by Contractor's equipment.

### 1.9 SECURITY

- .1 Pay for suitable security measures and methods to guard site and contents of site after working hours and during holidays. To be submitted and approved by Contract Administrator.
- .2 Contractor shall pay for monitoring of the site during periods of no construction activity.

### 1.10 OFFICES

- .1 Provide office and washroom trailers for the sole use of the DR/CA as specified.
  - .1 Supply and maintain trailers, satisfactory to the Engineer and Owner, for the exclusive use of the DR/CA for the duration of the Contract until at least two (2) months following Substantial Performance.
  - .2 Trailer(s) to consist of a minimum of the following rooms:

- .1 Office for DR with own door with lock and key
- .2 Office for CA with own door with lock and key
- .3 Two (2) Offices for CM with own door with lock and key
- .4 Three (3) cubicles for shared use between DR/CA/CM
- .5 Meeting Room to fit a minimum of 12 chairs and persons
- .6 Washroom
- .7 Storage Room
- .8 Kitchen
- .3 The trailer to be set up in approved location within seven days of Notice to Proceed with all utilities including internet or actual work commencement whichever occurs first. Failure to comply will result in the City providing the required office and back-charging the Vendor.
- .4 Locate the trailer within the work area as directed by the Engineer, physically separated from any other structure.
- .5 Make all necessary applications, obtain permits and pay for all fees, charges for service and use.
- .6 Provide and pay for all temporary telephone, potable water, power, heating, air conditioning, high speed internet equipment and services and lighting required during construction.
- .7 Provide a windproof, weather tight structure at least 300 mm above ground level and 2.6 m ceiling height.
- .8 Equip the storage room with:
  - .1 a plan table with sloping top approximately 2.0 m long, 1.0 m wide and 960 mm high; with smooth plywood top
  - .2 two stools, approximately 710 mm high for the above plan table
  - .3 Three, three tier wooden bookcases
  - .4 Shelves, plan racks, and a lockable steel wardrobe and storage cabinet, 1900 mm high 900 mm wide and 500 mm deep for storing instruments and clothing
- .9 Equip each office with (size to be 10x10' minimum clear space) and cubicle (size to be minimum 5'x5' clear space)
  - .1 one standard office desk having three lockable drawers
  - .2 one swivel type office chair with adequate ergonomic and lumbar support
  - .3 one legal-size, 4 drawer file cabinet with lock and key
  - .4 one standard four drawer, legal-size, lockable, steel filing cabinet with three sets of keys.
  - .5 One, three tier wooden bookcase
  - .6 one telephone with one phone line (separate to others) complete with voicemail, caller ID and call waiting. Phone to be supplied is capable of call display and speaker.
  - .7 high speed internet connection from independent telephone line, including Wi-Fi internet service
  - .8 one wastepaper basket
- .10 Equip meeting room with:
  - .1 a 3.0 m x 1.25 m meeting table
  - .2 12 standard office chairs
  - .3 fire extinguisher and first aid kit
  - .4 whiteboard with two sets of markers

- .5 one telephone with one phone line (separate to others) complete with voicemail, caller ID and call waiting. Phone to be supplied is capable of call display and speaker.
- .6 one wastepaper basket
- .11 Equip kitchen with:
  - .1 one combination hot and cold water cooler.
  - .2 one standard refrigerator, minimum 0.5m<sup>3</sup> (18 ft<sup>3</sup>)
  - .3 one standard microwave
  - .4 one hot and cold water sink with dishwashing soap and rags
  - .5 cabinetry with drawers to store napkins, paper towels, dishes and cutlery along with a minimum set of six plates, cups, knives, forks and spoons
  - .6 one waste basket
- .12 The trailer to be insulated, electrically heated, air-conditioned and electrically lighted as follows:
  - .1 wall-mounted electrical heaters sized to maintain an interior temperature of 21oC when the outside temperature is -30oC
  - .2 wall mounted air conditioning units
  - .3 temperature to be controlled at 21degrees Celsius year round
  - .4 adequate lighting with supplementary lighting in each area, including over the plan table and desks
  - .5 electrical outlets in each office, storage room and meeting room (4 minimum) as required
- .13 Provide doors to the trailer and to each office with suitable locks. Main door to the trailer shall come with at least eight sets of keys.
- .14 Provide at least two windows within the meeting room and one window within each office and the kitchen, each window having a size of at least 2.0 m2 on the opposite wall in which the exterior door is located. Provide window shades with screens.
- .15 Provide washroom facilities with hot and cold sink, toilet, waste basket and mirror for the sole use of the Engineer and Owner. Maintain a supply of paper towels, toilet paper, and soap throughout the duration of the project.
  - .16 Provide weekly janitorial services and all washroom supplies.
  - .17 Provide one printer/copier/scanner multi-function machine to meet the following specifications:
    - .1 Required functions- colour copying, printing, scanning, colour digital sending, with multi-tasking capability
    - .2 Print speed- 40 pages per minute (colour or black and white)
    - .3 Monthly duty cycle 5000-20,000 pages
    - .4 Processor speed 800 mHz
    - .5 Memory 1 GB RAM
    - .6 Hard disk 320 GB
    - .7 Print technology and quality -laser, up to 600 x 600 ppi

- .8 Number of cartridges- 4 (1 each high yield cyan, magenta, yellow)
  - .9 Number of paper trays- 4 (letter, legal, 11x17, with 1 multi- purpose adjustable tray)
  - .10 Duplex printing - automatic
  - .11 Document finishing sheet fed, job separator, stacking, stapling
  - .12 Scanner type - flattened
  - .13 Scanner resolution - up to 600 dpi with scan resolution software
  - .14 Task speed- 5.6 seconds, 600 x 600 dpi
  - .15 Maximum scan size 11x17
  - .16 Automatic document feeder capacity- 50 sheets
  - .17 Copier- resolution of 600x600 dpi for colour, copy reduce/enlarge settings of 25 to 400%, with number of copies up to 999 copies maximum
  - .18 Fax- resolution of 300 x 300 dpi for black, polling
  - .19 Connectivity- internal and external print servers, plus wireless print servers
  - .20 Software - print drivers and installation software
  - .18 Pay the lease or purchase costs for printer/copier/scanner/fax machine, and associated equipment, including maintenance, technical support, paper, cartridge and supply services.
  - .19 Provide Wi-Fi and high speed mobile Internet (minimum internet speed of 1 Gbps download and 50 Mbps upload) access suitable for a minimum of 100 GB monthly usage. Pay for the monthly charges by the Internet service provider. Internet access shall be designated for the Engineer's trailer and shall not be shared with the Vendor's trailer.
  - .20 Provide connection services in each office and meeting room for the printer. Provide technical services to assist the Engineer, Owner and its representatives to connect to the Wi-Fi and printing system.
  - .21 Provide and pay for the services of a security alarm system and take every reasonable precaution to protect the office and its contents against fire and theft, or other damage. Indemnify the Engineer and its agents against loss by fire, theft and injury to the building, to the office or its contents.
  - .22 Maintain the field office, stairs and the performance of the office equipment as specified until at least two (2) months following Substantial Performance.
  - .23 Provide ice and snow removal for the office and washroom trailers.
- .2 Subcontractors may provide their own offices as necessary. The CA will direct the location of these offices.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

1.12 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Provide cigarette receptacles throughout the site to cut down on litter.

1.13 CONSTRUCTION SIGNAGE

- .1 Provide and erect, within three weeks of signing Contract, a project sign in a location designated by Contract Administrator.
- .2 Construction sign of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.
- .3 Company logos are not permitted on any signage.
- .4 No other signs or advertisements, other than warning signs, are permitted on site.
- .5 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321.
- .6 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Contract Administrator.
- .7 Contract Identification and Public Advisory Signs shall be a minimum 2400 mm x 1200 mm in size and shall meet the visibility requirements of OPSS 706.
- .8 Contract Identification Signs containing the following information:

Port Severn Main Dam Reconstruction  
Owners Name and Logo  
Project Name

Contract No. R.076951.037037 Port Severn,  
Contractor's Name, Address, and Telephone Number

- .9 Public Advisory Signs if required for road closures containing the following:

Port Severn Main Dam Reconstruction

Closed for Construction on "Date"  
Local Traffic Only  
Through Traffic Use Detour Route

#### 1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Refer to Section 01 55 26.

#### 1.15 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use clearly marked separate bins for recycling.

#### PART 2 - PRODUCTS

##### 2.1 NOT USED

- .1 Not Used.

#### PART 3 - EXECUTION

##### 3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control
- .2 Section 01 52 00 - Construction Facilities
- .3 Section 01 35 43 - Environmental Procedures
- .4 Section 01 35 29 - Health and Safety Requirements
- .5 Section 01 74 11 - Cleaning
- .6 Section 01 77 00 - Project Closeout

1.2 SCOPE OF WORK

- .1 Road closures on Port Severn Road shall be scheduled to be as short as possible, maximum 1 day.
- .2 The Swing bridge is load limited to a maximum of 5 tonnes. No oversized vehicles or track equipment used by the Contractor's workforce are permitted to use the swing bridge at any time. Rubber tire equipment meeting the load limit of the swing bridge and personal vehicles used by the Contractor's workforce may cross the swing bridge, if deemed safe by the Contract Administrator.
- .3 Contractor shall provide signage for boat operators warning of the construction in conformance with the Navigation Protection Act.
- .4 Contractor shall complete all preparatory work within and outside the work areas.
- .5 Upon completion of the work, restoration of the site to its original condition, all to the approval of the Construction Inspector.
- .6 The requirements of OPSS 706 shall apply as amended below.

1.3 REFERENCES

- .1 Ontario Provincial Standard Specifications (OPSS):

- .1 OPSS 706 - Construction Specification for Traffic Control Signing.

#### 1.4 ADDITIONAL TO THE OPSS 706

- .1 Scope - OPSS 706.01 shall be amended to include the following:
  - .1 The work administered under this item will include the supply, placement, maintenance, repair and replacement as necessary, and removal of all signs, TC 54 delineators, and barricades necessary to advise the public, control traffic, and protect the work area (vehicle and pedestrian barricades) during all stages of construction.
  - .2 The work also includes the covering and or removal and replacement of any existing signs that may be deemed to confuse drivers or boat operators approaching or travelling in the work zone.
  - .3 The work shall also include the maintenance and submission of a detailed sign log that will be provided to the CA at the conclusion of the project.
- .2 Design and Submission Requirements - OPSS 706.04 shall be amended to include the following:
  - .1 The Contractor shall provide the Contract Administrator with a detailed construction sign plan prior to moving onto the site. The plan shall include all necessary advisory and Contract Identifications Signs including signs for boat operators, all detour warning signs including type, size and location as well as all signs and barricades required to limit vehicle and pedestrian traffic during construction.
  - .2 Contract Identification and Construction Advisory Signs as described above shall be placed at both ends of the work areas and should be identified on the Contractor's detailed signing plan.
  - .3 Construction Advisory Signs shall be placed upstream and downstream of the lock and shall contain text sized appropriately for the required viewing distance.
    - .1 The height of a capital letter on the Construction Advisory Signs shall be 0.29 cm for every meter of viewing distance.
    - .2 Acquire permission to erect signs on land not owned by PCA.
  - .4 The Contractor shall be required to maintain a traffic sign log throughout construction. The Contractor shall inspect all project and detour signs at least three times per week (Monday am, Wednesday and Friday pm). The log shall indicate that all signs are in place and visible and shall record any replacement, reinstatement or removal of any sign during construction.
  - .5 A copy of the sign log shall be provided to the CA at the conclusion of the project as part of the As-built Drawings submission.
- .3 Construction - OPSS 706.07 shall be amended to include the following:

- .1 The Contractor shall provide, erect, inspect, maintain, repair, and replace as necessary, all necessary construction, detour, advisory, identification and warning signs in accordance with the Ontario Traffic Manual and the Navigation Protection Act.
- .2 Two Contract Identification Signs as described shall be provided with one each located at the ends of the work area.
- .3 Two or more Construction Advisory Signs are required for boat operators upstream and downstream of the lock.
- .4 All signs shall be placed in locations that do not impair driver visibility in either direction or from any intersection, driveway or laneway or that do not impair navigation.
- .5 All signs shall be by buried installation.
- .6 The Contractor shall:
  - .1 Provide the Contract Administrator with a detailed description of the proposed traffic control equipment and procedures that they intend to use on this project.
  - .2 Supply traffic control signage in accordance with the Ontario Traffic Manual - Book 7 - Temporary Conditions.
  - .3 Maintain the traffic control signage in good order for the duration of the Contract, and to repair or replace if necessary.
  - .4 Provide, erect, and maintain signs, flashing lights, etc. as required by the Contract Administrator to properly warn the public approaching the Contract site.
  - .5 Completely enclose, using snow fence and appropriate signings, all open excavations during non-working hours.
  - .6 Erect suitable barricades, signs, snow fence, etc. along the traveled (pedestrian or vehicular) lanes, if construction is proceeding adjacent to the traveled lanes.
  - .7 Provide any traffic control as necessary during the course of the work.
- .7 Traffic control on this Contract shall be in conformance with Ministry of Labour Policies, Occupational Health and Safety Act, the provisions of the District of Muskoka's Engineering Department Road Occupancy Permit, and the procedures outlined in the pamphlet entitled "Correct Methods for Traffic Control" issued by the Construction Safety Associations of Ontario. Copies of this pamphlet may be obtained from the Ministry of Transportation's District Office.
- .8 Each Traffic Control Person (TCP) shall, while controlling traffic, wear the following:
  - .1 an approved fluorescent blaze orange or fluorescent red safety vest; and
  - .2 an approved fluorescent blaze orange or fluorescent red armband on each arm; and
  - .3 an approved fluorescent blaze orange or fluorescent red hard hat.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Signs shall conform to M.U.T.C.D. Reflective materials and surfaces shall conform to M.U.T.C.D.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Not Used.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Barriers.
- .2 Environmental Controls.
- .3 Traffic Controls.
- .4 Fire Routes.

1.2 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 Section 01 52 00 - Construction Facilities.
- .3 Section 01 55 26 - Traffic Control

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
  - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA):
  - .1 CSA 0121-08(R2013), Douglas Fir Plywood.

1.4 INSTALLATION AND REMOVAL

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

1.5 HOARDING

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

#### 1.6 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of platforms and decks, and along steep changes in grade.
- .2 Provide as directed by the Contract Administrator.

#### 1.7 ACCESS TO SITE

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

#### 1.8 PUBLIC TRAFFIC FLOW

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

#### 1.9 FIRE ROUTES

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

#### 1.10 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.

### PART 2 - PRODUCTS

#### 2.1 NOT USED

- .1 Not Used.

### PART 3 - EXECUTION

#### 3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Field engineering survey services to document existing limits of works and Reconstruction of all surrounding properties and roads.

1.2 REFERENCES

- .1 Owner's identification of existing property limits.

1.3 QUALIFICATIONS OF SURVEYOR

- .1 Qualified Canadian Land Surveyors (CLS).

1.4 SURVEY REFERENCE POINTS

- .1 Control points are not identified on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Contract Administrator.
- .4 Report to Contract Administrator when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.5 SURVEY REQUIREMENTS

- .1 Establish lines and levels, locate and lay out, by instrumentation.

1.6 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines

in area of Work and notify Contract Administrator of findings.

#### 1.7 LOCATION OF EQUIPMENT AND FIXTURES

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

#### 1.8 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

#### 1.9 SUBMITTALS

- .1 Submit name and address of Surveyor to Contract Administrator.
- .2 Submit Control Survey in CAD and PDF formats for review immediately after completing initial survey.
- .3 Submit certificate signed by surveyor certifying those locations and lengths of completed Work that conform with Contract Documents.

### PART 2 - PRODUCTS

#### 2.1 NOT USED

- .1 Not Used.

### PART 3 - EXECUTION

#### 3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Instructions for general execution of work.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.

1.3 MATERIALS

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

1.4 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are susceptible to damage from water or cold.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Remove and replace defective and non-conforming Work.

- .4 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .5 Execute Work by methods to ensure a dry environment for installation of equipment.
- .6 Restore Work with new products in accordance with requirements of Contract Documents.
- .7 Submit proposed materials, finishes and installation method for patching to Contract Administrator for approval, prior to patching.
- .8 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

#### 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse or recycling in accordance with Section 01 74 21.

#### 1.7 WORK SEQUENCE

- .1 Contractor shall ensure the installation works are carried out in a dry environment prior to the start of the works by using the Client's stoplogs in the upstream service gains of the sluices and meter-bags downstream.
- .2 If the Client's maintenance stoplogs are not available for use, the Contractor shall supply the necessary equipment as per Division 35 of this Specification to ensure dewatering of the working areas.

#### 1.8 CONTRACTOR USE OF PREMISES

- .1 Contractor shall limit use of premises for Work, storage, and access, to allow;
  - .1 Owner access to the entire work site.
  - .2 CA and CA subcontractor operations.
  - .3 PCA access to operate the dam.
  - .4 Roadway public traffic when possible.
  - .5 Pedestrian public traffic at all times.
- .2 Coordinate use of premises under direction of Contract Administrator.
- .3 Obtain and pay for use of additional private laydown, parking, or work areas as needed for operations under this Contract.

### 1.9 OWNER OCCUPANCY

- .1 Owner will occupy and require continuous access to the work areas during the entire construction period for execution of normal operations.

### 1.10 PROTECTION OF WORK

- .1 Protect finished work against damage until take-over.
- .2 Protect the work from damage caused by ice, flooding, and other adverse climatic conditions.
- .3 Protect adjacent work against the spread of dust and dirt beyond the Work areas.
- .4 Protect Client Department users and other users of the site from all hazards.

### 1.11 FLOOD EVENTS

1. In the event of an extreme flood advisory, the Contractor will be required to stop work, secure the site, and, if directed to do so, open a non-functioning gate to allow passage of water. The Contractor will be given at least 48 hours' notice of an extreme flood event and will also be advised when the flood crest has occurred so that work may resume.

## PART 2 - PRODUCTS

### 2.1 ACCEPTANCE OF MATERIALS

- .1 Where materials and equipment are specified to CSA, CGSB, ASTM, or similar standards, submit a written request to the Contract Administrator for approval of the relevant items. Include all relevant items. Do not use listed items until written approval has been provided by the Contract Administrator.
- .2 Use new, unused material only, except as noted or approved by the Contract Administrator in writing.

- .3 Include with each request relevant material data sheets from the manufacturer with full item details, and any other relevant documentation which will substantiate its quality, conformance and cost.
- .4 Materials and equipment specified by a manufacturer's name, catalogue number or trade name within the specifications or drawing package are intended to establish a standard of quality. Materials or equipment at least equivalent thereto may be submitted to the Contract Administrator for approval along with proof of equivalence.
- .5 Cost of additional work and modifications, if any, to the design due to use of alternative materials shall be borne by the Contractor.
- .6 Alternatives will not be considered during the tender period. Base the tender on the exact material and equipment specified, and on the design concepts shown on the drawings.

## 2.2 SAMPLES

- .1 Be responsible for test specimens, samples and sampling.

## 2.3 RECTIFICATION OF EXISTING SURFACES AND MATERIALS

- .1 Repair, replace and/or refinish, to the Contract Administrator's approval, existing surfaces and items damaged or altered in connection with the work.
- .2 The repaired, replaced and/or refinished items to be at least equal to those that existed immediately before damage occurred.
- .3 The Contractor shall restore, at its expense, all areas which have been disturbed by the Contractor's operations under this contract and which are not covered by other items of the contract. Where disturbance is to graveled or timber or concrete curb lined areas, completely restore using like materials and to the satisfaction of the Contract Administrator.
- .4 Sodded and seeded areas: Refer to Contract Drawings.
- .5 Restoration of the site must occur as soon as possible after construction is completed.

## PART 3 - EXECUTION

### 3.1 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Adhere to National, Provincial and Municipal requirements relating to the safety, health and protection of workers and the environment.
- .2 Be entirely responsible for the design and adequacy of all scaffold, supports, set forms, bracing, blocking, ties, shoring, handrails, guardrails, fencing, conveyance systems, etc. used in the construction and comply with applicable Federal, Provincial and Municipal ordinances and regulations.
- .3 Adhere to noise bylaws of the authority having jurisdiction.
- .4 Dispose of all unwanted materials at a location off Parks Canada lands approved by the Ontario Ministry of the Environment.

### 3.2 SCHEDULING

- .1 The Contract must be substantially completed on or by the date specified in the instruction to tenderers portion of documents.
- .2 Submit the Construction Progress Schedule, (in CPM form) within ten (10) days of award of Contract. Progress schedule must include the quantity of work to be accomplished within each 2 week timeframe. No progress payments will be made until an up-to-date Construction Progress Schedule is received and reviewed. Submit together with the progress schedule a cost breakdown for each lump sum payment item - the breakdown to be sufficient in detail as to permit the calculation and processing of the first and future progress payment claim amounts. Upon receipt of notice from the Contract Administrator, in writing, that the progress schedule is not approved or no longer valid, submit a revised Construction Progress Schedule within five (5) days. Submit together also with the Progress Schedule, an equipment and manpower loading schedule. Contractor to provide a weekly 3 week look ahead. Superintendent to review with CA weekly.
- .3 After approval by the Contract Administrator, cost breakdown and cash loaded schedule will be used as the basis for all progress payments. Progress payments will not be made without an approved detailed breakdown of the individual Lump Sum or quantity itemizations.
- .4 When requested by the Contract Administrator, resubmit the schedule with all revisions made to show the progress of the work and to show any changes which are required to meet the approved completion dates.
- .5 Take all necessary measures to complete the work within the scheduled times approved by the Contract Administrator.

- .6 Do not make changes to the reviewed schedule, without the Contract Administrator's approval.
- .7 The requirements of Section 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE apply to the Construction Progress Schedule.
- .8 Carry out the work during "regular hours" Monday to Friday from 08:00 to 17:00 hours unless otherwise noted and approved in writing by the Contract Administrator.
- .9 Request permission from the Contract Administrator, with forty-eight (48) hours' notice, for any work to be carried out during "off hours". All "off hours" work will be done only with the Contract Administrator written approval.

### 3.3 LAYOUT OF THE WORK

- .1 Lay out the work according to the elevations and dimensions shown on the plans and verified in the field.
- .2 Notify the Contract Administrator immediately of any discrepancies between field measurements and dimensions shown on the plans or reference drawings.
- .3 Be responsible for rectification of errors resulting from failure to verify dimensions, elevations and other pertinent data shown on the plans and reference drawings, and from improper layout.

### 3.4 EXAMINATION OF THE WORK SITE

- .1 No visits will be scheduled by the Owner and, should the tenderer wish to visit the site at other times, it will be his responsibility to make the appropriate arrangements.
- .2 Investigate and be fully informed as to the character and extent of the work to be performed and the difficulties involved, the facilities available for delivering, placing and operating the necessary plant and delivering and handling of materials.
- .3 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions.
- .4 Provide photographs of surrounding properties, objects and structures liable to be damaged or be the subject of subsequent claims prior to start of work. Submit the record to Contract Administrator for verification.

### 3.5 TESTING

- .1 Provide safe working areas and assist with testing procedures, including provisions for materials or services and co-ordination, as required by testing agency and as authorized by the Contract Administrator.
- .2 Where tests indicate non-compliance with specifications, Contractor to pay for initial test and all subsequent testing of work to verify acceptability of corrected work.

### 3.6 CONTRACT DOCUMENTS

- .1 Drawings and Specifications are complementary, items shown or mentioned in one and not the other are deemed to be included in the Contract work.
- .2 The Contractor will be responsible for printing/duplicating any required drawings or specifications for:
  - .1 Suppliers;
  - .2 Sub-contractors;
  - .3 On-site drawings and specifications;
  - .4 Project record drawings.

### 3.7 DOCUMENT REQUIREMENTS

- .1 Maintain at the job Site, one copy of the following:
  - .1 Most recent Issued for Construction Drawings,
  - .2 Specifications,
  - .3 Addenda,
  - .4 Change orders,
  - .5 Other modification documents,
  - .6 Field test reports,
  - .7 Copy of reviewed work schedule (to be keep up to date),
  - .8 Manufacturer's' installation and application instructions,
  - .9 Notice of Project issued by the Ministry of Labour,
  - .10 All items required to be maintained on site as per Section 01 35 29 - HEALTH AND SAFETY REQUIREMENTS,
  - .11 Site Specific Safety Plan,
  - .12 Environmental Management Plan,
  - .13 Waste Management Plan,
  - .14 Traffic Management Plan.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Final cleaning.

1.2 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 21.
- .6 Remove waste material and debris from site at end of each working day.
- .7 Dispose of waste materials and debris off site.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Clean roadways where mud and debris has been tracked onto the roadway from the project site.

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .9 Remove dirt and other disfiguration from exterior surfaces.
- .10 Sweep and wash clean paved areas.
- .11 Remove by vacuum truck all material, construction debris and buildup around sills and gates prior to commissioning in water.

## PART 2 - PRODUCTS

### 2.1 NOT USED

- .1 Not Used.

## PART 3 - EXECUTION

### 3.1 NOT USED

- .1 Not Used.

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Text, schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects, including:
  - .1 Diversion of Materials.
  - .2 Demolition Waste Audit (DWA) - Schedule A.
  - .3 Canadian Governmental Responsibility for the Environment Resources - Schedule B.

### 1.2 DEFINITIONS

- .1 Demolition Waste Audit (DWA): Relates to actual waste generated from project.
- .2 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .3 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .4 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .5 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
  - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
  - .2 Returning reusable items including pallets or unused products to vendors.
- .6 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .7 Separate Condition: Refers to waste sorted into individual types.
- .8 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.
- .9 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as

coordinating related, required submittal and reporting requirements.

### 1.3 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
  - .1 Demolition Waste Audit.
  - .2 Schedules A and B completed for project.

### 1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Prepare and submit following prior to project start-up:
  - .1 Submit 2 copies of completed Demolition Waste Audit (DWA):  
Schedule A.
- .3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
  - .1 Failure to submit could result in hold back of final payment.
  - .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, or disposed of.
  - .3 For each material reused, sold or recycled from project, include amount and the destination.
  - .4 For each material land filled or incinerated from project, include amount of material and identity of landfill, incinerator or transfer station.

### 1.5 DEMOLITION WASTE AUDIT (DWA)

- .1 Prepare DWA prior to project start-up.
- .2 Complete DWA: Schedule A.
- .3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

### 1.6 WASTE PROCESSING SITES

- .1 Province of Ontario.
  - .1 Name: Ontario Ministry of Environment, St. Clair Avenue West, Toronto, ON, M4V 1P5.
  - .2 Telephone: 800-565-4923 or 416-323-4321.

- .3 Fax: 416-323-4682.
- .2 Recycling Council of Ontario: 51 Wolseley Street, 2nd Floor, Toronto, ON, M5T 1A4.
  - .1 Telephone: 416-657-2797.
  - .2 Fax: 416-960-8053
  - .3 Email: rco@rco.on.ca.
  - .4 Internet: <http://www.rco.on.ca/>.

### 1.7 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Contract Administrator.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Contract Administrator.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Separate and store materials produced during dismantling of structures in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
  - .1 On-site source separation is recommended.
  - .2 Remove co-mingled materials to off-site processing facility for separation.
  - .3 Provide waybills for separated materials.

### 1.8 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil,

or paint thinner into waterways, storm, or sanitary sewers.

- .3 Keep records of construction waste including:
  - .1 Number and size of bins.
  - .2 Waste type of each bin.
  - .3 Total tonnage generated.
  - .4 Tonnage reused or recycled.
  - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

#### 1.9 USE OF SITE AND FACILITIES

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

#### 1.10 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 Handle waste materials not reused, salvaged, or recycled in accordance

with appropriate regulations and codes.

### 3.2 CLEANING

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

### 3.3 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Contract Administrator, and consistent with applicable fire regulations.
  - .1 Mark containers or stockpile areas.
  - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged, reusable, and recyclable materials is not permitted.

#### .3 Demolition Waste

Material Type	Recommended Diversion %	Actual Diversion %
Metals	100	[_____]
Rubble	100	[_____]
Wood (uncontaminated)	100	[_____]
Other		[_____]

#### .4 Construction Waste

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	[_____]
Plastic Packaging	100	[_____]
Rubble	100	[_____]
Steel	100	[_____]
Wood (uncontaminated)	100	[_____]
Other		[_____]

### 3.4 DEMOLITION WASTE AUDIT (DWA)

- .1 The following pertains to Schedule A - Demolition Waste Audit (DWA). Column-1 refers to the type of material salvaged. Column-2 refers to

the material quantity shown in column-1. Several columns may be required to identify specific demolition areas. Column-3 refers to the unit of measurement used to describe Column-2. Column-4 refers to the total quantity of salvaged material. Column-5 refers to the cumulative volume of salvaged material. Column-6 refers to the total weight in kilograms. Column-7 refers to remarks and assumptions made about the specified material.

.2 Schedule A - Demolition Waste Audit (DWA)

(1) Material Descrip.	(2) Quantity	(3) Unit	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks and Assump- tions
Metal						
Wood (Uncontaminated)						
Wood (Contaminated)						
Wood (new)						
Rubble						
Cardboard						
Plastic						
Packaging						
<u>Other</u>						

### 3.5 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule B - Government Chief Responsibility for the Environment

Province	Address	General Inquires	Fax
Ontario	Ministry of Environment and Energy 135 St Clair Avenue West Toronto, ON M4V 1P5	(416) 323-4321 (800) 565-4923	(416) 323-4682
	Environment Canada Toronto, ON	(416) 734-4494	

### 3.6 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert from D&C waste destined for landfill to maximum extent possible. Reuse, recycle or sell material off site for reuse except where

indicated otherwise. On site sales are not permitted.

- .2 For construction and demolition projects maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
  - .1 Provide facilities for collection, handling and storage of source separated wastes.
  - .2 Source separate the following waste:
    - .1 Brick and Portland cement concrete.
    - .2 Corrugated cardboard.
    - .3 Wood, not including painted or treated wood or laminated wood.
    - .4 Steel. Section 01 35 43 - Environmental Protection and Section 02221 - Demolition. These sections have detailed lists of materials to be recycled.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
  - .1 Indicate how material being removed from the site will be reused or recycled.
- .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Contract Administrator prior to removal of waste from the demolition site.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Activities associated with the interim and final inspection, certification and closeout of the Work.

1.2 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1 Notify Contract Administrator in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
  - .2 Request Contract Administrator's Inspection.
- .2 Contract Administrator's Inspection: Contract Administrator and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
  - .1 Work has been completed and inspected for compliance with Contract Documents.
  - .2 Defects have been corrected and deficiencies have been completed.
  - .3 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Contract Administrator and Contractor. If Work is deemed incomplete by Contract Administrator, complete outstanding items and request re-inspection.

1.3 CLEANING

- .1 In accordance with Section 01 74 11.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site.

1.4 PREREQUISITES TO TOTAL PERFORMANCE

- .1 Before completion of work, collect all manufacturer's guarantees and

warranties and submit a hard copy to the Contract Administrator.

## PART 2 - PRODUCTS

### 2.1 NOT USED

- .1 Not Used.

## PART 3 - EXECUTION

### 3.1 COMMISSIONING

- .1 Commissioning shall also consist of demonstration of all Gates & Hoist equipment as described in Section 11 10 00 & 11 20 00 of the present document. All demonstrations shall be to the satisfaction of PCA, the Construction Inspector, and the QVE.
- .2 Contractor shall organize the commissioning process for any equipment installations and processes as may be required.
- .3 Schedule commissioning activities to ensure availability of testing agencies, witnesses, affected trades, and Commissioning Team members as may be appropriate.
- .4 Administer and manage independent testing and documentation as may be required.
- .5 Obtain copies from suppliers and subcontractors of all test results, equipment documentation, and manuals as may be appropriate.
- .6 Ensure all environmental considerations have been addressed adequately in accordance with the DIA.
- .7 Verify that all information and results provided comply with manufacturer's submitted shop drawings and performance specifications.
- .8 Validate that all tests and measurements are in accordance with applicable standards, guidelines and/or accepted manufacturer's performance measurements.
- .9 Follow up on any non-compliant installations and/or failed tests and verify corrective measures have been taken.

- .10 Arrange for witnessing tests as may be appropriate and document accordingly.
- .11 Complete and sign off all verification reports and compile a comprehensive Commissioning Manual on an ongoing basis. Draft Commissioning Manual outlining the contents of the final version to be submitted within 30 days of notice to proceed.
- .12 Organize Commissioning Team meetings as may be required including preparing agenda, taking, and issuing meeting minutes.
- .13 Advise CA of any issues, concerns, delays, or other developments which may have project impacts.
- .14 Establish operator training requirements and coordinate training including arranging for qualified instructors and suitable training materials.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 As-built drawings and specifications.
- .2 Product data, materials and finishes, and related information.
- .3 Warranties and bonds.
- .4 Operation and Maintenance Manuals

1.2 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned with Contract Administrator's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, final copies commissioning documentation in English.
- .5 Ensure spare parts, maintenance materials and special tools (including pad locks) provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.
- .9 Supply all product and installation documentation including product data and operations information, warranties, guarantees and other post-construction commitments, organize material and deliver to the CA
- .10 Gather and provide all necessary construction information including 'red-line' drawings, accepted shop drawings, equipment specification documentation, etc., and submit to the CA so as to prepare detailed record drawings identifying the extent of the Work and final restoration conditions.

- .11 Assist the CA with project closeout including, but not limited to, preparing and submitting construction information with details of significant events, lessons learned, and sub-contractor evaluations.

### 1.3 OPERATIONS AND MAINTENANCE MANUALS

- .1 The Contract Administrator shall identify the Manual requirements with adjustments as the specific site scope is determined. Three (3) weeks prior to any scheduled training, submit to the CA four (4) copies of approved Operations Data and Maintenance Manual compiled as follows:
  - .1 Bind data in vinyl hard cover 3 "D" ring type loose leaf binders for 212 x 275 mm size paper. Binders must not exceed 75 mm thick or be more than 2/3 full.
  - .2 Enclose title sheet labelled "Operation Data and Maintenance Manual", project name, date and list of contents. Project name must appear on binder face and spine.
  - .3 Organize contents into applicable sections of work to parallel project specifications breakdown.
  - .4 Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets. Include following information plus data specified:
    - .1 Maintenance instructions for finished surface and materials;
    - .2 Copies of hardware and paint schedules.
    - .3 Description: Operation of the equipment and systems defining start-up, shut-down an emergency procedures, and any fixed or adjustable set points that affect the efficiency of the operation. Include nameplate information such as make, size, capacity and serial number.
    - .4 Maintenance: Use clear drawings, diagrams or manufacturers' literature which specifically apply and detail the following:
      - .i Lubrication products and schedules;
      - .ii Trouble shooting procedures;
      - .iii Adjustment techniques;
      - .iv Operational checks;
      - .v Suppliers' names, addresses and telephone numbers and components supplied by them must be included in this section. Components must be identified by a description and manufacturers part number.
    - .5 Guarantees showing:
      - .i Name and address of projects.
      - .ii Guarantee commencement date (date of Interim Certificate of Completion).
      - .iii Duration of guarantee.
      - .iv Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
      - .v Signature and seal of Guarantor.

- .vi Additional material used in project listed under various Sections showing name of manufacturer and source of supply.
- .6 Spare parts: List all recommended spares to be maintained on site to ensure optimum efficiency. List all special tools appropriate to unique application. All parts/tools detailed must be identified as to manufacturer, manufacturer part number and supplier (including address).
- .5 Include one complete set of final shop drawings (bound separately) indicating corrections and changes made during fabrication and installation. As Built drawings and O&M manual shall be converted, where necessary, into Portable Document File (PDF) format permit for viewing using Acrobat reader.

#### 1.4 FORMAT

- .1 All information to be submitted electronically in PDF format. Two USB drives compatible with PSPC encryption requirements will be submitted for archiving, each containing the final version of all submission documents.
- .2 Organize data for easy search and retrieval.
- .3 Arrange content in folders and provide a master list of submission documents in the root folder.
- .4 In addition to PDF format, provide drawings in 1:1 scaled CAD files in AutoCAD dwg format.

#### 1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
  - .1 Date of submission; names,
  - .2 Addresses, and telephone numbers of 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 clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component

parts of equipment and systems, to show control and flow diagrams.

- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

#### 1.6 AS-BUILTS

- .1 In addition to requirements in General Conditions, maintain one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Amendments and addenda.
  - .4 Change Orders and other modifications to the Contract.
  - .5 Reviewed shop drawings and product data.
  - .6 Field test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Contract Administrator.
- .6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Contract Administrator on completion of work. Submit files on USB compatible with PSPC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Contract Administrator.
- .7 If project is completed without significant deviations from Contract drawings and specifications submit to Contract Administrator one set of drawings and specifications marked "AS-BUILT".

#### 1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
  - .1 Measured depths of elements of foundation in relation to finish

- first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.
- .7 References to related shop drawings and modifications.
- .2 Specifications: legibly mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Amendments and change orders.
- .3 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records required by individual specifications sections.

#### 1.8 FINAL SURVEY

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

#### 1.9 MATERIALS AND FINISHES

- .1 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .2 Additional Requirements: as specified in individual specifications sections.

#### 1.10 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.

- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.

#### 1.11 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.
- .8 Submit a schedule of warranties showing all products and their warranty periods.
- .9 Unless more stringent warranties are specified, all warranties are to be one year from the date of substantial performance. If any equipment and/or items are not commissioned at the point of substantial performance their start of warranty will be assessed and commence on the date it is functioning as per the design intentions. The Contractor shall be responsible for attending all warranty site meetings. At approximately (10) months from the commencement of the warranty period, the Contractor shall arrange with the Contract Administrator, the Contract Administrator, the Owner and others as may be appropriate for an inspection of the facility to determine all deficiencies to be corrected. Prepare a deficiency list for review and acceptance by the Contract Administrator. Provide a schedule indicating when correction of all deficiencies covered under the warranty will be corrected and submit to the Contract Administrator for review and

acceptance. Arrange for and correct all identified deficiencies in accordance with the schedule and advise when all deficiencies have been properly corrected. Ensure that all warranty deficiencies are properly corrected in a timely manner.

#### 1.12 WARRANTY INSPECTION

- .1 A warranty inspection with the Departmental Representative, the Constructor, and the Vendor will be completed within 12 months of acceptance of substantial completion.
- .2 All deficiencies and items identified as incomplete or in need of repair are to be rectified by the Vendor at no additional cost.
- .3 The Contract Hold-back will not be released to the Vendor until all deficiencies and items identified as incomplete or in need of repair have been rectified.

#### 1.13 COMMISSIONING VERIFICATION

- .1 Provide a letter, written by the QVE, verifying that the commissioning was completed to the satisfaction of the QVE, PCA, and the Construction Inspector.
  - .1 Provide separate letters for the swing bridge bearing seat, the log lifter operation on the rails, and the log movement within each gain.
  - .2 Each letter shall provide space for PCA and the Construction Inspector to sign as well.
  - .3 CM will acquire signatures from PCA and the Construction Inspector and provide a copy of the completed letter to the Contractor.
  - .4 Commissioning is not considered complete until all three parties have signed each letter.

### PART 2 - PRODUCTS

#### 2.1 NOT USED

- .1 Not Used.

### PART 3 - EXECUTION

#### 3.1 NOT USED

- .1 Not Used.

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of equipment and systems to Departmental Representative's O&M personnel.
- .2 O&M personnel includes property facility manager, building operators, maintenance staff, security staff and technical specialists, as applicable.

### 1.2 RELATED SECTIONS

- .1 Section 11 10 00 - Dam Gates.
- .2 Section 11 20 00 - Wire Rope Hoist.

### 1.3 DESCRIPTION

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.
- .2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

### 1.4 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Departmental Representative's personnel, and provide written report that demonstration and instructions have been completed.
- .2 Submit training schedule of time and date for demonstration and training of each item of equipment and each system in accordance with the training plan four weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within [one week] after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Report shall give time and date of each demonstration and training,

with list of persons present.

#### 1.5 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with Sections [11 10 00 and 11 20 00].
- .2 Testing and adjusting has been performed [in accordance with Sections [11 10 00 and 11 20 00] and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

#### 1.6 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated O&M personnel are present.

#### 1.7 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

#### 1.8 TIME ALLOCATED FOR INSTRUCTIONS

- .1 Ensure amount of time required for instruction of the following equipment or system:
  - .1 Dam Gate maintenance: 2 sessions @ 8 hours at site.
  - .2 Wire rope hoist control system: 2 sessions @ 8 hours at site.
  - .3 Wire rope hoist maintenance: 2 sessions @ 8 hours at site.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Conform to the requirements stated in the General Conditions and Supplementary General Conditions of this Specification and all addenda.

1.2 RELATED SECTIONS

- .1 Section 03 20 00 - Concrete Reinforcement
- .2 Section 03 30 00 - Cast-in-Place Concrete

1.3 REFERENCE STANDARDS

- .1 Do concrete formwork and falsework in accordance with OPSS 919 (Nov 2011), except where specified otherwise.
- .2 Do concrete formwork in accordance with CAN/CSA-A23.1, except where specified otherwise.
- .3 Do falsework in accordance with CSA S269.1 (latest edition), except where specified otherwise.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings for formwork and falsework in accordance with Section 01 33 00.
- .2 Indicate method and schedule of construction, materials, arrangement of joints, shores, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings.
- .3 Each shop drawing submission shall bear stamp and signature of qualified Professional Engineer registered or licensed in the Province of Ontario.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Formwork materials:
  - .1 Plywood and wood formwork materials to CAN3-086-M84, CAN/CSA-086.1.
- .2 Falsework material:
  - .1 to CSA S269.1.
- .3 Form ties:
  - .1 Above Water Level (EL 180.5): Use snap ties complete with plastic cones and light grey concrete plugs (colour to match concrete).
  - .2 Below Water Level (EL 180.5): Fibreglass ties coloured light grey meeting requirements of ACI 440.3R-04 and ASTM D 3916-02 or snap ties with 50 mm tall light grey concrete plugs.
    - .1 All ties below the water level shall be installed with rubber form tie waterstops.
- .4 Form liner:
  - .1 Plywood: 7 ply, 17 mm minimum thickness exterior grade Douglas Fir Plywood according to CSA O121.
- .5 Form release agent:
  - .1 Chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, preventing concrete from sticking to forms.
- .6 Waterstops:
  - .1 For Concrete Cold Joints: Hydrophilic rubber sealing strip based material installed in continuous strips and rectangular in shape with dimensions not less than 25 mm x 7 mm. Refer to Section 11 10 00 - Dam Gates for detail requirements.
  - .2 For Form Ties: SEBS Rubber compound with hydrophilic polymers capable of expanding 400% in fresh water and service temperatures from -50 degrees Celsius to +70 degrees Celsius.

PART 3 - EXECUTION

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Consultant's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .8 Align form joints and make watertight. Keep form joints to minimum.  
Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .9 Use 76 mm diameter rounded strips on external corners and/or 25 mm fillets at interior corners of concrete members, joints, unless specified otherwise.
- .10 Form chases, slots, openings, drips, recesses, expansion and control joints, as indicated.
- .11 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, including painting.
- .12 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

### 3.2 REMOVAL AND RESHORING

- .1 Remove formwork when concrete has reached 75% of its design strength, and replace immediately with adequate reshoring.
- .2 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction, as required.
- .3 Space reshoring in each principal direction at not more than 3000 mm apart.
- .4 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Conform to the requirements stated in the General Conditions and Supplementary General Conditions of this Specification and all addenda.

1.2 RELATED SECTIONS

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

1.3 REFERENCE STANDARDS

- .1 Do reinforcing work in accordance with OPSS 905 (Nov 2014), except where specified otherwise.
- .2 Do reinforcing work in accordance with CAN/CSA-A23.1, except where specified otherwise.

1.4 SOURCE QUALITY CONTROL

- .1 Provide CA with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, prior to commencing reinforcing work.
- .2 Inform CA of proposed source of material to be supplied

1.5 SHOP DRAWINGS

- .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00.
- .2 Submit shop drawings including placing of reinforcement in accordance with design drawings.
- .3 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices, if approved by Consultant, with identifying code marks to permit correct placement without reinforce to structural drawings. Also include mechanical properties of the

GFRP bars used for the Contract including: designated bar diameter, guaranteed tensile strength, and guaranteed tensile modulus. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.

- .4 Detail lap lengths and bar development lengths to CAN3-A23.3.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise. Stainless rebar to ASTM A955. GFRP (glass fibre reinforced polymer) bars to CSA-S807. GFRP bars shall be Grade 1 (minimum) modulus reinforcement. All GFRP bars in the same structural component shall be supplied by the same manufacturer; there shall be no mixing of products from different manufacturers. The GFRP bars shall be uniform in diameter/size and free of defects that would be injurious to the mechanical properties and durability.
- .2 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.
- .3 Chairs, bolsters, bar supports, spacers: Steel bars to CAN/CSA-A23.1. GFRP bars chairs for supporting GFRP bars shall be plastic or non-corrosive. Fastening of GFRP bars shall be with coated tie wire, stainless steel wire or nylon ties.
- .4 GFRP dowels into concrete are to be installed using Hilti HIT 200 Adhesive System or equal and shall be used in accordance with the manufacturer's recommendations and as directed by the CA.
- .5 Anchors into bedrock shall be installed using Hilti HIT RE 500 Adhesive System or equal and shall be used in accordance with the manufacturer's recommendations and as directed by the CA.

## 2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Consultant's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- .4 Refer to Ontario Provincial Standard Drawing SS12-1 of MTO Structural Design Manual for rebar hook dimensions.

## PART 3 - EXECUTION

### 3.1 MATERIAL STORAGE

- .1 All reinforcement and accessories shall be kept clean of all mud, oil and other deleterious materials and stored clear of ground contact.
- .2 Delivery, storage and handling of GFRP bars shall be in accordance with the manufacturer's instructions to prevent damage.
- .3 The bars shall be lifted using multiple pickup points to prevent sags. Nylon slings or padded wire rope slings shall be used to lift bars. Lifting of bundles of bars shall be with a strong back, spreader bar, multiple supports or a platform bridge. The bars shall not be dragged or dropped.
- .4 The bars shall be stored clear of the ground on timbers or other suitable protective cribbing spaced to prevent sags in the bundles.
- .5 The GFRP bars shall be covered with opaque white polythene during site storage.
- .6 Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.
- .7 GFRP bars shall be stored separately from reinforcing steel bars, with the bar tags maintained and clearly visible until ready for placing.
- .8 GFRP reinforcing bars shall be protected from any abrasive blasting operation in its immediate vicinity by adequate covering or wrapping with protective material.

### 3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.
- .4 Field bending of GFRP bars will not be allowed;

### 3.3 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
- .2 Prior to placing concrete, obtain Consultant's approval of reinforcing material and position.
- .3 Ensure cover to reinforcement is maintained during concrete pour.
- .4 GFRP bars shall be accurately placed in the positions shown on the Contract Drawings and held in the correct location during the operations of placing and consolidating concrete.
- .5 Bars shall be tied at least at every third intersection. The maximum untied length of any bar shall be 900 mm.
- .6 Bar support chairs shall not exceed 900 mm average spacing in each direction.
- .7 GFRP bars within the formwork shall be secured to prevent movement during concrete placement. The bars must be adequately supported or tied to resist settlement, floating upward, or movement in any direction during concrete placement.
- .8 Field cutting OF GFRP bars will be permitted only with the approval of the CA. The field cutting shall be with a high speed cutter, fine blade saw, diamond blade or masonry saw. The bars shall not be shear cut.
- .9 The GFRP bars shall be placed in accordance with OPSS 905 unless otherwise specified.

### 3.4 DOWELS INTO CONCRETE AND BEDROCK

- .1 The holes shall be free of water, dust, and debris and be properly cleaned immediately prior to placement of the anchoring agent. When the anchoring agent fails to fill the hole after insertion of the dowel, additional anchoring agent shall be added to fill the hole. Holes that are started but not complete because reinforcing material is encountered shall be cleaned and filled with an approved patching material. All debris resulting from the operation shall be disposed of as specified elsewhere in the Contract.

PART 1 - GENERAL

1.1 SCOPE

- .1 The Contractor shall supply all labour, equipment, and materials including all reinforcing work and all formwork required to complete the work in accordance with OPSS 904, unless specified otherwise, the Contract Drawings and to the satisfaction of the CA.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forms and Accessories
- .2 Section 03 20 00 - Concrete Reinforcement

1.3 REFERENCES

- .1 Ontario Provincial Standard Specifications (OPSS):
  - .1 OPSS 904 - Construction Specification for Concrete Structures.
  - .2 OPSS 919 - Construction Specification For Formwork And Falsework
  - .3 OPSS 1350 - Material Specification for Concrete - Material and Production.
- .2 Canadian Standards Association (CSA):
  - .1 CAN/CSA-A23-1 - Concrete materials and methods of concrete construction
  - .2 CAN/CSA-A23-2 - Test methods and standard practices for concrete

1.4 CERTIFICATES AND SUBMITTALS

- .1 Minimum 4 weeks prior to starting concrete work, submit to CA, manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
  - .1 Portland cement
  - .2 Blended hydraulic cement
  - .3 Supplementary cementing materials
  - .4 Grout
  - .5 Admixtures
  - .6 Aggregates
  - .7 Water
  - .8 Joint filler

- .2 Prepare and submit design mixes for the various strengths of concrete required. Have the design mixes prepared by the concrete supplier giving exact proportions of all tested and approved materials. Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1, and that mix design is adjusted to prevent alkali aggregate reactivity problems.
- .4 Prepare and submit a Concrete Placement Plan. The Concrete Placement Plan should include a plan for hot weather concreting and cold weather concreting. Concrete Placement Plan shall include location of thermocouples for piers and slabs, rate of placement, anticipated build-up of heat due to hydration, means of controlling heat of hydration, methods of curing, and finishing procedures.

#### 1.5 QUALITY ASSURANCE

- .1 Minimum 4 weeks prior to starting concrete work, submit to CA, manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
  - .1 False work erection
  - .2 Hot weather concrete plan
  - .3 Cold weather concrete plan
  - .4 Concrete Placement Plan
  - .5 Curing
  - .6 Finishes
  - .7 Formwork removal
  - .8 Joints

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A5.
- .2 Water: to CAN/CSA-A23.1.
- .3 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.
- .4 Air entraining admixture: to CAN3-A266.1-M78.
- .5 Chemical admixtures: to CAN3-A266.2-M78. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Premoulded joint fillers: Product selection shall be approved by Consultant.
- .7 Joint Sealant: Product selection shall be approved by Consultant.
- .8 Proportion normal density concrete in accordance with CAN/CSA-A23.1. Do not change concrete mix without prior approval of Consultant. Should change material source be proposed, new mix design to be approved by Consultant.

2.2 MIXES

- .1 Mix Proportions of cast-in-place concrete work in accordance with OPSS 904, OPSS 353, OPSS 1350 and CAN/CSA-A23.1.
  - .1 All Concrete (Unless Noted Otherwise)
    - .1 Cement Type: Type GU, Normal Portland.
    - .2 Specified Strength: 35 MPa.
    - .3 Class of Exposure: C-1.
    - .4 Normal Size of Coarse Aggregate: 20 mm.
    - .5 Slump at Point of Discharge: 80 mm +/- 20 mm.
    - .6 Air Content: 5-8%.
    - .7 Admixtures and Characteristics: compatible water reducing admixture to achieve specified slump.
    - .8 Maximum and/or Minimum Density of Air Dry Concrete: normal 2,320 kg/cubic metres.
    - .9 Maximum Water/Cement Ratio by mass: 0.40.
    - .10 Shrinkage performance to comply with CSA A23.1/A23.2 requirements for low shrinkage concrete - less than 0.04% when testing under 8.8.2.

- .2 Main Dam Piers
  - .1 Cement Type: Type MH, Moderate Heat of Hydration
  - .2 Specified Strength: 35 MPa.
  - .3 Class of Exposure: C-1.
  - .4 Normal Size of Coarse Aggregate: 20 mm.
  - .5 Slump at Point of Discharge: 80 mm +/- 20 mm.
  - .6 Air Content: 5-8%.
  - .7 Admixtures and Characteristics: compatible water reducing admixture to achieve specified slump.
  - .8 Maximum and/or Minimum Density of Air Dry Concrete: normal 2,320 kg/cubic metres.
  - .9 Maximum Water/Cement Ratio by mass: 0.40.
  - .10 Shrinkage performance to comply with CSA A23.1/A23.2 requirements for low shrinkage concrete - less than 0.04% when testing under 8.8.2.
  - .11 Concrete Mix Design and Concrete Placement Plan shall ensure concrete internal temperature will not exceed 70 degrees Celsius during curing.
  - .12 Concrete Mix Design and Concrete Placement Plan shall ensure maximum temperature differential between center of concrete and concrete surface will not exceed 20 degrees Celsius during curing.
  
- .3 Concrete Toppings
  - .1 Cement Type: GU, Normal Portland.
  - .2 Specified Strength: 35 MPa.
  - .3 Class of Exposure: C-1.
  - .4 Normal Size of Coarse Aggregate: Group 1, 10 to 5 mm.
  - .5 Basic Slump: 60 mm +/- 10 mm, prior to addition of site added admixture.
  - .6 Air Content: 6-9%.
  - .7 Admixtures and Characteristics: compatible water reducing admixture to achieve workable slump.
  - .8 Maximum and/or Minimum Density of Air Dry Concrete: normal 2,320 kg/cubic metres.
  - .9 Maximum Water/Cement Ratio by Mass: 0.38.
  
- .4 Grout
  - .1 Cement Type: HE, High Early Strength Portland.
  - .2 Specified Strength: 40 MPa.
  - .3 Admixtures and Characteristics: Flowable mix with expanding agents. No ferrous additives or corrosive additives. No additives containing calcium chloride.
  - .4 Maximum Water/Cement Ratio by Mass: 0.55.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- .1 Obtain Construction Inspector's approval before placing concrete. Provide 24-hour notice prior to placing of concrete. Complete pre-pour documentation as required by the CA.
- .2 Pumping of concrete is permitted only after approval of equipment and mix.
- .3 Ensure that reinforcement and inserts are securely tightened and will not be disturbed during concrete placement.
- .4 Verify that Concrete Mix Design and Rate of Concrete Placement has been coordinated with Formwork Design.
- .5 Prior to placing of concrete, obtain Construction Inspector's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .7 Do not place load upon new concrete until authorized by Consultant.

### 3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with OPSS 904, OPSS 353, OPSS 1350 and CAN/CSA-A23.1.
- .2 Sleeves and Inserts:
  - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, columns, except where indicated or approved by Consultant.
  - .2 Where approved by Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by Consultant.
  - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from CA before placing of concrete.
  - .4 Check locations and sizes of sleeves and openings shown on drawings.
  - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

- .3 Anchor Bolts:
  - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
  - .2 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
  - .3 Set bolts and fill holes with epoxy grout.
  - .4 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
  
- .4 Drainage Holes and Weep Holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
  
- .5 Finishing:
  - .1 Finish concrete in accordance with CAN/CSA-A23.1.
  - .2 Use procedures acceptable to Consultant or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces. Apply finish on concrete. Provide written declaration that compounds used are compatible.
  - .4 To CAN/CSA-A23.1, provide a raked finish to concrete floor slab, which are to receive toppings.
  - .5 For light non-slip surface, provide a magnesium trowel finish.
  - .6 For vehicular traffic surfaces, provide textured finish as indicated on the drawings.
  - .7 Exposed formed surfaces shall be medium density overlay plywood in conformance with OPSS 919.
  
- .6 Joint Fillers:
  - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Consultant. 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 isolation and construction joints as indicated. Install joint filler.
  - .3 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
  
- .7 Plugs at Recessed Ties:
  - .1 Clean tie holes to remove all foreign matter.
  - .2 Coat plugs by dipping in adhesive to cover small end of plug depth.

- .3 Insert plugs in tie holes with a rotating motion and tap in place with a wooden or rubber mallet.
- .4 Remove excess adhesive immediately with thinner which will not stain concrete, as recommended by its manufacturer.
  
- .8 Curing:
  - .1 Cure with a sealing and curing compound, finished horizontal concrete surfaces, except as follows:
    - .1 Surfaces to receive bonded toppings or mortar beds.
    - .2 Surfaces to receive membrane waterproofing.  
in which case, wet cure and cover with polyethylene for seven consecutive days minimum.
  - .2 Use a sealing and curing compound which will leave the surface with a uniform appearance and with a minimum of discolouration after drying. Check that the curing compound will be compatible with the architectural finishes or adhesives for architectural finishes. Apply the compound in accordance with its manufacturer's instructions.
  - .3 Protect surfaces which will be exposed to direct sunlight during the curing period and which will remain exposed permanently with a light coloured, laminated waterproof paper immediately after the curing and sealing compound has hardened sufficiently for the paper to be placed without damage to the sealed surface. Lap the paper a minimum of 100 mm and seal the laps. Leave the paper in place at least seven days.
  - .4 Water used for curing shall be free of sediment and organic compounds that may create odours or staining.
  - .5 Take appropriate measures for hot weather concreting. Concrete shall not exceed 70 degrees Celsius during curing. Concrete differential between surface and center shall not exceed 20 degrees Celsius during curing.
  - .6 Take appropriate measures for cold weather concreting. Cold weather is defined as concrete work (including curing) when ambient temperatures drop below 5 degrees Celsius.
    - .1 Submit a temperature control plan to the CA at least 7 days in advance of cold weather concrete work. The plan should include:
      - .1 Concrete element for which the plan applies.
      - .2 Temperature monitoring system, including the locations and depths, number of thermocouples, and frequencies of recordings to be used in each placement.
      - .3 Method of ensuring concrete temperature and temperature difference are maintained for the duration of the protection period.
      - .4 Any alterations to work schedule, production, delivery schedule, and time of placement for temperature control purposes.
      - .5 Any modification to mix design for temperature control purposes.

- .6 Any other specific measures to be taken.
- .7 Method of withdrawal of protection.
- .8 Type of insulation, R value and number of layers, including test data verifying the R value. The submission for cold weather protective measures shall be accompanied by samples of insulation, if requested by the CA.
- .9 Type and layout of heaters and type and extent of housing.
- .2 Minimum cold weather protective measures shall be:
  - .1 For footings and slabs on the ground:

Anticipated Minimum Ambient Air Temperature (°C)	Thickness > 1.0 m	1.0-0.5 m	0.5-0.25 m	< 0.25 m
+5 to 0	PM1	PM1	PM1	PM2
-1 to -10	PM2	PM2	PM2	PM3
-11 to -20	PM3	PM3	PM4	PM5
Less Than -20	PM3	PM4	PM5	PM5

- .2 For all other concrete components

Anticipated Minimum Ambient Air Temperature (°C)	Thickness > 1.0 m	1.0-0.5 m	0.5-0.25 m	< 0.25 m
+5 to 0	PM1	PM1	PM1	PM2
-1 to -10	PM2	PM2	PM3	PM4
-11 to -20	PM3	PM3	PM4	PM5
Less Than -20	PM4	PM5	PM5	PM5

- .3 Where:

PM1 - Cover components with a moisture vapour barrier as specified for curing with moisture vapour barrier.

PM2 - Cover components as for PM1, then cover the moisture vapour barrier with insulation having an R-Value of 0.67.

PM3 - Cover components as for PM1, then cover the moisture vapour barrier with insulation having an R-Value of 1.33.

PM4 - Cover components as for PM1, then cover the moisture vapour barrier with insulation having an R-Value of 2.00.

PM5 - Housing and heating.

All R-Values are metric.

Ambient Air Temperature shall include wind chill.

- .3 The maximum allowable drop in concrete temperature per 24 hours is 10 degrees Celsius for elements more than 2 m thick; 15 degrees Celsius for elements more than 1 m thick but less than 2 m; and 20 degrees Celsius for elements less than 1 m thick.

- .9 Defective Concrete:
  - .1 Concrete not meeting requirements of Specifications and Drawings shall be considered defective concrete.
  - .2 Modify or replace concrete not conforming to lines, details and grades specified herein, or as indicated on Drawings.
  - .3 Repair or replace concrete not properly placed, resulting in excessive honeycombing, and honeycombed and other defects in critical areas of stress.
  - .4 Strengthen or replace concrete failing to meet strength requirements.
  - .5 The Contractor shall pay for additional testing and related expenses if the concrete has proven to be deficient.
  - .6 The Contractor shall replace or strengthen deficient concrete work as directed by the Consultant and pay for all testing and related expenses for replaced work until approved by the CA.
  - .7 Obtain CA's approval of exposed concrete. Regrind or otherwise correct surfaces the CA has not approved, to his satisfaction.
  - .8 Concrete that exceeds an internal temperature of 70 degrees Celsius during curing shall be replaced.
  
- .10 Temperature Monitoring:
  - .1 Monitor internal temperature of all mass concrete pours including dam piers.
  - .2 Monitor internal temperature of deck slabs.
  - .3 Monitoring shall include internal temperatures using thermocouples and surface temperature readings.

### 3.3 TESTING

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Owner/Consultant in accordance with CAN/CSA-A23.1/A23.2.
- .2 One concrete test shall be taken for each concrete pour, unless specified on site by the Consultant. Test shall include slump test and air entrainment.
- .3 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-destructive methods for testing concrete shall be in accordance with CAN/CSA-A23.2

PART 1 - GENERAL

Note: In this Section, the acronym "DR" is used for the Departmental Representative which defines the Owner's Engineer Consultant.

1.1 RELATED SECTIONS

- .1 Section 01 32 16 - Construction Progress Schedules - Bar Chart (GANTT)
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 35 29 - Health & Safety Requirements
- .4 Section 01 35 43 - Environmental Procedures
- .5 Section 01 45 00 - Quality Control.
- .6 Section 01 74 21 - Waste Management and Disposal
- .7 Section 01 78 00 - Closeout Submittals
- .8 Section 01 79 00 - Demonstration and Training
- .9 Section 03 10 00 - Concrete forming and accessories
- .10 Section 03 20 00 - Concrete reinforcing
- .11 Section 03 30 00 - Cast in place concrete
- .12 Section 11 20 00 - Wire Rope Hoists
- .13 Section 11 50 00 - Shop Painting and Galvanizing - Gates, Hoists
- .14 Division 26 00 00 - Electrical
- .15 Section 35 20 22 - Dewatering

## 1.2 SCOPE OF WORK

- .1 This Section covers the requirements for the supply of four (4) vertical lift gates with dimensions as shown on the tender drawings.
- .2 The scope of work includes design, fabrication, shop assembly, shop testing, delivery, erection and site testing of gates at the dam site according to requirements and standards described in this Section.
- .3 The scope of work also includes design, fabrication, shop assembly, shop testing, delivery, erection and site testing of gate embedded parts at the dam site according to requirements and standards described in this Section.
- .4 The scope of work also includes the concreting of the gate's embedded parts at the dam site, the supply and installation of waterstops in concrete cold joint.
- .5 The design of primary anchors for the embedded parts is excluded and shall be considered final as shown on tender drawings.

## 1.3 REFERENCES (considered the latest edition)

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA-S16-01, Limit States Design of Steel Structures.
  - .2 CSA-S16-1969, Steel Structures for Buildings.
  - .3 CSA-W59, Welded Steel Construction (Metal Arc Welding)
  - .4 CSA-G4-09, Steel Wire Rope for General Purpose and for Mine Hoisting and Mine Haulage.
  - .5 CAN/CSA-B78.2-M91 (R2002), Dimensioning and Tolerancing of Technical Drawings.
  - .6 CSA B97.1-1970 (R2002) - Standard Tolerances for Linear Dimensions, Inch and Metric.
  - .7 CSA B97.3-M1982 (R2002) - Tolerances and Standard Fits for Mating Parts, Metric Sizes.
  - .8 CAN/CSA-G40.20-13, G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.

- .9 CSA-W47.1-09, Certification of Companies for Fusion Welding of Steel.
- .10 CAN/CSA-W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .2 American Society for Testing and Materials (ASTM)
  - .1 A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - .2 A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - .3 A514/A514M-18e1, Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
  - .4 A504/A504M-18, Standard Specification for Wrought Carbon Steel Wheels.
  - .5 A27/A27M-19, Standard Specification for Steel Castings, Carbon, for General Application.
  - .6 A668/A668M-19a, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
  - .7 B584-14, Standard Specification for Copper Alloy Sand Castings for General Applications.
  - .8 A276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.
  - .9 E94/E94M-17, Standard Guide for Radiographic Examination.
  - .10 E390-15, Standard Reference Radiographs for Steel Fusion Welds.
  - .11 E709-15, Standard Guide for Magnetic Particle Examination.
  - .12 E165/E165-18, Standard Test Method for Liquid Penetrant Examination.
  - .13 E433-71(2018), Standard Reference Photographs for Liquid Penetrant Inspection.
  - .14 E164-19, Standard Practice for Contact Ultrasonic Testing of weldments

- .3 American National Standards Institute (ANSI)
  - .1 B4.1-1967(R2009), Preferred Limits and Fits for Cylindrical Parts
  - .2 B106.1M, Design of transmission shafting
- .4 National Building Code (NBC)
  - .1 Chapter I, Building and National Building Code of Canada 2015.
- .5 Ontario Construction regulation
  - .1 Occupational Health and Safety Act, R.S.O. 1990\_2018
- .6 American Iron and Steel Institute (AISI)
- .7 The American Society of Mechanical Engineers (ASME)
  - .1 ASME B46.1-2009, Surface texture (Surface Roughness, Waviness, and Lay)
  - .2 ASME/ANSI B1.1-2019, Unified Inch Screw Threads
- .8 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-48.9712-2006, Non-destructive Testing - Qualification and Certification of Personnel (ISO 9712: 1999, MOD).
- .9 Society of Automotive Engineers (SAE)

#### 1.4 DRAWINGS, DESIGN DATA AND CALCULATION BRIEFS

- .1 Tender drawings: the mechanical drawings attached to these documents are not intended to be "shop" or "working" drawings. Sizes and/or arrangements shown are only intended to demonstrate the feasibility of the preliminary design of the required works based on these technical specifications document.
- .2 Submit for review all erection and shop drawings, calculations for main components, technical specifications sheets, shop assembly procedure, site erection procedure and site testing procedure as per Section 01 33 00 - Submittal Procedures.
- .3 Show on the shop drawings, as a minimum, details of all the components including manufacturing materials, thicknesses of components, reinforcing components, locations and types of welds, details of weld joints, anchor rods, waterstops, locations of exposed fasteners, methods of assembly, surface finishes and textured of machined area, surface preparation, coating system, weights and characteristics of mechanical and electrical appliances and devices. Any other relevant information, as applicable, shall also be submitted.
- .4 Submit shop drawings and design calculations including load diagrams, reactions, and calculations for stresses and deflections for all parts provided for approval by the Departmental Representative "DR" prior to starting manufacture.
- .5 Gate calculations shall include, but not be limited to, combination of loading cases and various gate openings that evaluate the forces and other input used for sizing components and main features of the gate such as: skin plate, structural frame, gate wheels, gate wheel axles, bearings and boxes, guiding devices, lifting points and dogging devices.
- .6 Embedded parts calculations shall include, but not be limited to, combination of loading cases that evaluate the forces and other input used for sizing components and main features of the guides such as: Wheel tracks, guiding bars, sill beam and others supports for primary anchors. Calculations shall confirm that strength of concrete under gate wheel track is adequate for forces and pressures generated by the highest wheel loads.
- .7 Include on the drawings updates of revisions encountered during manufacture and submit a set of "As Built" drawings upon completion of the work.

- .8 Clearly identify information about bolt strength and required bolt torque on the shop drawings.
- .9 Before beginning manufacture, submit to the "DR", the mill test certificates, corresponding to all the materials to be used. Should these certificates not be available, pay the corresponding tests by an external laboratory subject to approval by the "DR".
- .10 Determine the mechanical and chemical characteristics of the materials in accordance with the requirements of the standards chosen and in accordance with the specific requirements in these specifications and on the drawings submitted to the "DR" for approval. Take and deliver to the "DR", at no additional cost, a representative sample of any material that the "DR" may require before and during the manufacture or during the assembly of the material on site.
- .11 Within one month of the awarding of the contract, provide the "DR" with a precise indication of the maximum loads, reactions, moments and thrusts transmitted to the structures, so that the definitive drawings for carrying out the civil engineering work can be reviewed.

#### 1.5 SUPPLIER QUALIFICATIONS

- .1 Design, drawings and manufacturing works to be carried out by qualified technicians, shall be supervised and approved by a professional engineer recognized by the Professional Association of Engineers in the province where the manufacture takes place. Apply for a permit, from the "Professional Engineers Ontario", to supervise the field work.
- .2 The Professional Engineer shall, at the least:
  - .1 Make and sign all calculations,
  - .2 Check, sign and seal all shop drawings,
  - .3 Perform site inspections of installed gates, embedded parts and their anchorages and confirms verification in writing that they were properly installed, have all the required components and are safe to operate. The Certificate shall be provided to the "DR" upon completion of the site testing.
- .3 The equipment supplier (and/or his subcontractors) shall be qualified in accordance with the requirements of CSA W47.1, Division 1 or 2.1.

- .4 The equipment supplier of the dam gates described in this Section shall also be the supplier of the wire rope hoist, the electrical controls for the hoists, the heating systems and the machinery bridge; described in other Sections of this specification.
- .5 All subcontractors shall be submitted to the "DR" for approval.
- .6 The equipment supplier is responsible for the coordination of the design, supply, installation and testing of the dam gates with all other equipment described in other Sections of this specification and is also responsible for their subcontractors' works.
- .7 The equipment supplier shall review and validate the content of any deliverable carried out by his subcontractor and shall apply a validation stamp on the document before issuing to the "DR" for approval.

#### 1.6 CLOSEOUT SUBMITTALS

- .1 Provide Operation and Maintenance Manuals as specified in Section 01 78 00 - Closeout submittals. Include in these manuals, all the information required for safe operation and maintenance, the technical data sheets for standard main components, the spare parts list, adjustment log sheets, technical bulletins and maintenance and operating instructions from subcontractors.
- .2 Provide a quality assurance manual which shall include the followings but not limited to:
  - all the materials certificates used as well as the quality control certificates;
  - Complete Inspection and Test Plan (ITP) including hold points, witness points, inspection and test procedures and reports;
  - Welding and preheat procedure, welding inspection reports;
  - General inspection reports, heat treatment charts and reports, assembly and FAT tests procedure and report;
  - Commissioning procedure and report.
- .3 Provide copies of all purchase orders, operating and maintenance manuals and specific certificates from the manufacturers.
- .4 Provide a complete list of "As Built" drawings and copies to include in Operation and Maintenance Manuals as specified in Section 01 78 00 - Closeout submittals.

### 1.7 TRAINING

- .1 Provide training for the operation and maintenance personnel as specified in Section 01 79 00 - Demonstration and training.

### 1.8 DESIGN OF GATES AND EQUIPMENT

- .1 Design all equipment to be supplied. Design, manufacture, assembly, method of operation and tests shall comply with the design criteria, codes and standards specified in these specifications. Do not modify without the "DR" approval.
- .2 Components with the same functions shall be interchangeable. This interchangeability shall extend to last with no fitting alterations to so-called wear parts. All mechanical equipment and accessories that have the same functions shall be supplied by a single manufacturer.
- .3 The "DR" has determined the dimensions of the sluiceway, the type and location of the gates and their method of operation.
- .4 Do not modify the dimensions of the gain slots planned in the primary concrete and all other dimensions for the civil structures, as well as the spacing and the physical characteristics of the primary anchors without the "DR" approval.
- .5 Coordinate the design work, manufacturing and installation until the work has received final approval.
- .6 Provide the "DR" with free access to the plant where the work is being performed. Also provide the "DR" with the resources necessary for him to be able to inspect the quality of the components to be provided.

### 1.9 HYDRAULIC DATA AND GENERAL DIMENSIONS

- .1 Maximum critical upstream water level (IDF): 181.35 m.
- .2 Maximum upstream water level (normal operating): 180.50 m.
- .3 Minimum upstream water level (normal operating): 180.20 m.
- .4 Maximum downstream water level (ever recorded): 177.66 m.
- .5 Average downstream water level: 176.48 m.
- .6 Elevation of deck: 181.80 m.
- .7 Upper level of the side guides for the gates: 182.80 m.
- .8 Level of the sill for the gates: 176.842 m.
- .9 Clear opening width: 6.096 m.
- .10 Gate height minimum: 4.035 m.
- .11 Minimum lift gate opening: 4.0 m.
- .12 Number of gates: 4

### 1.10 DESIGN CRITERIA

- .1 Gate Assembly
  - .1 Design the gates using the stressed skin plate design concept, which implies that the skin plate acts in conjunction with the main horizontal beams and the vertical stiffeners to which it is welded.
  - .2 The self-weight of the gate assembly shall exceed by a minimum of 25% the forces resisting closure considering the maximum critical upstream water level, including friction assuming static friction coefficients, buoyancy and hydraulic uplift.

- .3 The gate assembly shall be designed to satisfy the Von Mises-Hencky criteria for ductile fracture, with biaxial stresses limited in accordance with:

$$F_v/n = [f_x^2 + f_y^2 - f_x f_y + 3f_{xy}^2]^{1/2}$$

Where:

- $F_v$  = minimum specified yield strength of the material;  
 $n$  = Design factor >1.33;  
 $f_x$  = normal stress in x-direction;  
 $f_y$  = normal stress in y-direction;  
 $f_{xy}$  = shear stress.

- .4 Design the gates and embedded parts so that any deflection, bending, oscillations and vibrations to which they are submitted, will not result in faulty operation, deterioration or permanent distortion of the parts or the assemblies under stress.
- .5 Design all the work described in these specifications for a useful life of 50 years.

.2 Allowable Stresses

.1 Structural Normal Loading

- .1 The working stress method in CSA Standard S16-1969, CAN/CSA-G4 and CSA Standard W59 shall be used as a basis for the design of gate equipment. For normal loading conditions, the allowable stresses shall not exceed 90% of those permitted by the standards.

- .2 Where "Limit States Design" is used for the gates and their embedded parts, apply the provisions of Standard CAN/CSA S16 and CSA Standard W59. Apply loads, resistance and importance factors of these standards and consider the following:

- a) The hydrostatic load factor:  $\alpha L = 1.5$ .
- b) For simultaneous hydrostatic and seismic loading:  
 $\alpha L = 1.0$  hydrostatic load and  $\alpha L = 1.0$  seismic load.

- c) Consider the significance of the structures and the risk of injury in case of a failure, use an importance factor:  
 $\gamma = 1.0$  and a resistance factor for steel:  $\phi = 0.9$ .
- .3 Use 90% of the values given in the National Building Code for any stress limits not specified in the standards mentioned above.
- .4 The maximum combined stress in the skin plate shall not exceed  $\frac{2}{3}$  of the elastic limit of the material provided that the individual bending and shearing stresses do not exceed respectively 0.54 and 0.36 of the yield strength of the materials.
- .2 Structural Exceptional Loading
  - .1 Assume that the hoist motor develops its maximum torque when a gate jams in the guides and that the lift load is applied either to only one or both lifting points. The maximum combined stress in the material shall not exceed:
    - a) If load applied on two lifting points, 125% of the constraints allowed by CSA standards S16-1969 and CSA W59, without exceeding 75% of the elastic limit of the stressed materials.
    - b) If load applied on only one lifting point, 150% of the constraints allowed by CSA standards S16-1969 and W59, without exceeding 90% of the elastic limit of the stressed materials.
  - .2 For exceptional loading conditions considering an earthquake, IDF water level, ice or/and wind load applied on the gate, the working stress method in CSA Standard S16-1969, CSA Standard W59 and CSA B167-16 shall be used as a basis for the design of gate equipment. The allowable stresses shall not exceed 100% of those permitted by the standards.

.3 Embedded Parts

- .1 For the stresses in the concrete, use 90% of the values given in the National Building Code. The strength of the second phase concrete after 91 days is 35 MPa.
- .2 For the bearing pressure transmitted to the concrete by the rear flange of the beam supporting the rolling path of the gate main wheels, do not exceed a value of 11.6 MPa if  $L > L'/4$  or 7.8 MPa if  $L < L'/4$ .
  - a) In this definition,  $L$  is the distance measured at right angle to the rear flange, between the effective end of this flange and the surface in contact with the water, and  $L'$  is the effective width of the rear flange.
  - b) For the effective width of the flange, use the width of the flange, and assume a uniform stress distribution, symmetrical with respect to the beam web.
- .3 When a gate jams in the guides and the lift load is applied either to only one or both lifting points, the bearing pressure transmitted to the concrete by the embedded parts shall not exceed 23.6 MPa.
- .4 The gate guides shall be designed using theory of "beams on an elastic foundation".

.4 Welded Connections

- .1 Basic allowable stresses in welded connections shall not be greater than 90% of the values permitted by CSA Standard W59. In the welded compression ("bearing") assemblies of wheel path, the welds must be established considering that all the effort is transmitted by the through these.

.5 Bolted Field Connections

- .1 All field connections for structural steel shall be designed using high strength bolts in friction type connections, in accordance with the CSA Standard S16. The loads shall not exceed 90% of those permitted by CSA Standard S16.

.6 Mechanical Components - Fixed Wheel

- .1 To minimize roller loads due to the misaligned roller path, the design will be conducted to distribute the total gate load as evenly as possible among the wheels.
- .2 The maximum shear stress of the wheel and of the wheel path will not exceed the lesser of the following values: 2.4 times the minimum BHN hardness of the softer material or 620 MPa.
- .3 The maximum compressive stress of the wheel and of the wheel path will not exceed the lesser of the following values: 6.9 times the minimum BHN hardness of the softer material or 1725 MPa.
- .4 The rolling surface of the wheels must be crowned. The ratio of the radius of curvature of the radius of the wheel must be equal to or less than 8. The radius of curvature shall however, not exceed 3000 mm.
- .5 The minimal width of the wheel and the wheel path will not be less than:

$$W_{wheel} = \frac{P}{F_{p wheel} D} \qquad F_p = \frac{0.169 (BHN_{wheel}) - 15.169}{3}$$

$$W_{wpath} = \frac{P}{F_{p wpath} D} \qquad F_p = \frac{0.169 (BHN_{wpath}) - 15.169}{3}$$

W = Wheel or Wheel path width in mm.

P = Wheel load in N.

D = Wheel diameter in mm

Fp = Allowable stress on wheel projection or wheel path projection in MPa.

BHN= Brinell Hardness Number

- .6 However, the width W will not be less than the length of the major axis of the contact ellipse plus 25 mm or minimum 75 mm, taking into account the deflection of the gate.
- .7 The thickness of the wheel path shall not be less than seven times the half-length of the minor axis of the contact ellipse formed in contact with the wheel on the wheel path.

- .8 The angle of diffusion of the load of a wheel through the beam supporting the wheel path must be considered equal to  $45^\circ$  to the lower flange without the superposition of the loads coming from the adjacent wheels.
- .9 The beam web's design which supports the wheel path must consider the forces induced by the anchor rods for all specified load cases.
- .7 Mechanical Components - Shaft
  - .1 Rotating shaft must be design in accordance with ANSI/ASME B106.1M Standard.
  - .2 The corrected endurance limit  $S_f$  of the material shall be considered equal to  $S_f = 0,5 k_f F_u$ , where:
    - $F_u$  = Ultimate strength of the material
    - $K_f$  = Concentration bending factor
  - .3 For all normal conditions, effort must be increased by 25% due to an impact factor and the Safety factor must be greater than 3.3.
  - .4 For exceptional conditions as the lifting load is applied on only one or two lifting points, the Safety factor must be greater than 2.7 and 2.2 respectively.
- .8 Mechanical Components - Others
  - .1 For all components for which allowable stresses are not covered in these criteria, the allowable stresses shall not exceed 33% of the yield strength and 20% of the ultimate strength of the material.
  - .2 AISE Standard No. 7 shall be used for determination of allowable stresses for hooks with no additional safety factors applied. Stresses may be increased by 33% for extreme loading conditions.
- .9 Allowable Deflection
  - .1 In addition to the load cases, do not exceed  $1/800$  of the span for the deflection of the structural members of the gate.
  - .2 For design purposes, use the following coefficients of friction:

	<b>Static</b>	<b>Dynamic</b>
▪ Self-lubricated bronze bearings ("Lubrite" or approved equivalent)	0.15	0.10
▪ Stainless steel on stainless steel	0.4	0.2
▪ Rubber seals on stainless steel	1.5	0.75
▪ Rubber seals with fluorocarbon sealing surfaces on stainless steel	0.15	0.10
▪ Rolling of wheel on the track	0.75	0.75
▪ Roller bearing	0.015	0.01
▪ Wet steel on wet steel	0.4	0.2
▪ Steel on steel (non-lubricated)	0.5 @ 0.8	0.4

.3 Minimum Thickness of Component

.1 The thickness of the materials must be sufficient to withstand the stresses to which they are subjected given the permissible constraints. However, every component must respect the following minimum thicknesses:

a) Embedded parts

1. Exposed parts: 12 mm
2. Partially exposed: 12 mm
3. Embedded: 8 mm
4. Machined or S/ST faces: 10 mm

b) Gate

5. Structural component: 12 mm
6. Non-structural component: 8 mm
7. Machined or S/ST faces: 10 mm

c) A thickness of 1.5 mm for corrosion must be provided on the skin plate and weld components of the skin plate of the gate.

.4 Temperature

- .1 Design the equipment to operate adequately following a prolonged shutdown, and in outdoor temperatures varying between -40 and +40 degrees Celsius with 100% of relative humidity.

1.11 DESIGN LOADS

.1 Gates

Design the gates so that the stresses in each of their components are less than the maximum allowable defined in these specifications, for the most unfavourable combinations of load cases described below:

.1 Normal Load Conditions

- .1 Maximum hydrostatic pressure acting on the gate, corresponding to the maximum upstream operating water level and to the average downstream operating water level.
- .2 All hydrodynamic forces acting on the gate, both when it is moving and when it is not, that is during normal opening and closing, for whatever the variations are in upstream and downstream levels for the range of foreseeable variations.
- .3 The weight of the gate and its accessories;
- .4 All the lifting and friction forces possible acting independently or simultaneously.
- .5 The required lifting load shall be multiplied by 125% to take into account the impact load.
- .6 A 150 kN/m, 300 mm thick floating ice load acting on the width of the gate within the range of winter water levels. This load can act over the entire height of the upstream face of the gate, taking into account the possibility of operation of the gate in partial openings. Ice loading could also act on its downstream skin plate within the highest water level.

- .7 An ice load 75 mm thick on half of all the external surfaces of the gate.
- .8 A wind load of 0.4 kPa on all external parts of the gate.
- .9 A snow load of 2.4 kPa on exposed horizontal surfaces.
- .10 In addition to the load cases listed above, design the gate structure and the main wheels for a lateral load applied to the exterior surface of the wheel path, equivalent to 30% of the maximum normal hydraulic load for the most loaded wheel.

.2 Exceptional Load Conditions

- .1 The increase in hydrostatic pressure due to earthquakes calculated in accordance with the method proposed by the USBR in its "Monogram 11 -Hydraulic Pressure on Dams Due to Horizontal Earthquake Effect" using a factor for seismic intensity is taken as being equal to 0.02.
- .2 All forces resulting from a jamming of the gate in the guides when it is suspended by one or two lifting points and the hoist motor develops its maximum stalling torque (refer to Section 11 20 00 - Wire Rope hoist Article 3.1.6).
- .3 The maximum hydrostatic pressure acting on the gate, corresponding to the maximum critical upstream water level(IDF) and to the average normal downstream water level for operation.
- .4 All forces acting on the downstream side of the gate resulting from the hydrostatic pressure corresponding to the downstream maximum water level ever recorded.

.2 Embedded Parts

Design the embedded parts, including the tie rods that connect them to the primary anchors so that the stresses in each of their components are less than the maximum allowable defined in these specifications, for the most unfavourable combinations of load cases described below:

- .1 Design the embedded parts of the gates to resist the most critical stresses developed by the gates when subjected to the loads described in the preceding paragraphs (Article 1.11.1).
- .2 Design the embedded parts, including the tie rods that connect them to the primary anchors, to resist a lateral load of 100% of the maximum hydrostatic load exerted on the gate, assuming the concrete under the support beams of the rolling paths is sheared along on a frictionless slip plane at 45° with respect to the centre lines of the beams, tie rods and anchors for the beams.
- .3 Design the portion of the embedded parts downstream of the seals to resist forces exerted by the infiltration of water between the first and second phase concrete under the maximum head. Do not combine this load case with the other cases.
- .4 Design the portion of the embedded parts downstream of the seals to resist forces exerted by the infiltration of water between second phase concrete and the steel liner of the embedded parts under the maximum head. Do not combine this load case with the other cases.
- .5 Design the embedded parts, including the tie rods that connect them to the primary anchors and the steel lining of the side guides to resist the forces exerted by the second phase fluid concrete. Do not exceed a maximum height of the pour of 2 m. Use a specific weight of the fluid concrete of 2,400 kg/m<sup>3</sup>. Do not combine this load case with the other cases.
- .6 Design the embedded parts so that the stresses to which the tie rods and anchors are exposed during installation and during operation do not exceed the allowable stresses in the materials used.

### 1.12 TOLERANCES

- .1 Except where otherwise indicated in these specifications, refer to the following standards concerning the design and tolerancing of the mechanical parts:
  - .1 CAN/CSA-B78.2;
  - .2 CSA B97.1;
  - .3 CSA B97.3.

### 1.13 WASTE MANAGEMENT AND DISPOSAL

- .1 Eliminate waste from the site in compliance with Section 01 74 21 - Waste management and disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the "DR" for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.
- .2 Use new materials for the fabrication of all permanent elements.
- .3 Use only stainless steel fasteners for the assembly of all equipment.

.2 Materials

- .1 Skin plates and steel profiles: CAN/CSA G40.20/G40.21 Type W, Cat.3, except where otherwise indicated.
- .2 Primary anchors, tie rods and nuts: ASTM A325 / A307 ; washers: AISI 4142. Fabricate as shown on the drawings.
- .3 Rolling paths of the main wheels: ASTM A514 Grade Q
- .4 Wheels: ASTM A504 Class C
- .5 Wheel axles: AISI 4340
- .6 Moulded parts: ASTM A27 Grade 70-40
- .7 Forged parts: ASTM A668
- .8 Bronze bearings: ASTM B584
- .9 Stainless steel plates and bars: ASTM A276 Grade 304
- .10 Stainless Steel bolts, washers and nuts: ASTM A276 Grade 304 / A193 B8-B8M AISI 430 F.
- .11 Helical springs: AISI 5160 with hardness from RC 41 to 48.
- .12 Leaf springs: AISI 5160 with hardness from RC 41 to 48.

.3 Waterstops selection and notes

.1 Type: Hydrophilic rubber sealing strip

.2 Model: *Sika Hydrotite CJ-0725-3K*

.3 Sealant: *LEAKMASTER LV-1*

.4 Manufacturer's notes:

- The Vendor shall store *Sika Hydrotite* in a cool, dark, dry place (or as per manufacturer recommendations).
- *Sika Hydrotite* shall be installed following the procedure recommended by the manufacturer (including quality assurance).
- *Sika Hydrotite* CJ profiles shall be installed after the form is stripped from the first pour and before the second concrete pour is made.
- The Vendor shall remove all dust, oil, laitance, etc, from concrete surface prior to adhering *Sika Hydrotite*.
- Installation of the *Sika Hydrotite* profile should be timed as close as possible to the second placement of concrete to reduce the chance of premature expansion of *Sika Hydrotite* due to rainwater or ground water exposure.
- The Vendor shall protect exposed length of *Sika Hydrotite* from moisture. In the event the exposed *Sika Hydrotite* exhibits expansion before the next placement of concrete, the Vendor shall remove swelled material before splicing to a new length of *Sika Hydrotite*.
- Splicing of *Sika Hydrotite* shall follow the procedure recommended by the manufacturer (including quality assurance) and shall comply with the procedure approved by the CA.

PART 3 - EXECUTION

3.1 DESCRIPTION OF THE EQUIPMENT - GATES

.1 General

- .1 Provide four (4) heated dam gates.
- .2 The gates shall be flat, mounted on wheels, with two lifting points and a watertight upstream seal.
- .3 The gates shall have a full upstream skin plate, and a partial downstream skin plate, on their lower portion as shown on the drawings in order to create a watertight casing.

.2 Framework

- .1 The framework of the gates shall be of welded construction. Each gate shall comprise an upstream skin plate welded to main horizontal beams spaced so that each is submitted to the same hydrostatic load. The framework shall be reinforced, as required, by diaphragms and stiffeners and side mounts on which shall be mounted the main wheels that are supported on the rolling paths of the embedded parts.
- .2 The top of the gate shall be flat and slightly inclined downstream to prevent any water accumulation.
- .3 The gate shall be fabricated in a single section having such dimensions as to enable transportation. No field splicing or onsite welding of the gate skin plate to be permitted.
- .4 The gate lip shall be designed to avoid vibrations and harmful hydrodynamic forces during manoeuvres.
- .5 Dismantlable watertight and insulated inspection traps shall be provided on the downstream cladding as shown on the drawings.
- .6 Prepare fabrication details so that no accumulation of water or dirt on the structures occurs and all surfaces are easily accessible for inspection and maintenance.
- .7 Drainage holes at least 75 mm diameter shall be provided by Vendor in the web of each horizontal beam. Additional holes shall be provided where necessary for drainage and equalize pressure.

.3 Heating

- .1 The gate shall be heated so that ice will not adhere to the upstream face of the gates nor build up on the vertical seals, or vertical end members and wheels when the gate is in the closed position.
- .2 The heating system for each gate shall consist of electric tubular heating elements with capacities and characteristics as indicated in Section 26 24 21 - Gain and gate heating. This system consists of six (6) heating elements located in vertical square tubing beam as shown on drawings. The bottom end of the heater gains shall be provided with a drain. The drain shall be equipped with a check valve (1-way valve) to direct the condensation water to the downstream side of the gate while preventing downstream water from entering the gate.
- .3 Additional heating elements shall be provided in order to avoid ice formation at the bottom on the downstream side of each gate, consistently adapted with the gate structural design proposed by the Vendor. This additional heating system shall be adapted to work within a possible presence of water inside the bottom of the gate.
- .4 The systems shall be mounted as shown on drawings with heaters connections located in the top section and ensure easy access for maintenance and removal/replacement with removable seal covers with stainless steel fasteners. The covers shall be paint coated independently from the gate.
- .5 Supply the flexible power supply cable on the outside of the gate and accessories. Refer also to Division 26 00 00 - Electrical.

.4 Main wheels, upstream guide rollers

- .1 The number of main wheels and their spacing shall be established so that each wheel carries the same hydrostatic load.
- .2 The bottom pair of wheels shall be located as high as possible in order to avoid being trapped in ice formation because of the downstream water.

- .3 During the lifting of the gate, at a specific level, its upper portion comes out of the gain. In order to keep the balance of the gate from this point until it reaches the fully open position, the location of the wheels shall be established so the gate is adequately support inside the lateral gains. Load calculations shall demonstrate the balance of the gate in fully open position.
- .4 The wheels shall be of forged steel with a rolling surface hardened to between 320 and 365 BHN. The rolling surface shall be slightly convex (crowned) to take into account the deflection of the gate due to load.
- .5 The wheels shall be double flanged type to provide proper lateral guidance for the gate during its descent. The lateral clearance between the wheel flange and the roller path shall be 6 mm.
- .6 They shall be mounted on tapered roller bearings fabricated by a reputable manufacturer (SKF, FAG, TIMKEN or Equivalent manufacturer). The safety factor for the bearing static load shall be greater than 1.0.
- .7 The nominal clearances between the main wheels and their upstream wheel path on the embedded parts shall be 10 mm when the upstream hydrostatic pressure is applied on the gate.
- .8 The ends of the main wheel axles shall be machined with an eccentricity of at least 3.0 mm with respect to the machined surface of the bearings, to allow the wheels to be aligned. In addition, after adjusting the wheels, these axles shall be locked mechanically to prevent them from rotating and becoming misaligned.
- .9 The roller bearing shall be provided with steel covers having watertight seals to protect the bearings.
- .10 A grease point shall be provided in each wheel axle. Stainless steel tubes shall bring each grease point to centralized lubrication watertight panels at the top of the gate. The lubrication nipples shall be also watertight.

.5 Sealing

- .1 The gate lip shall have a flat type rubber seal located below the gate bottom edge. In addition, the gate sill shall be sealed watertight by machining the bottom edge of the gate and assembled in accordance with the tolerances and gaps specified in Table F2 in Article 3.11 of these specifications.
- .2 The gate lip shall be protected by a cladding of stainless steel with a final minimum thickness of 5 mm.
- .3 Side seals shall be made using stainless steel solid round bars suspended from the top of the skin plate at each end of the gate by an articulated holding system. This system shall be adjustable in height and allow the bars to move laterally easily and thus, with the action of the hydrostatic pressure, to rest on the stainless steel machined plate welded to the gate and to the stainless steel machined plate of the embedded parts.
- .4 The stainless steel plates welded to the gate and to the embedded parts shall be machined along their entire length. The bottom face of the round bar shall be machined to create a sealing plan with the sill beam top surface.
- .5 The holding system of the sealing bars shall be composed of the following:
  - Stainless steel hanging bracket welded to the gate
  - Stainless steel welded eyebolt with nuts and washers 3/4in dia. min.
  - Stainless steel grade 8 welded chain links 1/2in dia. min.
  - Minimum of five (5) two-parts retaining brackets along the seal bars to hold them in contact with the sealing plates. First part consists of a supporting plate welded to the skin plate of the gate with threaded holes and second part consists of a short guide arm with a rounded cut-out adapted to the seal bar and bolted with stainless steel hardware into the supporting plate.

Note: The bottom retaining bracket shall be located as low as possible while the top bracket shall be located as high as possible.

- .6 Sealing continuity shall be maintained between the bottom and the side seals.
  - .7 The sill rubber seal shall be of moulded elastomeric fabrication mounted on machined steel bars and fixed with clamping bars and stainless steel fasteners.
  - .8 The seals shall be in sections as long as practicable. Seal fasteners shall not be less than 16 mm diameter, countersunk, flat head, stainless steel cap screws with stainless steel hexagon nuts and washers.
  - .9 Normal spacing of fasteners shall not exceed 100 mm.
  - .10 When the gate is closed and the hydrostatic pressure is exerted by the maximum water head, leakage shall be no greater than 2 litres/min per metre of seal. The leakage rate of the gate shall be no greater than 50 L/min.
- .6 Lifting points
- .1 The gates shall be provided with two stainless steel lifting points located at the bottom of the downstream skin plate, welded and designed in accordance with the requirements of the design of the hoists complying with Section 11 20 00.
  - .2 Lifting lugs shall be provided on the upper part of the gates for inserting them into their respective openings using a mobile crane.
- .7 Suspension arms
- .1 The gate shall be designed to support his own weight when in dogging position.
  - .2 The dogging device shall be located in the lateral side of the gains (extension part above the deck elevation).
  - .3 The gate shall be designed to provide varying level of suspension over the height of the gate.
  - .4 The gate shall be designed to fit with the dogging device from the embedded parts.

.8 Staff gauge and square

- .1 The gate position indicator shall consist of a marker attached to the top of each gate pointing to a staff gauge attached to the lateral guide and shall be provided at each hydraulic passage (sluice). The indicator must be positioned on the left bank and downstream side of the gate and shall not exceed the height of the lateral guide (stop at the top of the embedded guide top covers as shown on tender drawings).
- .2 The graduation of the staff gauge must be in meters and centimeters (with bold marks each 5 cm and 10 cm) and must indicate the position of the lower edge of the gate from the sill elevation. The graduation shall be easily readable from the control panel located on the right bank.
- .3 Components shall be made of corrosion resistant material as aluminium and fixed with stainless steel fasteners.
- .4 Staff gauge marks shall be painted in black and the square shall be painted in red.

.9 Metal cladding

- .1 The downstream surface of the gate shall be closed by means of cladding panels fixed to the flanges of the horizontal beams in order to form a closed and heated sections. The downstream cladding shall consist of metal cladding, minimum 38 mm thick rigid insulation and a Vicwest type steel cladding. The installation shall avoid thermal bridge. The top horizontal beam shall also be insulated with an insulation of the same type. This cladding is to close off the gate in order to meet the criteria for heating in Article 3.1.3.
- .2 The cladding shall be a type of corrugated sheet in a black colour.
- .3 The cladding shall be watertight and integrated localised hatches for maintenance of the heating units, access to the wheel assemblies and to the bottom casing of the gate.
- .4 Provide galvanized bolts to hold the cladding sections in place.

### 3.2 DESCRIPTION OF THE EQUIPMENT - EMBEDDED PARTS

#### .1 General

- .1 Supply four (4) set of embedded parts including waterstops and second phase concreting.
- .2 One set of embedded parts is required for each sluiceway. A set includes one (1) sill beam and two (2) side guides.
- .3 Supply for each set of embedded parts, the tie rods for fastening the embedded parts to all of the primary anchors, the nuts and washers.
- .4 The second phase concrete called as "new concrete" on drawings shall be formed and reinforced with rebars and dowels. It shall include the supply and installation of the primary anchors as mentioned in Article 3.2.4.
- .5 The number of tie rods, washers and nuts shall be at least 4% higher than the exact number needed as determined on the drawings.
- .6 Primary anchors are not adjustable and considering the installation tolerances, the diameter of the holes in the embedded parts shall be at least 12 mm larger than the diameter of the anchors. Provide special wide washers to allow effective tightening of the nuts.
- .7 Manufacturing tolerances shall allow for ease of installation and final adjustment of the embedded parts, in accordance with the tolerances for assembly specified in these specifications, without rectification on site.
- .8 The design shall take into account requirements for transportation and lifting points for installation. Temporarily reinforce the side guides with cross-bracing to prevent these parts from warping while they are being handled and concreted.
- .9 The arrangement of all the embedded parts shall be such that the pouring of the second phase concrete does not form air pockets.

.2 Sill beam

- .1 The sill beam shall be of welded construction. It shall be subjected to mechanical or heat treatment for stress relieving before any machining work and shall be machined in the shop. Its upper face shall be stainless steel and machined along its entire length.
- .2 The upper face of the sill beam shall be levelled with the concrete, as shown on the drawings.

.3 Side guides

- .1 The side guides include the downstream roller paths, the upstream guiding path, the sealing path and the steel liner covering the slots. The guides shall be rigid and of welded construction. The guides shall be reinforced with stiffeners, subjected to heat treatment for stress relieving and shall be machined in the shop. Final assembly of the guides shall be carried out prior to heat treatment and machining.
- .2 The upper end of the upstream, lateral and downstream faces of the guides shall be flared to allow the gate to engage gradually in the guides.
- .3 The sealing plate shall be stainless steel and machined along its entire length. It shall be designed to ensure the watertightness required after installation. The top edge of the sealing faces shall be chamfered to allow gradual engagement of the seal when the gate is lowered.
- .4 The rolling paths for the main wheels of the gates shall be made from a corrosion-resistant alloy steel, with a hardness of between 235 and 270 BHN. These rolling paths, machined along their entire length, shall be made of continuous strips along the entire height of the guides.
- .5 Machined surfaces shall be provided for the lateral guiding surfaces (side surface of roller path) and shall be paint coated after machining).
- .6 The nominal clearance between the upstream guide path and the main wheels shall be 10 mm. The lateral clearance between the main wheel flanges and the side surface of the roller path shall be between 6 mm and 10 mm per side.

- .7 Lining shall be provided on the downstream side of the guides. This lining shall be assembled by welding it on site to the guides and to the corner members embedded in the first phase concrete, as shown on the drawings. This lining shall be anchored securely enough in the second phase concrete to prevent it from warping.
  - .8 The extension part of the side guides above the deck elevation 181.80 m, shall be covered on the exterior side by a steel jacket. The steel jacket shall be used to protect the concrete at this elevation and shall be watertight. The top of the extension part of the embedded parts are covered with a removable gain heater cover. Both parts are made from 3 mm galvanized steel as shown on drawings. The cover and the gate shall not be in interference at any time during operation of the gate.
  - .9 As the extension part of the side guides above the deck elevation 181.80 m is formed out of second phase concrete only (without primary concrete supporting behind), there are no primary anchors in this portion of the side guides. Taking into account a concrete strength of 35 MPa, the vendor shall reinforce the steel jacket covering the extension part in order to improve the adhesion of the concrete to the metal and also reinforce the embedded part structure.
  - .10 To help withstand lateral loads that could applied on the extension part above the deck level, anchors shall be added in the portion of second phase concrete between elevations 181.20 m and 181.80 m (new concrete as shown on drawings) to tie up with the side guides. Vendor shall include the validation of these anchors in the calculations to be submitted for approval.
- .4 Primary Anchors
- .1 The primary anchors for the embedded parts will be supplied and installed by the civil Contractor during the dam construction.
  - .2 The primary anchors to be installed in the portion of the secondary phase concrete above deck level, identified as "new concrete" on the drawings, shall be supplied and installed as shown on drawings by the Vendor.

- .3 The primary anchors shall be installed in the concrete within a position tolerance of +/-6 mm.
- .5 Heating
- .1 All the embedded parts of the gate water passages shall be equipped, as shown on drawings, with tubes to accommodate heating elements to prevent ice from forming at all times on the seals path and the wheel path. The four (4) water passages shall be equipped with adequate heating elements with capacities and characteristics as indicated in Division 26 00 00 - Electrical.
- .2 The heating elements shall be supplied by the Vendor.
- .3 The heating elements shall be installed in square tubular beams welded on embedded parts to heat rolling paths and sealing surfaces (see tender drawings).
- .4 The heating elements shall be provided with an incoloy sheath of high quality to ensure they can be used immersed or dry. The ends of the sheaths shall be sealed in epoxy within a metal terminal box that adapts to the sleeves of the heating tube of the guide.
- .5 Each side guide for a gate shall be equipped with three (3) heating elements 5.95 m long.
- .6 The elements shall provide heat from level 176.842 m to level 182.80 m.
- .7 The required linear heating power is 500 W/m.
- .8 The lower ends of the heating elements tubular beams shall be closed, watertight and connected to the drainage pipe installed in the civil structure (by others) as shown on drawings with welded connections. At their upper ends, they shall have sleeves adapted to the shape of the terminal box of the heating element.
- .9 For transportation and installation manoeuvres, the heating elements tubular beams shall be cleaned and supplied with removable plugs in all openings in order to avoid dust and other debris to get inside. Plugs shall be removed only to install and connect the heating elements and drainage pipes.

.10 The cables routing from the electrical cable tray to the heating element upper end shall be hidden in the concrete and under the deck as possible.

.6 Dogging device

- .1 The dogging device shall be located in the side extension guide concrete structure at the elevation 182.35 m. Based on Vendor's gate design, the final dogging positions of the gate shall be submitted for approval to the "DR".
- .2 The dogging device shall consist of a thick steel plate of minimum 50 mm, equipped with a handle on the exterior side of the guides, which rotates around a middle pivot pin as shown on the drawings.
- .3 The dogging device shall be lockable providing a padlock and eyelet.
- .4 The concrete pocket around the dogging device opening shall be reinforced.

.7 Waterstops

- .1 Waterstops shall be supplied for all sluices and installed, in construction joints, in vertical (lateral) and horizontal (sill) gain slots as shown on drawings.
- .2 Waterstops type shall be of Hydrophilic rubber sealing strip and shall be used with a water swelling sealant and fixed with concrete nails. Refer to Part 2 - 2.1.3 *Waterstops selection and notes*.
- .3 Adequate clearances shall be maintained between waterstops and reinforcing steel and embedded parts.
- .4 The Vendor shall specify on concrete pour drawings all the details for the path, the installation and the protection of waterstops.
- .5 Prior to starting works, the Vendor shall submit the procedure for waterstop installation to the CA for approval.
- .6 The Vendor shall comply with the waterstop manufacturer's requirements, which include those specified in Part 2 - 2.1.3 *Waterstops selection and notes*.

### 3.3 FABRICATION - GENERAL

- .1 Fabrication by the Vendor shall comply with the requirement of CSA S16 for Structural Steel, except where otherwise specified herein or shown on Vendor's shop drawings.
- .2 All plate and structural steel shall be accurately fabricated by the Vendor true to drawing dimensions and free from warp or rust. The edges to be joined by the Vendor shall expose sound metal, free of visual laminations, cracks and other injurious defects.
- .3 All tolerances shall be defined on the Vendor's shop drawings for both manufacturing and installation purposes.
- .4 Holes shall be drilled full size or drilled under size and reamed during shop assembly. Punches holes shall only be permitted in plates 20 mm or less in thickness provided that all such holes are subsequently reamed full size during shop assembly.
- .5 Surface finishes shall be indicated on the Vendor's shop drawings in accordance with ASME B46.1. Compliance with the specified surface finish shall be determined by comparison with standard roughness specimens in accordance with ASME B46.1.
- .6 All the threads shall be SAE standard type.

### 3.4 QUALITY CONTROL

- .1 Develop and submit for review and approval by the "DR" and execute a comprehensive "Inspection and Test Plan (ITP)" including but not limited the following:
  - .1 The fabrication control methods for the gate and the embedded parts showing that the tolerances specified in Table F1 and F2 will be met during assembly and after concreting.
  - .2 The welds inspection requirements described in items of the present specification.
  - .3 Engage the service of 3rd party inspectors to perform the appropriate inspection and test plan.
  - .4 Submit copies of all inspection reports and quality records generated during fabrication.

### 3.5 WELDING AND WELD QUALITY CONTROL

- .1 Welds and welding procedures shall be qualified in accordance with CSA W47.1.
- .2 The electrodes for welding: CSA W48.1. Use low hydrogen electrodes. Reject any electrodes that have absorbed moisture.
- .3 All welds shall comply with CAN/CSA W59 and all inspection and non-destructive testing shall comply with CAN/CSA W59 Part 11.
  - .1 For members on which forces occur, execute welds in the shop. In general, only sealing welds are permitted on site. Submit any weld executed on site to the "DR" for approval.
  - .2 Submit welding procedures along with proof that the qualification tests were carried out for each type of joint. The welding procedures are submitted to the "DR" for approval.
  - .3 All inspection and non-destructive testing requirements shall be clearly specified on Vendor's shop drawings.
  - .4 The plates to be welded shall be cut carefully to the correct sizes. The dimensions and shape of the edges to be joined shall provide for a strong bond and complete penetration.
  - .5 Welds shall be executed only when the temperature of the base metal is above 10°C. Preheat all surfaces within a radius of 75 mm of the welding point, in accordance with CAN/CSA W59, and maintain this temperature until the welding process is completed. Measure the temperature with temperature indicator sticks or other means submitted to the "DR" for approval. Hammering of welds is not permitted.
  - .6 Clean off a 50 mm band on each side of the joint for a total width of 100 mm to eliminate rust, grease and burrs.
  - .7 Submit the welded parts, the surfaces of which are machined for precise alignment, to mechanical or heat treatment prior to machining. Specify the treatment method in the description of the procedure or on the shop drawings.
  - .8 Inspect visually 100% of all welds.
  - .9 Inspect 20% of butt welds in flanges stressed under tension by X-ray.
  - .10 Inspect 5% of butt welds in flanges under compression and any

- skin plate acting as a beam flange by X-ray.
- .11 Inspect 10% of butt welds in the beam webs by magnetic particle inspection or by dye penetrant inspection.
  - .12 Inspect 10% of fillet welds by magnetic particle inspection or dye penetrant inspection.
  - .13 Whenever there are repairs to be made following the inspection, grind out the defects down to the sound metal and the repaired welds shall be 100% inspected in accordance with the method used originally. When an inspected area reveals defects that are subject to repair, adjacent areas must also be inspected in accordance with CSA W59. If any of the adjacent areas also have defects, the seal must be inspected in its entirety.
  - .14 When an X-ray inspection is impossible due to difficulty of access, an ultrasound examination submitted to the "DR" for approval may be used.
  - .15 Lack of penetration and incomplete fusion shall not be tolerated. Porosity and insertion shall not exceed the limits of "Level 4", as defined in ASTM Standard E390 for the thickness concerned.
- .4 Perform weld quality control by X-ray, ultrasonic examination, magnetic particles or dye penetrant as follows.
- .1 Perform X-ray in accordance with ASTM standards E94 and E390 and taking into account the utilization limits for each method specified. Operators and technicians shall possess a competency card issued by the Canadian General Standards Board (C.G.S.B.). The interpretation of radiographic shots shall be carried out by a specialist recognized and certified by the C.G.S.B., in compliance with CAN/CGSB-48.9712 level 2. Each weld deemed unacceptable shall be repaired or replaced by an acceptable weld.
  - .2 Carry out ultrasonic examination in accordance with ASTM E164-19.
    - .1 Ultrasonic examination of welds, as a replacement for or complementary to X-ray examination, is acceptable on condition that all justifications for the validity of the proposed method be provided, subject to the prior agreement of the "DR".

- .2 Ultrasonic examination is only acceptable if it is carried out using a machine of a recognized brand.
  - .3 Technical procedure sheets describing the method used, the degree of sensitivity obtained, the equipment, the sensors, etc., shall be submitted to the "DR" with proof of the competency of the technicians, before this examination method can be adopted.
  - .4 Inspection reports including drawings, sketches and photographs shall be submitted to the "DR" with all the details to allow the ultrasonic examination to be repeated exactly, at any time.
  - .5 Only senior technicians holding a "C.G.S.B. - CAN/CGSB 48.9712 - Senior Level" competency cards are authorized to prepare the technical procedure sheets and to interpret the results.
- .5 Perform magnetic particle inspection in accordance with ASTM Standard E709.
- .1 Eliminate striations and irregularities prior to examination.
  - .2 Take all precautions to avoid a deterioration or a superficial burn at the contact points of the electrodes. The strength of the electrical current, the period of time it is applied and the direction of the magnetic field, shall be as prescribed in the standards. An indicator for the intensity of the magnetic field shall be used frequently. In addition, include demagnetization of the part, should residual magnetism present a problem.
  - .3 Only operators and technicians approved and certified by the C.G.S.B. in compliance with CAN/CGSB-48.9712 are authorized to carry out these examinations and to interpret the results.
- .6 Perform Dye penetrant inspection according to ASTM standards E165 and E433.
- .1 Eliminate striations and irregularities prior to examination.
  - .2 Carry out effective conditioning or cleaning shall prior to the application of a liquid penetrant.
  - .3 Only operators and technicians approved and certified by the C.G.S.B. in compliance with CAN/CGSB-48.9712 are authorized to carry out these examinations and to interpret the results.

### 3.6 LUBRIFICATION

- .1 The components requiring lubrication are the main wheels.
- .2 Lubrication points shall be connected by tubes to header blocks at the top of the gate. All lubricating header blocks shall be equipped with 1/2" stainless steel button type grease fitting.
- .3 All lubricants shall be all-season type and biodegradable. They shall be able to withstand temperature changes from -40°C to +40°C without losing their properties.
- .4 Provide a mobile automatic lubrication pump with hose for the lubrication process such as DEWALT 18V. model DCGG570K or equivalent.

### 3.7 NAMEPLATE

- .1 Provide and install a nameplate on top of the gate. This nameplate shall be easily readable and shall clearly show the following information, but not limited to:
  - .1 Name of the Vendor;
  - .2 Name or identification of the equipment;
  - .3 Year of manufacture or installation;
  - .4 Weight of the gate.
- .2 All information and instructions shall be in English.

### 3.8 SHOP PAINTING

- .1 Paint and galvanize surfaces in accordance with Section 11 50 00 - Shop painting and galvanizing.
- .2 Preparation of surfaces to be painted, application and characteristics of the paint shall meet the requirements described in Section 11 50 00 - Shop painting and galvanizing.
- .3 The gates and their embedded parts shall be painted in black, RAL-9005.
- .4 Unless specifically requested, do not paint machined surfaces, such as the wheel axles but protect these surfaces from rust as required in Section 11 50 00 - Shop painting.

### 3.9 MECHANICAL ASSEMBLY AND SHOP TESTS

- .1 Assemble the various parts of the equipment in the shop prior to shipping, to allow the "DR" to assess the quality and precision of fabrication and to demonstrate that all specification requirements and all design and manufacturing requirements shown on the shop drawings have been met. Carry out all inspections of the assembly that may be required by the "DR".
- .2 Upon approval from the "DR", dismantle accessories of the gate for transportation purposes, if required.
- .3 To facilitate assembly on site, ensure that all the parts are properly identified and dowelled, so that it is possible to reassemble the material on site with a precision compatible with the tolerances obtained during assembly in the shop and with the requirements of the specifications. The number of bolts and dowels shipped to site shall be at least 4% higher than the exact number determined in the shop.
- .4 The four (4) gates shall be assembled in the shop with their respective wheels and seals adjusted.
- .5 Assemble each set of embedded parts (guides and sill beam), by laying them flat on supports
- .6 Lateral guides shall be assembled with their respective gain heaters in order to ensure that the heating system can be properly installed on site and watertight.
- .7 The dogging structure shall be assembled by the Vendor to verify easy functioning of the dogging system.
- .8 All electrical equipment, including gate heaters, gains heaters and cables, shall be tested and functional. Point-to-point wiring continuity checks shall be performed by the Vendor to confirm that the final connections agree with the wiring diagrams, confirmation of fuse sizing, etc.
- .9 Pressure grease testing shall be performed on all mechanical equipment that required lubrication such as main wheels.
- .10 Prior to carrying out the tests described above, submit to the "DR" a detailed procedure that includes a description of the assembly, electrical tests and the sequence for inspections. All equipment necessary for carrying out the inspections shall be provided. After testing, submit the results to the "DR".

- .11 Shipping to site is only authorized once the equipment has been successfully inspected and has received the approval of the "DR".
- .12 Approval by the "DR" for shipping does not relieve the Vendor from his responsibilities with regards to final approval of the equipment. This is done on site during the installation. Any operating defect after assembly of the equipment on site must be repaired and adjusted as required.

### 3.10 SHIPPING, TRANSPORTATION AND DELIVERY

- .1 General
  - .1 Pack, load, transport, deliver and unload all material to be delivered to the site at the Port Severn Main Dam.
  - .2 Store and ensure safe-keeping of the components delivered as described in Sections 01 51 00 - temporary utilities and 01 52 00 - Construction facilities.
- .2 Packing and Shipping Procedures
  - .1 Provide a packing list for all the items in the shipment for delivery. The list shall identify each part, its description, its dimensions and its weight. The weight shall be accurate within +/- 5%.
  - .2 Carefully handle and adequately protect all items, so as to avoid damaging their surface finishes and bending them out of shape beyond the manufacturing tolerances specified on the drawings or in these specifications. During manufacture, take these requirements into account and reinforce the parts as needed.
  - .3 Submit to the "DR" methods for packing and shipping. Do not ship any part to site without prior approval from the "DR".
  - .4 Replace or repair any part damaged in transit. Submit to the "DR" for acceptance, a repair method for the damaged part, should the "DR" deem the latter to be repairable. Should a part need to be replaced, proceed with its replacement including its delivery to site. Pay all costs incurred by this work.
- .3 Delivery of the equipment shall be made in accordance with the planned schedule for the work, in accordance with Section 01 32 16 - Construction progress schedule.

### 3.11 TOLERANCES

- .1 Surfaces for which tolerances of less than 1 mm are specified shall be inspected with readings taken at least every 300 mm. Other surfaces for which tolerances have been specified shall be inspected with readings taken at least every 600 mm.
- .2 Machined surfaces shall be smooth and scratch-free. If required, any damaged surface shall be repaired with the tolerances specified being respected.
- .3 On assembly, joints between the different embedded parts, surfaces for guiding and sealing shall be continuous and shall not present any projections or bumps.
- .4 Submit to the "DR" for acceptance, its methods of control for the fabrication, assembly and concreting of the embedded parts, to demonstrate to the satisfaction of the "DR" that the tolerances specified can be met in the assembly and after concreting.
- .5 The gate embedded parts shall be installed and adjusted in such a way that the tolerances specified in Table F1 are met before and after concreting.
- .6 Manufacturing tolerances shall be such that they allow the parts to be installed and adjusted with ease, in accordance with the tolerances specified in these specifications, without rectification on site. However, in cases where the parts involved are adjusted on site the manufacturing tolerances shall not exceed half of the final tolerances after assembly.
- .7 Control of machining tolerances shall be independent of the machining methods.
- .8 The gates shall be manufactured and assembled in such a way that after assembly and final installation, the tolerances shown in Table F2 are met.

**Table F1**  
**Final tolerances for the embedded parts**

<b><u>Embedded parts</u></b>	Position or dimension (mm)	Verticality (mm/height)	Horizontality (mm/length)	Flatness (mm/m)	Alignment (mm/m)	Perpendicularity (mm/m)
<b>Sill</b> Machined surfaces of the sill beam	±1.50(*)		0.15(**)	0.15/2.00		
<b>Side guides</b> Machined surfaces of the rolling paths for the main wheels	±1.50(*)	0.75		0.15/2.00		
Machined surfaces of the upstream guide	±1.50(*)	0.75		0.40/2.00		
Machined surface of the sealing plate	±1.50(*)	0.75		0.15/2.00		
Side surfaces of the rolling paths for the main wheels	±1.50(*)	1.50		0.40/2.00		
Machined surfaces of the rolling paths for the main wheels vs machined surfaces for the sealing plates	0.75					

(\*) These position tolerances are defined in accordance with the centre lines of the water passages as installed and shall be met along the entire length of the parts.

(\*\*) Applies to longitudinal and transverse directions.

**Table F2**  
**Final tolerances for the gates**

<b><u>Gates</u></b>	Position or dimension (mm)	Verticality (mm/height)	Horizontality (mm/length)	Flatness (mm/m)	Alignment (mm/m)	Perpendicularity (mm/m)
Surfaces of the upstream guide	±1.50(*)	0.75				
Contact surfaces for the main wheels (for all wheel positions) vs line passing through the contact surfaces for the first and last main wheels				0.10/length		
Machined faces of the sealing plate				0.15/2.0	0.75/length	
Machined edge of the gate lip				0.10/length		1.00(**)
Sealing surface at the four corners of the gate				3.00		
Gap between the lip and the sill	0.20					

(\*) These position tolerances are defined in accordance with the centre lines of the water passages as installed and shall be met along the entire length of the parts.

(\*\*) This perpendicularity tolerance is defined in accordance with the line connecting the points of contact for the main wheels.

3.12 SITE ERECTION AND FIELD TESTS

.1 Site Erection - General

- .1 Install, put into operation and submit to field tests all material included in these specifications under the direct supervision of the equipment supplier.
- .2 Prepare and supply field assembly drawings and procedure with the specific information required to install all material. The site erection procedure shall include a visual inspection procedure. The field assembly drawings shall include details of the components and how they shall be lifted in place, and the weights and lift points of these components.

- .3 When selecting the on-site installation methods, the Vendor must take into account the limits imposed by the constraints of the work site, such as the dimensions and maximum allowable loads. Crane load diagrams and rigging diagrams shall be provided in the erection procedure for each major lift showing radius of lift with analysis of the loads in comparison with the established crane lifting chart (i.e. percentage of rated lift required at the maximum radius for each piece of equipment provided).
  - .4 Provide a temperature-controlled shelter to avoid variations in temperature during the installation and the second phase concreting of the embedded parts.
  - .5 Install the material in accordance with the assembly procedures previously established and submitted for approval. All measurements of the works carried out shall be submitted to the "DR" who reserves the right to verify them.
  - .6 Provide the labour, all lifting equipment, slings, jacks, tools, welders, supports and scaffolding necessary for the installation of the material.
  - .7 Engage the services of a field representative from the equipment supplier to be responsible for supervising for the entire duration of the installation of the embedded parts, their anchors and fasteners and the gates. The field representative has full authority over quality control for the work.
- .2 Site Erection of Embedded parts
- .1 Ensure that the methods for the handling and assembly submitted to the "DR" are being followed.
  - .2 Ensure that the temperature and the humidity level in the shelter is appropriate for carrying out the work in accordance with the specifications.
  - .3 Adjust and hold in place embedded parts with tie rods bolted to the primary anchors installed in the primary concrete. Submit the position of these anchors to the "DR".
  - .4 Ensure that the assembly tolerances before concreting are acceptable.
  - .5 Ensure that the second phase concreting can begin (bolt tightening, etc.).

- .6 Ensure that the "DR" can proceed with the necessary inspections during the concreting. Concreting shall meet the requirements of Division 03 00 00 - Concrete of the technical specifications.
- .7 Ensure that the assembly tolerances after concreting comply with the specification requirements and give his acceptance. Submit the geometry inspection report to the "DR".
- .3 Site Erection of the Gates
  - .1 Ensure that the methods for handling and assembly submitted to the "DR" are being followed.
  - .2 See that the equipment is handled carefully.
  - .3 Verify the function of the equipment and verify the assembly tolerances by making sure that they comply with the specification requirements and give his acceptance.
  - .4 Prepare and submit inspection reports.
  - .5 Ensure that all corrections necessary to the gates and accessories during the assembly and the field tests are carried out in accordance with these specifications.
- .4 Field Testing - General
  - .1 Perform field test in order to demonstrate to the "DR" that the material is complete, that it satisfies, on every point, the standards, design criteria and specification requirements, that it complies with the approved design and shop drawings, that it is in a perfect state of operation and that is properly installed and adjusted. Subject the gates to a series of tests as described below (Witness points).
  - .2 Site tests shall be carried out for the gate and hoisting system, as described in the present specifications, at the same time and based on the same site testing procedure.
  - .3 Electrical tests and verifications shall be conducted prior to mechanical testing of the gates, hoists and gain's heater.
  - .4 Any defect shall be immediately corrected by the Vendor, at Vendor's expense, and the tests shall be repeated until is proven that the installation functions satisfactorily.
  - .5 Following each test, the Vendor shall submit the test result report.

.5 Field Testing - Dry Tests

- .1 Following the installation of each gate assembly, embedded parts and hoists and prior to stoplogs removal, carry out dry operating tests on all assemblies of the gates and hoisting system.
- .2 The tests shall be carried out in accordance with the accepted procedure and shall include, but not be limited to, the following operations:
  - .1 Carry out the dry tests for the gates in the presence of the manufacturer's representative and the "DR".
  - .2 Close and open each gate at normal speed of descent and lifting with stops and starts, for the normal open position and in the suspended position, in addition to intermittent stops and starts, with a demonstration of the effectiveness of the electromagnetic brake to immobilize and hold the gate;
  - .3 Verify the satisfactory operation of all the limit switches and others, of the position indicator and of the suspension mechanism for each gate;
  - .4 Verify clearance and contact of the main wheels of the gate, the lateral and upstream bumpers of the gate and their surface of contact of the embedded parts;
  - .5 Verify the allowable gap between the lip of the gate and the sill beam of the embedded parts.

.6 Wet Tests

- .1 Carry out the wet tests for the gates in the presence of the manufacturer's representative and the "DR".
- .2 The tests shall be carried out in accordance with the accepted testing procedure and shall be undertaken after removal of the stoplogs.
- .3 Wet testing shall be performed using the maximum available operating head.
- .4 Simulate the main conditions likely to arise during normal and emergency operations and demonstrate that the equipment can operate normally and without excessive vibration.
- .5 Measure the rate of leakage and compared to the allowable

values in these specifications. To perform this measurement, the upstream side of the gate shall be under hydrostatic water pressure while the downstream side is still dry.

- .6 If upon testing, the maximum specified leakage rates are found to be exceeded, the Vendor shall take the necessary operations to permanently correct this situation, and demonstrate successfully to the "DR" that the measured leakage rates do not exceed the maximum specified leakage rates set out in the Contract Documents.
- .7 Once these tests have been completed to the "DR" satisfaction, a preliminary certificate of acceptance for the work will be issued.

### 3.13 SPARE PARTS AND SPECIAL TOOLS

- .1 The Vendor must include in its offer a complete list of spare parts required for the proper operation and maintenance of the equipment. This list shall be prepared according to the recommendations of the manufacturers and / or subcontractors. Each item in this list shall be accompanied by a description and its unit price.
- .2 This list shall include, but not be limited to, the following parts:
  - .1 Six (6) gain tubular element heaters.
  - .2 Six (6) gate tubular element heaters.
  - .3 One (1) replacement set for gate bottom heaters.
  - .4 A set of two (2) stainless steel sealing bars.
- .3 All parts must be interchangeable, manufactured with the same quality standards as the corresponding original parts, as described in these technical specifications.
- .4 The Vendor shall include in its offer a complete list of all special tools appropriate to unique application. All parts/tools detailed shall be identified as to manufacturer, manufacturer part number and supplier (including address). Each item shall be accompanied by its unit price.
- .5 Supply the spare parts and special tools upon delivery of the four (4) Dam gates and embedded parts packaged separately and clearly identified.
- .6 The Owner reserves the right to buy or not the special tools and spare parts listed.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 32 16 - Construction Progress Schedules - Bar Chart (GANTT).
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 35 29 - Health & Safety Requirements.
- .4 Section 01 35 43 - Environmental Procedures.
- .5 Section 01 45 00 - Quality Control.
- .6 Section 01 74 21 - Waste Management and Disposal.
- .7 Section 01 78 00 - Closeout Submittals.
- .8 Section 01 79 00 - Demonstration and Training.
- .9 Section 11 10 00 - Dam Gates.
- .10 Section 11 50 00 - Shop Painting and Galvanizing - Gates & Hoists.
- .11 Division 26 00 00 - Electrical

## 1.2 SCOPE OF WORK

- .1 This Section covers the requirements for the supply of four (4) electrically driven, mechanical wire rope hoists, machinery bridges and all associated equipment for the gate hoisting systems.
- .2 The scope of work includes design, fabrication, shop assembly, shop testing, delivery, erection and site testing of wire rope hoists, machinery bridges with anchors, guardrails and all associated equipment at the dam site according to requirements and standards described in this Section.
- .3 Each machinery bridge shall be shipped with the following equipment on them, but not be limited to:
  - .1 One motorized electric hoist: including an electric motor with brake, speed reducer gearboxes, power transmission shafts and couplings, wire ropes, slack rope devices, limit switches, control panel, necessary structural frames and all accessories described in this Section;
  - .2 Two drum units, each including a double grooved wire rope drum, input shafts, necessary structural frames, bearings etc.
- .4 The whole assembly is to be covered with low profile covers, all as shown on the tender drawings and described in this Section.

## 1.3 REFERENCES (considered the latest edition)

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA-B167-96 (R2002), Safety Standard for Maintenance and Inspection of Overhead Cranes, Gantry Cranes, Monorails, Hoists and Trolleys.
  - .2 CSA-B167-1964, General Purpose Electric Overhead Traveling Cranes.
  - .3 CAN/CSA-S16-01, Limit States Design of Steel Structures.
  - .4 CSA-S16-1969, Steel Structure for Buildings.
  - .5 CSA-W59-03, Welded Steel Construction (Metal Arc Welding).
  - .6 G4-09, Steel Wire Rope for General Purpose and for Mine Hoisting and Mine Haulage.
  - .7 CAN/CSA-B78.2-M91 (R2002), Dimensioning and Tolerancing of Technical Drawings.

- .8 B97.1-1970 (R2002) - Standard Tolerances for Linear Dimensions, Metric and Metric.
- .9 CSA B97.3-M1982 (R2002) - Tolerances and Standard Fits for Mating Parts, Metric Sizes.
- .10 CAN/CSA-G40.20-04 / G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .11 W47.1-03, Certification of Companies for Fusion Welding of Steel.
- .12 CAN/CSA-W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .2 National Building Code (NBC)
  - .1 Chapter I, Building and National Building Code of Canada 2015 (amended).
- .3 Ontario Construction regulation
  - .1 Occupational Health and Safety Act, R.S.O. 1990\_2018
- .4 Crane Manufacturers Association of America, Inc. (CMAA)
  - .1 CMAA 70-2015, Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes.
- .5 American Society for Testing and Materials (ASTM)
  - .1 F738M-02, Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs.
  - .2 F836M-02, Standard Specification for Style 1 Stainless Steel Metric Nuts.
  - .3 F568M-04, Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.
  - .4 A563M-04, Standard Specification for Carbon and Alloy Steel Nuts [Metric].
  - .5 F436-04, Standard Specification for Hardened Steel Washers.
  - .6 A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - .7 A27/A27M-19, Standard Specification for Steel Castings, Carbon, for General Application.
  - .8 A668/A668M-19a, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
  - .9 E390-15, Standard Reference Radiographs for Steel Fusion Welds.
  - .10 E94/E94M-17, Standard Guide for Radiographic Examination.
  - .11 E709-15, Standard Guide for Magnetic Particle Examination.

- .6 American Iron and Steel Institute (AISI)
- .7 Society of Automotive Engineers (SAE)
- .8 The American Society of Mechanical Engineers (ASME)
- .9 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-48.9712-2006, Non-destructive Testing - Qualification and Certification of Personnel (ISO 9712: 1999, MOD).
- .10 American Gear Manufacturers Association (AGMA)

#### 1.4 DRAWINGS, DESIGN DATA AND CALCULATION BRIEFS

- .1 Tender drawings: the mechanical drawings attached to these documents are not intended to be "shop" or "working" drawings. Sizes and/or arrangements shown are only intended to demonstrate the feasibility of the preliminary design of the required works based on this technical specifications document.
- .2 Submit for review all erection and shop drawings, calculations for main components, technical specifications sheets, shop assembly procedure, site erection procedure and site testing procedure as per Section 01 33 00 - Submittal Procedures.
- .3 Show on the shop drawings, as a minimum, details of all the components including manufacturing materials, thicknesses of components, reinforcing components, locations and types of welds, details of weld joints, anchor rods, locations of exposed fasteners, methods of assembly, surface finishes and textured of machined area, surface preparation, coating system, weights and characteristics of mechanical and electrical appliances and devices. Add any other relevant information as applicable.
- .4 Submit shop drawings and design calculations including load diagrams, reactions, and calculations for stresses and deflections for all parts provided for approval by the "DR" prior to starting manufacture.
- .5 Hoist calculations shall include, but not be limited to, combination of loading cases and various gate openings that evaluate the forces and other inputs used for sizing components and main features of the gate hoist such as: motor, drums, wire ropes and lifting points, shafts, couplings, bearings, speed reducers, brake and machinery bridge structure including anchors.

- .6 Include in the drawings updates of revisions encountered during manufacture and submit a set of "As Built" drawings upon completion of the work.
- .7 Clearly identify information about bolt strength and required bolt torque on the shop drawings.
- .8 Before beginning manufacturing, submit to the "DR", the mill test certificates, corresponding to the materials to be used. Should these certificates not be available, pay the corresponding tests by a laboratory subject to approval by the "DR".
- .9 Determine the mechanical and chemical characteristics of the materials in accordance with the requirements of the standards chosen and in accordance with the specific requirements in these specifications and on the drawings submitted to the "DR" for approval. Take and deliver to the "DR", at no additional cost, a representative sample of any material that the "DR" may require before and during the manufacture or during the assembly of the material on site.
- .10 Provide manufacturing, assembly, installation and tests procedures.
- .11 Within one month of the awarding of the contract, provide the "DR" with a precise indication of the maximum loads, reactions, moments and thrusts transmitted to the structures, so that the definitive drawings for carrying out the civil engineering work can be reviewed.

#### 1.5 SUPPLIER QUALIFICATIONS

- .1 Design, drawings and manufacturing works to be carried out by qualified technicians, shall be supervised and approved by a professional engineer recognized by the Professional Association of Engineers in the province where the manufacture takes place. Apply for a permit, from the "*Professional Engineers Ontario*", to supervise the field work.
- .2 The Professional Engineer shall, at least:
  - .1 Make and sign all calculations,
  - .2 Check, sign and seal all shop drawings,
  - .3 Perform site inspections of installed gates hoist, machinery bridge structure and their anchorages and confirms verification in writing that they were properly installed, have all the required components and are safe to operate. The Certificate

shall be provided to the "DR" upon completion of the site testing.

- .3 The equipment supplier (and/or his subcontractors) shall be qualified in accordance with the requirements of CSA W47.1, Division 1 or 2.1.
- .4 The equipment supplier of the gates hoist described in this Section shall also be the supplier of the dam gates, the electrical controls for the hoists and the heating systems; described in other Sections of this specification.
- .5 All subcontractors shall be submitted to the "DR" for approval.
- .6 The equipment supplier is in charge to coordinate the design, supply, installation and testing of the wire rope hoist with all other equipment described in other Sections of this specification and is also responsible of their subcontractors works.
- .7 The equipment supplier shall review and validate the content of any deliverable carried out by his subcontractor and shall apply a validation stamp on the document before issuing to the "DR" for approval.

#### 1.6 CLOSEOUT SUBMITTALS

- .1 Provide Operation and Maintenance Manuals as specified in Section 01 78 00 - Closeout Submittals. Include in these manuals, all the information required for safe operation and maintenance, the technical data sheet for standard principal component, the spare parts list, adjustment log sheets, the technical bulletins and maintenance and operating instructions from subcontractors.
- .2 Provide a quality assurance manual which shall include the followings but not limited to:
  - All the materials certificates used as well as the quality control certificates;
  - Complete Inspection and Test Plan (ITP) including hold points, witness points, inspection and test procedures and reports;
  - Welding and preheat procedure, welding inspection reports;
  - General inspection reports, heat treatment charts and reports, assembly and FAT tests procedure and report;
  - Commissioning procedure and report.

- .3 Provide copies of all purchase orders, operating and maintenance manuals and specific certificates from the manufacturers.
- .4 Provide list of As-Built drawings and copies to include in Operation and Maintenance Manuals as specified in Section 01 78 00 - Closeout Submittals.

### 1.7 TRAINING

- .1 Provide training for the operation and maintenance personnel as specified in Section 01 79 00 - Demonstration and Training.

### 1.8 DESIGN OF HOISTING SYSTEM

- .1 Design all equipment to be supplied. Design, manufacture, assembly, method of operation and tests shall comply with the design criteria, codes and standards specified in these specifications and in particular in CSA B167-1964. Do not modify without the "DR" approval.
- .2 Components with the same functions shall be interchangeable. This interchangeability shall extend to last with no fitting alterations to so-called wear parts. All mechanical equipment and accessories that have the same functions shall be supplied by a single manufacturer.
- .3 The "DR" has determined the dimensions of the water passageways, the type and location of the hoists and their method of operation.
- .4 Do not modify the dimensions of the civil structures.
- .5 Coordinate the design work, manufacturing and installation until the work has received final approval.
- .6 Provide the "DR" with free access to the plant where the work is being performed. Also provide the "DR" with the resources necessary for him to be able to inspect the quality of the components to be provided.

### 1.9 HYDRAULIC DATA AND GENERAL DIMENSIONS

- .1 Maximum critical upstream water level(IDF): 181.35 m.
- .2 Maximum upstream water level (normal operating): 180.50 m.
- .3 Minimum upstream water level (normal operating): 180.20 m.
- .4 Maximum downstream water level(ever recorded): 177.66 m.
- .5 Average downstream water level: 176.48 m.
- .6 Elevation of deck: 181.80 m.
- .7 Upper level of the side guides for the gates: 182.80 m.
- .8 Level of the sill for the gates: 176.842 m.
- .9 Clear opening width: 6.096 m.
- .10 Gate height minimum: 4.035 m.
- .11 Minimum gate opening: 4.0 m.
- .12 Nominal lifting speed: between 0.8 and 1.0 m/min.
- .13 Number of hoists: 4

## 1.10 DESIGN CRITERIA

### .1 HOIST ASSEMBLY

- .1 Design the hoisting system and structure so that any deflection, bending, oscillations and vibrations to which they are submitted, will not result in faulty operation, deterioration or permanent distortion of the parts or the assemblies under stress.
- .2 Design the hoist to be capable of operating to full capacity without excessive noise or undue vibration under all conditions of temperature. All movements to be carried out progressively and smoothly. At no time, shall the load slide. Design the hoist so that it presents no danger to personnel and adjacent installations.
- .3 The rated capacity of the wire rope hoist shall not be less than 125% of the calculated required capacity and the reduction gearing of all hoists shall be designed with a minimum service factor of 1.25 under normal condition.
- .4 The Vendor shall provide detailed calculations of the power transmission of the hoist during lifting and lowering for all loading cases included in the specifications. These calculations must include speeds, loads, torques, efficiencies and power through the transmission from the motor to the wire rope lifting point. Load transmission in the hoist components in the case of maximum motor torque must also be provided. The components of the hoist and its support structure must be able to withstand the forces generated by the hoist, without exceeding the allowed stresses. These must be increased by 25% to take into account impact loads.
- .5 Design the hoisting system considering that the protective housing of the hoist is out of heating system and the efficiency of the hoist components, considering the lubricant temperature during winter, shall be taken into consideration and appear in the calculations.
- .6 Classification for the equipment to be class B in accordance with CSA B167-1964.
- .7 Mount all moving parts on bearings lubricated with grease.
- .8 Design the hoist so that the replacement of parts and general

maintenance may be carried out efficiently, in a minimum of time and at minimal cost.

- .9 Design the hoist with a minimum of parts and accessories.
- .10 Design all the works described in these specifications for a useful life of 50 years.

## .2 ALLOWABLE STRESSES

### .1 STRUCTURAL NORMAL LOADING

- .1 The mechanical and structural components of the hoist shall be designed according to CSA B167-16, CMAA 70-2015, CSA Standard S16-1969/s16-01, CAN/CSA-G4 and CSA Standard W59. For normal loading conditions, the allowable stresses shall not exceed 90% of those permitted by the standards.
- .2 The CSA B167-16 standard shall be used in priority for the complete design of the components. Reference to any requirement from other standards in these specifications represents a minimum level of performance to be achieved either through the application of the CSA B167-16 standard, or that of the cited standards.
- .3 Where "Limit States Design" is used for the hoists, apply the provisions of Standard CAN/CSA S16 and CSA Standard W59. Apply loads, resistance and importance factors of these standards and consider the following:
  - .1 The hydrostatic load factor:  $\alpha_L = 1.5$ .
  - .2 For simultaneous hydrostatic and seismic loading:  
 $\alpha_L = 1.0$  hydrostatic load and  $\alpha_L = 1.0$  seismic load.
  - .3 Consider the significance of the structures and the risk of injury in case of a failure, use an importance factor:  
 $\gamma = 1.0$  and a resistance factor for steel:  
 $\phi = 0.9$ .
- .4 Use 90% of the values given in the National Building Code for any stress limits not specified in the standards mentioned above.

.2 STRUCTURAL EXCEPTIONAL LOADING

.1 Assume that the hoist motor develops its maximum torque when a gate jams in the guides and that the lift load is applied either to only one or both lifting points. The maximum combined stress in the material shall not exceed:

- a) If load applied on two lifting point, 125% of the constraints allowed by CSA B167-16, CSA standards S16-1969 and CSA W59, without exceeding 75% of the elastic limit of the stressed materials.
- b) If load applied on only one lifting point, 150% of the constraints allowed by CSA B167-16, CSA standards S16-1969 and W59, without exceeding 90% of the elastic limit of the stressed materials.

.2 For exceptional loading conditions considering an earthquake, IDF water level, ice or/and wind load applied on the gate, the working stress method in CSA Standard S16-1969, CSA Standard W59 and CSA B167-16 shall be used as a basis for the design of gate equipment. The allowable stresses shall not exceed 100% of those permitted by the standards.

.3 WELDED CONNECTIONS

Basic allowable stresses in welded connections shall not be greater than 90% of the values permitted by CSA Standard W59. In the welded compression ("bearing") assemblies of wheel path, the welds must be established considering that all the effort is transmitted by the through these.

.4 BOLTED FIELD CONNECTIONS

All field connections for structural steel shall be designed using high strength bolts in friction type connections, in accordance with the CSA Standard S16. The loads shall not exceed 90% of those permitted by CSA Standard S16.

.5 MECHANICAL COMPONENTS - WIRE ROPE

- .1 For normal operating conditions, based the choice of wire ropes on a safety factor of 5 in relation to their breaking strength.
- .2 The load shall be calculated in accordance with CSA B167-1964 and must take into account the efficiency of the lifting system.
- .3 For exceptional condition, the maximum load in the wire rope shall not exceed:
  - a) 75% of the breaking strength of the wire rope when load applied on both lifting points (symmetrical loads).
  - b) 90% of the breaking strength of the wire rope when load applied on only one lifting point. (asymmetrical loads)

The maximum stress due to hoist stalling effort shall include the bending effect calculated by formula next:

$$f = \frac{Ed_w}{D}$$

Where:

- f = Bending stress in MPa
- E = Young Modulus in MPa
- D = Sheave primitive dia. in mm.
- d<sub>w</sub> = Wire dia. in mm

.6 MECHANICAL COMPONENTS - SHAFT

- .1 Rotating shaft must be design in accordance with ANSI/ASME B106.1M Standard.
- .2 The corrected endurance limit  $S_f$  of the material shall be considered equal to  $S_f = 0,5 k_f F_u$ , where:  
 $F_u$  = Ultimate strength of the material  
 $K_f$  = Concentration bending factor
- .3 For all normal conditions, effort must be increased by 25% due to an impact factor and the Safety factor must be greater than 3.3.
- .4 For exceptional conditions as the lifting load is applied on only one or two lifting points, the Safety factor must be greater than 2.7 and 2.2 respectively.

.7 MECHANICAL COMPONENTS - DRUM

- .1 Axial, bending, torsion and circumferential compression stresses in a drum also as the critical buckling pressure shall be calculated in accordance with the reference "Charts Simplify Hoisting Drum Design", N. Sag et A.C. Briggs, Machine Design, April 1953.
- .2 For all normal conditions, effort must be increased by 25% due to an impact factor and the Safety factor must be greater than 5. The combined stress must be smaller than the lesser of  $0.6F_y$  (elastic limit) and  $0.4F_u$  (ultimate strength).
- .3 For all exceptional conditions as the lifting load is applied on only one or two lifting points, the Safety factor for buckling must be greater than 4 and 3.3 respectively. In the same condition, allowable stresses must be increased by 25% and 50% respectively.

.8 MECHANICAL COMPONENTS - OTHERS

- .1 For all components for which allowable stresses are not covered in these criteria, the allowable stresses shall not exceed 33% of the yield strength or 20% of the ultimate strength of the material.
- .2 Stresses in self-lubricated bronze bearings shall not exceed 30 MPa for normal loading conditions and 50 MPa for extreme loading conditions.
- .3 AISE Standard No. 7 shall be used for determination of allowable stresses for hooks with no additional safety factors applied. Stresses may be increased by 33% for extreme loading conditions.

.3 ALLOWABLE DEFLECTION

In addition to the load cases, do not exceed 1/800 of the span for the deflection of the structural members of the gate.

.4 FRICTION COEFFICIENT

For design purposes, use the following coefficients of friction:

	<b>Static</b>	<b>Dynamic</b>
▪ Self-lubricated bronze bearings ("Lubrite" or approved equivalent)	0.15	0.10
▪ Rolling of wheel on the track	0.75	0.75
▪ Roller bearing	0.015	0.01
▪ Wet steel on wet steel	0.4	0.2
▪ Steel on steel (non-lubricated)	0.5 @ 0.8	0.4

.5 MINIMUM THICKNESS OF COMPONENT

The thickness of the materials must be sufficient to withstand the stresses to which they are subjected given the permissible constraints. However, every component must respect the following minimum thicknesses:

Hoist support

- 1. Structural component: 10 mm
- 2. Non-structural component: 8 mm

Checkered plates: 8 mm

Protective housing: 2.5 mm

Housing door panels: 3 mm

.6 TEMPERATURE

Design the equipment to operate adequately following a prolonged shutdown, and in outdoor temperatures varying between -40 and +40 degrees Celsius with 100% of humidity relative.

1.11 DESIGN LOADS

.1 HOIST

Designs the mechanical and structural components of the hoist to be capable of remaining stable and withstand, within the limits of allowable stresses, in the case of loads resulting from the most unfavourable combination possible for the following loads:

.1 NORMAL LOAD CONDITIONS

- .1 All dead loads, live loads, impacts and vibrations induced by the gate under normal operating conditions. Increase all loads produced by the normal capacity of the hoist by 25% to take into account the impact loads.
- .2 An ice load, 75 mm thick, covering the exposed surfaces of the hoist protection covers.
- .3 A snow load of 2.4 kPa acting on the exposed horizontal surfaces of the hoist protection covers.
- .4 A load of 5 kPa uniformly distributed over the machinery bridge floor checkered plates.

- .5 A linear load of 100 kg/m acting at the base of the support structure and induced by the electric cable tray supports suspended underneath.
- .6 Calculate the nominal lifting load required by combining the most unfavourable of the following loads:
  - .1 The weight of a gate described in Section 11 10 00 - Dam Gates;
  - .2 The hydrostatic load acting on a gate, when the upstream water level is at its maximum for normal operation and the downstream water level is at its minimum;
  - .3 all possible loads and vibrations induced during gate operations;
  - .4 all the forces resulting from the jamming of a gate in the guides during which time the hoist motor develops its maximum torque at stalling.

.2 EXCEPTIONAL LOAD CONDITIONS

- .1 All dead loads, live loads, impacts and vibrations induced by the gate under exceptional operating conditions assuming the efforts are transmitted whether by one or two lifting point.

1.12 TOLERANCES

- .1 Except where otherwise indicated in these specifications, refer to the following standards concerning the design and tolerancing of the mechanical parts:
  - .1 CAN/CSA-B78.2;
  - .2 CSA B97.1;
  - .3 CSA B97.3.

1.13 WASTE MANAGEMENT AND DISPOSAL

- .1 Eliminate waste from the site in compliance with Section 01 74 21 - Waste management and disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the "DR" for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.
- .2 Use new materials for the fabrication of all permanent elements.
- .3 Anchor tie rods for machinery bridge shall be chemical anchors. Contractor shall install them as per Vendor's recommendations.
- .3 Use only stainless steel fasteners for the assembly of all equipment.

.2 Materials

- .1 Plates and steel profiles: CAN/CSA G40.20/G40.21 Type W, Cat.3, except where otherwise indicated.
- .2 Positioning anchors and tie rods, washers and nuts: ASTM A325 / A307 or equivalent
- .3 Anchor tie rods: HILTI HAS-R 304/316 or accepted equivalent.
- .4 High strength bolts, nuts and washers whether exposed or not shall be stainless steel.  
Bolts: class A1-50, ASTM F738M / ASTM A276 Grade 304  
Nuts: class A1-50, ASTM F836M.
- .5 Galvanized anchors and washers: ASTM A325M.
- .6 Moulded parts: ASTM A27 Grade 70-40.

- .7 Forged parts: ASTM A668.
- .8 Bronze bearings: ASTM B584.
- .9 Stainless steel: ASTM A276 Grade 304.
- .10 High strength bolts and nuts: ASTM F3125 Grade A325
- .11 Helical springs: AISI 5160 with hardness from RC 41 to 48.

PART 3 - EXECUTION

3.1 DESCRIPTION OF THE EQUIPMENT - Wire rope hoist

.1 General

- .1 Provide four (4) wire rope hoists.
- .2 The hoist for the gate shall be driven by an electric motor with built-in motor brake and equipped with double lifting point with two wire ropes and a balancing system for each lifting point, gearbox units, gear couplings, limit switches, slack rope devices, position indicators, control panel, drum units and associated components mounted on a support structure anchored on the machinery bridge. The hoist shall be capable of raising, lowering and sustaining the gates in any position under all differential water head and flow conditions as required.
- .3 The hoist shall be compact and provide easy, direct access to all the components requiring maintenance. Also, provide enough clearances for manual operations of the hoist.
- .4 Give special attention and care to the visual design of the hoist and the arrangement of components so that the equipment provided presents an aesthetically pleasing aspect and respectable clearances for operators to operate and access all components.
- .5 The hoist shall be equipped with lifting lugs to allow the hoist to be handled as a complete unit once assembled with its structure.
- .6 Prepare the fabrication details so that no accumulation of water or dirt on the structures occurs and that all surfaces are easily accessible for inspection and maintenance.
- .7 The criterion for overload conditions shall be such that if a gate jams, power to the motor shall be automatically interrupted on overload without damaging the gate, its associated lifting components or the hoist machinery bridge structure.
- .8 All rotating components and assemblies shall be accurately balanced and aligned, and shall operate without damage or

- undue noise or vibration at a speed corresponding to three times the motor synchronous speed.
- .9 All exposed rotating parts shall be provided with a safety guard.
  - .10 All guardrails shall be provided, surrounding gate sluice opening as shown on the drawings, delimitating the pedestrian walkway including anchors and fasteners.
  - .11 All hoist equipment and covers, except the control panel and the MCC Cabinet (refer to Division 26 00 00 - Electrical), shall not exceed elevation 183.06 m.
- .2 Wire rope
- .1 Sixteen (16) wire ropes, eight (8) of which are of a right-hand lay and eight (8) are of a left-hand lay.
  - .2 The wire ropes shall be made of galvanized steel, of the improved plow type with a steel core. They shall comply with CAN/CSA-G4-15, classification 6 x 19.
  - .3 Balance and arrange the wire rope system in such a way as to avoid reverse bending. Install a wire rope adjustable guide on the drums and a slack rope device to prevent the wire ropes from leaving their grooves when the tension slackens by cutting off the power feed to the motor.
  - .4 Do not exceed 1/12 for the maximum slope of the angle of fall.
  - .5 The rope shall be impregnated with lubricant during fabrication.
- .3 Drums
- .1 Use cast or rolled steel minimum Grade 300W for the drums.
  - .2 The pitch diameter of the drums shall not be less than the values given for the service class in CSA B167-1964.
  - .3 Equip each drum with two winding, which are of a right-hand lay and a left-hand lay.
  - .4 Provide for each winding, a minimum of two (2) dead grooves to attach the wire rope and one (1) extra grooves in reserve.

- .5 The drums shall be of sufficient size to accommodate the total length of rope in a single layer when the gate is raised to its highest position and considering the wire rope stretched.
  - .6 Grooves shall be smooth and machined to a suitable quality of finish, to avoid undue wear of the rope and meet the requirements of CSA B167-1964 and CMAA-70.
  - .7 The grooves of the drums must be coated in the shop with a grease compatible with that used on the wire ropes.
- .4 Drum Bearings
- .1 Support the drums on spherical roller bearings that transfer the load to the support structure of the hoist. The bearing on the side opposite the drive shaft is the floating type and shall be able to tolerate a certain amount of axial movement of the drum due to thermal expansion.
  - .2 Hold in place each roller bearing by metal shear blocks welded into place.
  - .3 Each drum shall be supported by its own bearings which shall be arranged in such a way that they can be removed easily in a limited time.
- .5 Gearing and Shafts
- .1 The gear drive shall be operated using an enclosed, oil-lubricated mechanism without the use of open gears.
  - .2 The combination of speed reducers shall not use more than 2 gearboxes in series.
  - .3 The speed reduction shall be composed at least of one (1) self-locking worm gearbox as a primary speed reduction to hold the gate at any position without the need of an additional drum brake.
  - .4 The worm gearbox shall have two input shafts: one for the electric motor and one for the removable hand crank mechanism.
  - .5 The worm gearbox allows the lifting mechanism to be put into operation for lifting or lowering whenever manual operation is required. The gate dead load shall not cause the rotation of the input shafts.

- .6 The maximum force to manually operate the gate with a crank handle shall not be more than 130 N and the maximum torque to be generated shall not exceed 50 Nm.
- .7 The gears shall be capable of operating under all load conditions, silently and with no induced vibration. The gears shall comply with AGMA standards. The casing shall be oil tight and shall ensure lubrication of the gears and bearings which they enclose. The drains for the gearbox casings shall be equipped with a valve and a plug or cap attached to it with a chain. The location of the drains shall allow the gearbox casings to be emptied easily. Oil levels shall be easily readable on the outside using graduated gauges.
- .8 The gear units shall be equipped with a clearly marked oil sampling socket. This socket shall be located to obtain a representative sample following an operational test. It should not be at the bottom of the housing, but just below the normal oil level and should require a minimum purge.
- .9 The gear unit must be equipped with a breather and a dryer to ensure that the housings and the oil are free of moisture and a device that allows easy evacuation of condensate.
- .10 The gearbox assembly shall comply with the manufacturer's standards.
- .11 Support all shafts on roller bearings with individual grease points. Axial movements of the gearbox casings shall be appropriately balanced. Bearings shall be chosen in accordance with the manufacturer's specifications and shall have a life expectancy that conforms to the values given in CSA B167-1964.
- .12 Flexible couplings shall be used between the motor, the gear reducers, the drums and at all other places where relative movements or displacements may occur.
- .13 Gears, shafts and couplings shall be adequate to withstand the loads induced by maximum torque of the motor at stalling.
- .14 Shafts and couplings shall be covered with a rustproofing coating.
- .15 The reduction gearing of all hoists shall be designed with a

minimum service factor of 1.25 under normal operating conditions to cover impact loads.

- .16 Provide heating elements in the gearboxes to prevent condensation. The heating elements shall limit the temperature by means of thermostats, in order to prevent the oil from deteriorating. In case of detection of overheating of the gearbox oil, the controller must switch on a light on the front of the control cabinet in addition to sending an alarm.

#### .6 Motors

- .1 Supply totally enclosed, fan cooled type (TEFC) motors. They shall be squirrel cage induction type A and shall operate on 575 volts, 60 Hz, three-phase power. They shall have sufficient torque to satisfy all operating conditions and shall be continuous rated. They shall have Class F insulation with Class B (80°C) allowable temperature rise.
- .2 Braking torque and maximum torque of the hoist motor shall be guaranteed to be 190% and 210% of the full load torque, at a voltage of 575 V. The maximum voltage for the motor shall be 600 V. Subject hoist motor to undergo a dynamometer test, and submit the test results to the «DR» for acceptance.
- .3 The conductors for the motors shall end in terminals inside a terminal box.
- .4 Motor bearings shall be roller type, capable of being lubricated by means grease nipples. The grease nipples shall be of the same dimensions as the ones for the gate wheels.
- .5 Provide heating elements in the motors to prevent condensation.

#### .7 Brakes

- .1 Each hoist motor shall be provided with a built-in solenoid actuated brake of the "Stearns" type or an equivalent approved. Motor brake shall be mounted directly on the motor shaft.
- .2 This brake shall be activated automatically whenever there is a loss of electrical power. Select the brake to hold the gate

in all positions and under all operating conditions.

- .3 The braking torque capacity of the brake shall be equal to at least 150% of the motor full load torque.
  - .4 Release of the brake shall also be possible by a manual lever, to initiate opening or closing of the gate. The action of the lever shall simultaneously interrupt AC power supply to the motor.
  - .5 The lever shall not automatically lock the brake in the released "disengaged" position. When released, the lever shall return automatically to its initial "engaged" position. It shall be possible to manually lock the lever in the released position when used with the removable hand crank mechanism.
  - .6 The release of the brake shall allow the operator to lift or lower the gate at a controlled speed with the manual hand crank mechanism.
- .8 Hand Crank Mechanism
- .1 A hand crank mechanism shall be provided to lift the gates when the motor brake has been manually released. Provide one (1) hand crank mechanism for one wire rope hoist for a total of four (4) hand crank mechanism.
  - .2 A hydraulic drive shaft support shall be provided as shown on drawings. The support shall be fixed on the hoist cover, in front of the hand crank shaft opening to install PCA's owned Y2K device. The support could also be installed within the hoist enclosure but shall be easily accessible and have enough room to connect the system. A protection plate shall be installed to cover the opening of the support bracket to prevent contact to the motor shaft.
  - .3 In order to avoid accidental switching on of the motor while the hand crank mechanism is installed, which could represent a risk for a major Health & Safety incident, provide a safety system that allows to manually disconnect the electric motor shaft while connecting the hand crank mechanism. System could comprise couplings, one on motor side and one on hand crank side, that are mechanically linked together and shall be lockable with padlock. This system shall be equipped with a

- switch that cuts the electrical power to the motor when it's mechanically disconnected.
- .4 Each hand crank mechanism shall be composed of a removable extension bar and a standard steel rotating crank handle.
  - .5 The minimum length and diameter of the extension bar are 275mm and 25mm respectively. The length shall be longer than the hydraulic drive shaft support so it allows operating the crank handle without interference. The extremity of the extension rod shall be of a square socket shape in order to be fitted on a shaft. A locking mechanism shall be provided to avoid the hand crank mechanism to be disconnected from this shaft while operating.
  - .6 The lever length of the crank handle shall be determined by the Vendor in order to generate the required torque to manually operate the mechanism without requiring more than 130 N of force applied to the hand crank.
  - .7 Provide a toolbox storage in the hoist cover for the storage of the hand crank mechanism.
  - .8 The complete hand crank mechanism shall be the most compact and lightweight as possible, having to be carried and installed by hand.
  - .9 The hoist protective housing shall be provided along with all removable access panels and opening covers, prevent contact with the rotating shaft and provide sufficient inside room to allow easy installation of the hand crank mechanism. The complete system shall be put in operation within 5 minutes.
  - .10 The Vendor shall submit the calculations, drawings, installation and operating procedures of the hand crank mechanism to the "DR" for approval before supply of the equipment.
- .9 Slack rope devices
    - .1 Provide the hoist mechanism with a device that automatically cuts the power to the motor when either wire rope goes slack.
    - .2 The slack rope device shall be enclosed in the drum housing.
  - .10 Support structure - Machinery Bridge
    - .1 For each hoist, supply a rigid support structure on which the machinery rests. Design the structure to withstand the forces

- imposed under all gate and hoist operating conditions.
- .2 The structure shall also be designed to support adequately the MCC's that shall be positioned along the pedestrian walkway as shown on drawings and allow the passage of all electrical cables.
  - .3 For each hoist, supply a portion of decking to make the transition with adjacent machinery bridges and concrete slabs at deck elevation as shown on drawings.
  - .4 The support structure shall be made of structural steel members reinforced with secondary beams and stiffeners.
  - .5 Free accesses shall be provided to all parts of the hoisting and electrical systems for maintenance and repairs.
  - .6 Cover the top of the structure with checkered plates suitably stiffened.
  - .7 Provide guardrails on the upstream side of the sluice deck opening (anchored on concrete slab) and on the downstream of the sluice deck opening (anchored on the machinery bridge). These guardrails shall form a continuous walkway protection along the entire length of the dam gate deck opening. Provide also guardrails downstream of the machinery bridges along the pedestrian walkway as shown on drawings. The guardrail shall be of 1.07 m minimum total height and the bottom of the guardrail shall have a protective kick plate of a minimum height of 100 mm.
  - .8 The support structure shall rest on base plates anchored to the top of the piers and designed so that one end of the structure is fixed and the other end is floating. Supply the base plates and chemical anchors.
  - .9 Provide on the upper portion of the support structure of the hoists, a series of supports as shown on the drawings, and onto which the cable tray described in Division 26 00 00 - Electrical will be installed. Design the supports to be capable of being dismantled to allow the hoist to be removed without touching the electric cables.
  - .10 Lifting lugs are required on the top of the support structure for handling. Lugs shall be removable after installation or shall be designed and located beneath the deck floor elevation.

.11 Protective housing

- .1 Protect all hoist components from the weather with housings fabricated in sections with access doors and covers. The shape and arrangement of these housings shall harmonize with the rest of the hoist structure and shall optimize accesses and clearances for operators.
- .2 The protective housings, including openings for the passage of the wire ropes and electric cables, shall prevent the infiltration of wind-blown snow and bird's intrusion.
- .3 Fabricate the housings with 2.5 mm minimum thickness steel sheets.
- .4 Build the protective housings in watertight and lockable sections.
- .5 All covers of the motors and drum and shaft units, besides being completely removable, shall have lockable watertight doors for access for routine maintenance such as: adjustment of the brakes, adjustment of the encoder, lubrication of reducer and bearings, access to the hand crank mechanism and limit switch and slack rope device. Design such covers with reinforced sheet metal having a minimum thickness of 3 mm, so that it can be removed completely in units having a mass not greater than 50kg. Lifting lugs are required on the top of the covers for handling.
- .6 The effort required to open a door or a cover section shall not exceed 130 N. The Vendor shall provide hinges and retaining system for each cover or cover section.
- .7 All bolts holding covers and parts subject to disassembly must be made of stainless steel.
- .8 The Vendor shall take special care in the design and manufacture of guardrails and covers to avoid any rework or adjustment at site.
- .9 Protective housing shall provide openings, support bracket and protective covers for hand crank mechanism.

.12 Control Equipment

- .1 All control equipment and control parts located on the hoist shall be installed inside a stainless steel EEMAC/NEMA 4X cabinet.
- .2 Inspection, adjustment and repair of the controls shall be easy to carry out.
- .3 Switches for the slack rope device shall be included, so that power to the hoist motor can be interrupted should the tension in the wire ropes slacken.
- .4 The electrical circuit for controlling the hoist shall be in compliance with Division 26 00 00 - Electrical.
- .5 The high level (fully open) and low level (close) shall be controlled by rotary limit switches based on drum location.
- .6 The overtravel limit switch shall be included, so that power to the hoist motor can be interrupted to prevent over travel damage to sluice gate structure or drive components or other adverse consequences if the rotary limit switches are not functional.
- .7 A position encoder shall be included to determine precisely the position of the gate; the encoder shall be mounted on the shaft of the hoist drums. The information produced by the encoder shall be sent to a visual display unit on the local control panel. The encoder shall be capable of signalling the position of the gate at all times. Should a restart be required, it shall be capable of determining the exact position of the gate immediately after the supply power is restored.
- .8 A staff gauge indicator shall be designed and installed as per Section 11 10 00, article 3.1.8 of the present specifications.
- .9 The manual lever for disengaging the holding motor brake shall be equipped with a switch that changes state whenever the lever is activated. This change of state cuts the electrical power to the motor, preventing the hoist from accidentally starting up while the operator is holding the lever.

- .10 The control panel shall be mounted as shown on drawings facing at 90° (perp.) to the water flow and located in the right bank corner of the deck opening. Control panel enclosure details are provided in Division 26 00 00 - Electrical.
- .11 The manual disconnected coupling system shall be equipped with a switch that cuts the electrical power to the motor, preventing it from accidentally starting while the hand crank system (hydraulic pack) is in place.

### 3.2 FABRICATION - GENERAL

- .1 Fabrication by the Vendor shall comply with the requirement of CSA S16 for Structural Steel, except where otherwise specified herein or shown on Vendor's shop drawings.
- .2 All plate and structural steel shall be accurately fabricated by the Vendor true to drawing dimensions and free from warp or rust. The edges to be joined by the Vendor shall expose sound metal, free of visual laminations, cracks and other injurious defects.
- .3 All tolerances shall be defined on the Vendor's shop drawings for both manufacturing and installation purposes.
- .4 Holes shall be drilled full size or drilled under size and reamed during shop assembly. Punches holes shall only be permitted in plates 20 mm or less in thickness provided all such holes are subsequently reamed full size during shop assembly.
- .5 Surface finishes shall be indicated on the Vendor's shop drawings in accordance with ASME B46.1. Compliance with the specified surface finish shall be determined by comparison with standard roughness specimens in accordance with ASME B46.1.
- .6 All the threads shall be standard type.

### 3.3 QUALITY CONTROL

- .1 Develop and submit for review and approval by the Departmental Representative and execute a comprehensive 'Inspection and Test Plan (ITP)' including but not limited the following:
  - .1 The welds inspection requirements described in items of the present specification.

- .2 Engage the service of 3rd party inspectors to perform the appropriate inspection and test plan.
- .3 Submit copies of all inspection reports and quality records generated during fabrication.

#### 3.4 WELDING AND WELD QUALITY CONTROL

- .1 Welds and welding procedures shall be qualified in accordance with CSA W47.1.
- .2 The electrodes for welding: CSA W48.1. Use low hydrogen electrodes. Reject any electrodes that have absorbed moisture.
- .3 All welds shall comply with CAN/CSA W59, all inspection and non-destructive testing shall comply with CAN/CSA W59 Part 11 and welded connections of drums shall be inspected as per CAN/CSA W59 Part 12.
  - .1 For members on which forces occur, execute welds in the shop. In general, only sealing welds are permitted on site. Submit any weld executed on site to the "DR" for approval.
  - .2 Submit welding procedures along with proof that the qualification tests were carried out for each type of joint. The welding procedures are submitted to the "DR" for approval.
  - .3 All inspection and non-destructive testing requirements shall be clearly specified on Vendor's shop drawings.
  - .4 The plates to be welded shall be cut carefully to the correct sizes. The dimensions and shape of the edges to be joined shall provide for a strong bond and complete penetration.
  - .5 Welds shall be executed only when the temperature of the base metal is above 10°C. Preheat all surfaces within a radius of 75 mm of the welding point, in accordance with CAN/CSA W59, and maintain this temperature until the welding process is completed. Measure the temperature with temperature indicator sticks or other means submitted to the «DR" for approval. Hammering of welds is not permitted.
  - .6 Clean off a 50 mm band on each side of the joint for a total width of 100 mm to eliminate rust, grease and burrs.

- .7 Submit the welded parts, the surfaces of which are machined for precise alignment, to mechanical or heat treatment prior to machining. Specify the treatment method in the description of the procedure or on the shop drawings.
  - .8 Inspect visually 100% of all welds.
  - .9 Inspect 20% of butt welds in flanges stressed under tension by X-ray.
  - .10 Inspect 5% of butt welds in flanges under compression and any skin plate acting as a beam flange by X-ray.
  - .11 Inspect 10% of butt welds in the beam webs by magnetic particle inspection or by dye penetrant inspection.
  - .12 Inspect 10% of fillet welds by magnetic particle inspection or dye penetrant inspection.
  - .13 Whenever there are repairs to be made following the inspection, grind out the defects down to the sound metal and the repaired welds shall be 100% inspected in accordance with the method used originally. When an inspected area reveals defects that are subject to repair, adjacent areas must also be inspected in accordance with CSA W59. If any of the adjacent areas also have defects, the seal must be inspected in its entirety.
  - .14 When an X-ray inspection is impossible due to difficulty of access, an ultrasound examination submitted to the "DR" for approval may be used.
  - .15 Lack of penetration and incomplete fusion shall not be tolerated. Porosity and insertion shall not exceed the limits of "Level 4", as defined in ASTM Standard E390 for the thickness concerned.
- .4 Perform weld quality control by X-ray, ultrasonic examination, magnetic particles or dye penetrant as follows.
- .1 Perform X-ray in accordance with ASTM standards E94 and E390 and taking into account the utilization limits for each method specified. Operators and technicians shall possess a competency card issued by the Canadian General Standards Board (C.G.S.B.). The interpretation of radiographic shots shall be carried out by a specialist recognized and certified by the C.G.S.B., in compliance with CAN/CGSB-48.9712 level 2.

Each weld deemed unacceptable shall be repaired or replaced by an acceptable weld.

- .2 Carry out ultrasonic examination in accordance with ASTM E164-19.
  - .1 Ultrasonic examination of welds, as a replacement for or complementary to X-ray examination, is acceptable on condition that all justifications for the validity of the proposed method be provided, subject to the prior agreement of the "DR".
  - .2 Ultrasonic examination is only acceptable if it is carried out using a machine of a recognized brand.
  - .3 Technical procedure sheets describing the method used, the degree of sensitivity obtained, the equipment, the sensors, etc., shall be submitted to the "DR" with proof of the competency of the technicians, before this examination method can be adopted.
  - .4 Inspection reports including drawings, sketches and photographs shall be submitted to the "DR" with all the details to allow the ultrasonic examination to be repeated exactly, at any time.
  - .5 Only senior technicians holding a "C.G.S.B. - CAN/CGSB 48.9712 - Senior Level" competency card is authorized to prepare the technical procedure sheets and to interpret the results.
- .5 Perform magnetic particle inspection in accordance with ASTM Standard E709.
  - .1 Eliminate striations and irregularities prior to examination.
  - .2 Take all precautions to avoid a deterioration or a superficial burn at the contact points of the electrodes. The strength of the electrical current, the period during which it is applied and the direction of the magnetic field, shall be as prescribed in the standards. An indicator for the intensity of the magnetic field shall be used frequently. In addition, include demagnetization of the part, should residual magnetism present a problem.

- .3 Only operators and technicians approved and certified by the C.G.S.B. in compliance with CAN/CGSB-48.9712 are authorized to carry out these examinations and to interpret the results.
- .6 Perform Dye penetrant inspection according to ASTM standards E165 and E433.
  - .1 Eliminate striations and irregularities prior to examination.
  - .2 Carry out effective conditioning or cleaning shall prior to the application of a liquid penetrant.
  - .3 Only operators and technicians approved and certified by the C.G.S.B. in compliance with CAN/CGSB-48.9712 are authorized to carry out these examinations and to interpret the results.

### 3.5 LUBRIFICATION

- .1 Bearings shall be lubricated with 1/2" stainless steel button type grease-nipples. All the joints that require periodic lubrication shall be equipped with 1/2" stainless steel button type grease nipples. Lubrication points that are difficult to access shall be connected by stainless steel tubes to header blocks grouped together in easily accessible locations. The tubes shall be supported and protected along their entire lengths. Inspection ports shall be provided to ensure that lubrication has been effective for each part lubricated. The lubricant and lubrication nipples shall be compatible with the grease pump specified within the dam gate Section - 11 10 00.
- .2 In general, the gears shall be lubricated by immersion. The gauges, vent holes and drains for the oil pans shall be easily accessible.
- .3 All lubricated parts that are not protected by a watertight housing shall be greased. Drips shall be avoided through the use of drip pans.
- .4 All lubricants shall be all-season type. They shall be able to withstand temperature changes from -40°C to +40°C without losing their properties.
- .5 In addition to the information provided in the "Operation and Maintenance Manual", provide and install a lubrication chart printed or engraved on an anodized aluminium plate and installed in a place visible from the hoist, submitted to the «DR" for acceptance. This chart shall include (gate and hoist):

- .1 a lubrication diagram showing the mechanisms and the locations of lubrication points;
- .2 a list of lubrication points;
- .3 the type and the brand of lubricant to use at each point;
- .4 the names of at least three (3) manufacturers able to supply the compatible lubricants and the brand name of the lubricants;
- .5 the lubrication cycle for each point.

### 3.6 NAMEPLATE

- .1 Provide and install a nameplate in the inside of the main protective housing. This nameplate shall be easily readable and shall clearly show the following information:
  - .1 Name of the Vendor;
  - .2 Name or identification of the equipment;
  - .3 Year of manufacture or installation;
  - .4 Details on the nominal lifting load, the classification and general dimensions;
  - .5 Characteristics of the wire ropes for the hoist.
- .2 All information and instructions shall be in English.

### 3.7 SHOP PAINTING AND GALVANIZING

- .1 Paint and galvanize surfaces in accordance with Section 11 50 00 - Shop Painting.
- .2 Preparation of surfaces to be painted, application and characteristics of the paint shall meet the requirements described in Section 11 50 00 - Shop Painting and Galvanizing.
- .3 Galvanize the support structure, covering checkered plates, protective housings and guardrails.
- .4 Do not paint machined surfaces, such as the surfaces in contact with the gears or their bores, but protect these surfaces from rust as specified in Section 11 50 00 - Shop painting.
- .5 Non-machined surfaces of mechanical components that cannot be galvanized shall be painted in Grey 16251 - federal Standard 595C.

### 3.8 MECHANICAL ASSEMBLY AND SHOP TESTS

- .1 Assemble the various parts of the equipment in the shop prior to shipping, to allow the "DR" to assess the quality and precision of fabrication and to demonstrate that all specification requirements and all design and manufacturing requirements shown on the shop drawings have been met. Carry out all inspections of the assembly that may be required by the "DR".
- .2 Upon approval from the "DR", dismantle accessories of the gate hoist for transportation purposes, if required.
- .3 To facilitate assembly on site, ensure that all the parts are properly identified and dowelled, so that it is possible to reassemble the material on site with a precision compatible with the tolerances obtained during assembly in the shop and with the requirements of the specifications. The number of bolts and dowels shipped to site shall be at least 4% higher than the exact number determined in the shop.
- .4 The four wire rope hoists shall be completely assembled and adjusted in the shop and partially disassembled afterwards for shipping if required.
- .5 Prior to carrying out the shop testing, submit to the "DR" a detailed procedure that includes a description of the assembly, electrical tests and the sequence for inspections. All equipment necessary for carrying out the tests and the inspections shall be provided. After testing, submit the results to the "DR".
- .6 Shipping to site is only authorized once the equipment has been successfully inspected and has received the approval of the "DR".
- .7 Approval by the "DR" for shipping does not relieve the Vendor from his responsibilities with regards to final approval of the equipment. This is done on site during the installation. Any operating defect after assembly of the equipment on site must be repaired and adjusted as required, after first obtaining the agreement of the "DR".
- .8 The following shop tests shall be performed by the Vendor:
  - .1 Submit each hoist to a 30-minute functional test (clock-wise rotation / counter-clock wise rotation) which consist of motor operating the hoist without wire rope installed and taking measure of temperature, noise and vibration,

deformation/displacement of components, motor current (A) and tension (V), rotation speed.

- .2 Perform a test on one hoist to simulate a condition of the gate jamming against a single lifting point. Measure the deflection of the structure and the jamming load in the wire rope. Carry out this test in the presence of the «DR». The hoist shall resist, without damaging any components or structure, at lock rotor start and at nominal speed. In case of any damage or a fail result, the Vendor shall immediately remedy the situation and perform another test.
- .3 The Vendor shall provide at least six (6) sample of wire rope (minimum length of three (3) dead grooves plus bench test required) to be used during this test and that shall have identical properties of the selected wire rope that will be installed on site. These samples wire rope cannot be installed on site for hoist operation. Once a test is performed, whatever the result of the test, the sample wire rope needs to be change for a new one to perform the next test.
- .4 Instrumentation shall include at a minimum a load cell to measure the jamming load in the wire rope, digital indicator and recorder for the load and a dial indicator to measure displacement to critical location. Also, Vendor shall be equipped to record the current and tension of the electric motor all along the testing.
- .5 The Vendor shall demonstrate that the test is representative. For this purpose, the Vendor shall submit a calculation note modelling the maximum load in a wire rope during the gate jamming test. The results shall necessarily corroborate the calculations. Provide calculation note and shop drawings of the test bench. The Vendor has the responsibility to take all necessary security measure to protect workers during this test.
- .6 The tests shall be carried out only when all the electrical equipment provided for the wire rope hoist is installed. The electrical tests shall first be completed prior to the mechanical tests.
- .7 Grease testing shall be performed on all mechanical equipment that required lubrication.

### 3.9 SHIPPING, TRANSPORTATION AND DELIVERY

#### .1 General

- .1 Pack, load, transport, deliver and unload all material to be delivered to the site at the Port Severn Main Dam.
- .2 Store and ensure safe-keeping of the components delivered as described in Section 01 52 00 - Construction facilities.

#### .2 Packing and Shipping Procedures

- .1 Provide a packing list for all the items in the shipment for delivery. The list shall identify each part, its description, its dimensions and its weight. The weight shall be accurate within +/- 5%.
  - .2 Carefully handle and adequately protect all items, so as to avoid damaging their surface finishes and bending them out of shape beyond the manufacturing tolerances specified on the drawings or in these specifications. During manufacture, take these requirements into account and reinforce the parts as needed.
  - .3 Submit to the "DR" methods for packing and shipping. Do not ship any part to site without prior approval from the "DR".
  - .4 Replace or repair any part damaged in transit. Submit to the "DR" for acceptance, a repair method for the damaged part, should the "DR" deem the latter to be repairable. When a part needs to be replaced, proceed with its replacement including its delivery to site. Pay all costs incurred by this work.
- .3 Delivery of the equipment shall be made in accordance with the planned schedule for the work, in accordance with Section 01 32 16 - Construction progress schedule.

### 3.11 TOLERANCES

- .1 The contractor shall adjust the position and levelling of the hoist bases according to the tolerances in the installation drawing and ensure the alignment of the wire rope hoists with the gates in both horizontal axes.

- .2 The machined surfaces shall be smooth and scratch-free. If necessary, any damaged surface shall be repaired within the specified tolerances.

### 3.10 SITE ERECTION AND FIELD TESTS

#### .1 Site Erection - General

- .1 Install, put into operation and submit to field tests all material included in these specifications under the direct supervision of the equipment supplier.
- .2 Prepare and supply drawings field assembly and procedure with the specific information required to install all material. The site erection procedure shall include a visual inspection. The field assembly drawings shall include details of the components and how they shall be lifted in place, and the weights and lift points of these components.
- .3 When selecting the on-site installation methods, the Vendor must take into account the limits imposed by the constraints of the work site, such as the dimensions and maximum allowable loads. Crane load diagrams and rigging diagrams shall be provided in the erection procedure for each major lift showing radius of lift with analysis of the loads in comparison with the established crane lifting chart (i.e. percentage of rated lift required at the maximum radius for each piece of equipment provided).
- .4 Install the material in accordance with the assembly procedures previously established and submitted for approval. All measurements of the works carried out shall be submitted to the "DR" who reserves the right to verify them.
- .5 Provide the labour, all lifting equipment, slings, jacks, tools, welders, supports and scaffolding necessary for the installation of the material.
- .6 The Contractor shall ensure that the machined surfaces of the components are protected throughout the on-site assembly.
- .7 Engage the services of a field representative from the equipment supplier to be responsible for supervising for the entire duration of the installation of the wire rope hoists, the machinery bridges their anchors and fasteners. The field

representative has full authority over quality control for the work.

.2 Site Erection of the Wire rope hoists

- .1 Ensure that the methods for handling and assembly submitted to the "DR" are being followed.
- .2 See that the equipment is handled carefully.
- .3 Verify the function of the equipment and verify the assembly tolerances by making sure that they comply with the specification requirements and give his acceptance.
- .4 Prepare and submit inspection reports.
- .5 Ensure that all corrections necessary to the hoists, structures and covers during the assembly are carried out in accordance with these specifications.

.3 Field Testing - General

- .1 Perform field test in order to demonstrate to the "DR" that the material is complete, that it satisfies, on every point, the standards, design criteria and specification requirements, that it complies with the approved design and shop drawings, that it is in a perfect state of operation and that is properly installed and adjusted. Subject the gates to a series of tests as described below (Witness point).
- .2 Site tests shall be carried out for the gate and hoisting system, as described in the present specifications, at the same time and based on the same site testing procedure.
- .3 Provide the labour and all equipment required for testing the equipment.
- .4 Any defect shall be immediately corrected by the Vendor, at Vendor's expense, and the tests shall be repeated until is proven that the installation functions satisfactorily.
- .5 Following each test, the Vendor shall submit the test result report.
- .6 Include in the test procedures, a start-up test, a load test, a deflection test and a brake test. Submit measurements and test results to the "DR" who reserves the right to verify them.

.4 Field Testing - Dry Tests

- .1 Following the installation of each gate assembly, embedded parts and hoists and prior to stoplogs removal, carry out dry operating tests on all assemblies of the gates and hoisting system.
- .2 The tests shall be carried out in accordance with the accepted procedure and shall include, but not limited to, the following operations:
  - .1 Carry out the dry tests for the gates in the presence of the manufacturer's representative and the "DR".
  - .2 Close and open each gate at normal speed of descent and lifting with stops and starts, for the normal open position and in the suspended position, in addition to intermittent stops and starts, with a demonstration of the effectiveness of the holding motor brake to immobilize and hold the gate;
  - .3 Verify the satisfactory operation with the following:
    - .1 Check the operation of all the switches and position indicator.
    - .2 Record lifting and lowering gate speeds
    - .3 Measure the current and supply voltage of the motors at start-up and at established speed during lifting and lowering (real-time).
    - .4 Measure the load in the hoist wire rope as a function of the gate position during lifting and lowering.
    - .5 Measure bearing, reducers and motor vibrations and temperature.
    - .6 Simulate and check all indications and alarms
    - .7 Check the proper operation of equipment protection devices such as slack rope device.
  - .4 Having the gate in closed position, manually disengage the electric motor brake. Open and close each gate using the hydraulic drive shaft with intermittent stops and starts (with a few minutes pauses in between) that demonstrate the effectiveness of the gear reduction to

immobilize and hold the gate at any position without the need of the brake. Record the lifting and lowering speed values. Repeat with the hand crank mechanism.

.5 Field Testing - Water Acceptance Tests

- .1 Carry out the acceptance tests for the gates and the hoists in the presence of the manufacturer's representative and the "DR".
- .2 The tests shall be carried out in accordance with the accepted testing procedure and shall be undertaken after removal of the stoplogs.
- .3 Acceptance testing shall be performed using the maximum available operating head and shall include the same manoeuvres as the dry tests.
- .4 Simulate the main conditions likely to arise during normal and emergency operations and demonstrate that the equipment can operate normally and without excessive vibration.
- .5 Once these tests have been completed to the "DR" satisfaction, a preliminary certificate of acceptance for the work will be issued.

3.11 SPARE PARTS AND SPECIAL TOOLS

- .1 The Vendor must include in its offer a complete list of spare parts required for the proper operation of the equipment. This list must be prepared according to the recommendations of the manufacturers and / or subcontractor. Each item in this list must be accompanied by a description and its unit price.
- .2 This list must include, but is not limited to, the following parts:
  - .1 One (1) operating coil for each model of the starters and contactors.
  - .2 One (1) contactor and one relay of each type.
  - .3 One (1) set of rectifiers for each model of electromagnetic brakes.
  - .4 One (1) operating coil for each model of brake.
  - .5 One (1) complete set of all the brake linings.

- .6 One (1) grease gun and two (2) tubes of lubricant per type of lubricant used.
- .7 A sufficient quantity of oil to change the oil in each speed reducer.
- .3 All spare parts shall be interchangeable, manufactured to the same standards of quality as the original corresponding parts, as described in this technical specification.
- .4 The Vendor must include in its offer a complete list of all special tools appropriate to unique application. All parts/tools detailed must be identified as to manufacturer, manufacturer part number and supplier (including address). Each item must be accompanied by its unit price.
- .5 Supply the spare parts and special tools upon delivery of the four (4) hoists. They must be packaged separately and clearly identified.
- .6 The owner reserves the right to buy or not the special tools and spare parts listed.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 11 10 00 - Dam Gates.
- .4 Section 11 20 00 - Wire Rope Hoists.

1.2 SCOPE OF WORK

- .1 This section includes the painting of steel surfaces. Items to be painted include gates, embedded parts and gate hoisting system components.
- .2 This section includes the galvanization of steel surfaces. Items to be galvanized include gate hoisting system components (not painted or machined), machinery bridge components including covering checkered plates, gain removable heater covers, steel jackets, hoist protective housing and guardrails.
- .3 Unless otherwise indicated, all parts of equipment shall be coated by the Vendor. Coatings shall be designed to protect against corrosion as appropriate for the design life of the equipment.
- .4 No paint should be applied to surfaces in contact with concrete such as the backing surfaces of the embedded parts and items related to anchors. These surfaces must be free of rust, scale, grease and any other material that may affect the adhesion of the concrete. For this purpose, an abrasive blast cleaning, in accordance with SSPC-SP 7, must be performed on them.
- .5 Except as otherwise specified, the manufacturer's standard coating system shall be used for commercial grade equipment (non-customer designed). Uncoated machined or polished surfaces shall be adequately protected with an anti-rust compound approved by the "DR" prior to shipment. They also must be protected during surface preparation and painting of parts and the Vendor must provide two (2) liters of rust-proofing coatings of the same quality and from the same manufacturer as the one used in the workshop.
- .6 All surface preparation and painting shall be carried out by the Vendor in the shop.

- .7 Any area damaged during handling, transportation and erection shall be touched up at the site by the Vendor, at Vendor's expense.

### 1.3 REFERENCES

- .1 International Organization for Standardization (ISO)
- .1 ISO 12944-2:2017, Paints and varnishes - Corrosion protection of steel structures by protective paint systems - -Part 2: Classification of environments.
- .2 Canada Standard Association (CSA)
- .1 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 American Society for Testing and Materials (ASTM)
- .1 A385-17, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
- .4 Canada General Standard Board (CGSB)
- .1 A780 / A780M-09 (2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- .5 The Society For Protective Coating, SSPC Painting Manual, Volume Two (SSPC)
- .1 SSPC-PA2, Measurement of Dry Coating Thickness with Magnetic Gages.
- .2 SSPC-SP 1, Solvent Cleaning.
- .3 SSPC-SP 2, Hand Tool Cleaning.
- .4 SSPC-SP 3, Power Tool Cleaning.
- .5 SSPC-SP 6, Commercial Blast Cleaning.
- .6 SSPC-SP 7, Brush-off Blast Cleaning.
- .7 SSPC-SP 10, Near-White Blast Cleaning.
- .8 SSPC-SP 11, Power Tool Cleaning to Bare Metal.
- .9 SSPC-SP 12, Waterjetting.
- .10 SSPC-Vis 1, Guide and Reference Photographs for Steel Surfaces prepared by Dry Abrasive Blast Cleaning.
- .11 SSPC-Vis 3, Visual Standard for Power- and Hand-Tool Cleaned Steel.

### 1.3 QUALITY ASSURANCE

- .1 Demonstrate experience in carrying out similar work.
- .2 Provide copies of all maintenance manuals and specific certificates from the paint manufacturer.
- .3 Provide data for coating and other documents that prove proposed products will meet performance requirements of specification.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Use products supplied by the same manufacturer for all the painting work.
- .2 Paint products shall be manufactured and shipped so that all the steps in the process, including the disposal of waste generated during the work, are in accordance with the requirements of all laws, decrees and government regulations that are pertinent, with the Fisheries Act and with the Canadian Environmental Protection Act (CEPA).
- .3 Use paint meeting ISO 12944-2 classification C5I.
- .4 Paint shall be two-component epoxy, high-build, high solid content and with added aluminium pigment.
- .5 Paint colour shall be as specified in related Sections.
- .6 The zinc coat shall be uniform and its thickness shall be such that its minimum weight per square metre shall be at least 610 grams.

2.2 PAINT SYSTEM

- .1 PAINT SYSTEM #1: IMMERSION SURFACES
  - .1 One coat of two-component epoxy paint, Amercoat Amerlock 2AL or International Interseal 670HS AL;
  - .2 One final coat of two-component epoxy paint, Amercoat Amerlock 2 or International Interseal 670HS;
- .2 PAINT SYSTEM #2: NOT IN IMMERSION SURFACES (in housing w/o heat)
  - .1 One primer coat with zinc Amercoat 68HS or International Interseal Interzinc 315;
  - .2 One coat of two-component epoxy paint, Amercoat Amerlock 2AL or International Interseal 670HS AL;
  - .3 One final coat of two-component epoxy paint, Amercoat Amerlock 2 or International Interseal 670HS;

- .3 PAINT SYSTEM #3: NOT IN IMMERSION SURFACES (outside and expose)
  - .1 One primer coat with zinc: Amercoat 68HS or International Interseal Interzinc 315;
  - .2 One coat of two-component epoxy paint: Amercoat Amerlock 2AL or International Interseal 670HS AL;
  - .3 One final coat of two-component epoxy paint: Amercoat Amerlock 2 or International Interseal 670HS;
  - .4 One UV protection coat: Amercoat 450H or International Interthane 990;

PART 3 - EXECUTION

3.1 PAINTING - QUALITY CONTROL

- .1 Vendor shall check degree of cleanliness of surfaces against SSPC-Vis 1 and SSPC-Vis 3. Do not apply paint until prepared surfaces have been accepted by Departmental Representative.
- .2 Vendor shall check each coat of paint after it is applied and before next is applied. Acceptance criteria:
  - .1 Correct type and colour of paint.
  - .2 Correct dry film thickness.
  - .3 Coating is free from gross defects such as (but not limited to) holidays, pinholes, bubbles, runs, skips, drops, ridges, waves, laps, mud cracking, excessive or unsightly brush marks, and all variations in colour, texture, and gloss.
  - .4 Vendor shall pay particular attention to edges, corners, crevices, seams, joints, welds, corrosion pits, and all other such surface irregularities to ensure they have received special attention in providing adequate thickness of paint and quality of application.
- .3 Departmental Representative may require the Vendor to perform occasional random spot checks for adhesion; these checks shall be made in accordance with ASTM D-3359, method A or B, as applicable. Level 3 is the minimum standard for this test.
- .4 Bear cost of rectifying defects. This may include, when so directed by Departmental Representative, the removal of all defective paint, re-cleaning of surfaces, and repainting in accordance with these specifications.
- .5 Claims against PWGSC for delays in completion of project will not be entertained for reasons of failures of surfaces or coatings to pass examinations.

### 3.2 PAINTING - PREPARATION OF SURFACES

- .1 Smooth rough welds and sharp edges with a grinder, and remove any burrs left by the welding.
- .2 Prepare surfaces in contact with the concrete in the same way as for painting, but do not paint them.
- .3 Clean, dry and free of any trace of contamination all surfaces.
- .4 Remove oil and grease by proceeding in accordance with SSPC-SP 1.
- .5 Carefully clean surfaces using Near White abrasive blast cleaning, in accordance with SSPC-SP 10.
- .6 Compressed air to be free of water and oil before reaching nozzle.
- .7 Should any oxidation occur between the blast cleaning and the application of paint, repeat the blast cleaning process to re-establish the visual level originally specified.
- .8 Ground out, fill and treat appropriately surface imperfections revealed by the blast cleaning.
- .9 An angular surface profile, with a roughness of 50-75 microns is required.
- .10 Carry out all surface preparations in the shop. Repair any damage occurring during handling, shipping or installation.
- .11 The following surface shall not be coated:
  - .1 Corrosion-resistant steel surfaces (i.e., stainless steel, anodized aluminium, chromium plate and galvanized).
  - .2 Faying surfaces on connections designed for high strength bolts; however, if primer is of the zinc-rich type, faying surfaces shall be prime coated.
  - .3 Surfaces within 50 mm of field welds, prior to welding
  - .4 Areas of embedded parts which shall be in contact with concrete.
  - .5 Metal surfaces of copper, bronze and similar finished materials.
  - .6 Labels or equipment identification, performance rating, name or nomenclature plates.
- .7 Machine-finished or similar surfaces; however, such surfaces shall

- be protected with a corrosion preventive compound.
- .12 Apply paint or pre-treatment as soon as possible after surface has been cleaned and before deterioration of surface occurs (maximum 8 hour).
  - .13 Clean surfaces again if rusting occurs after completion of surface preparation.
  - .14 Protect cleaned and freshly painted surfaces from dust, to approval of Departmental Representative.

### 3.3 PAINTING - APPLICATION

- .1 Apply all paint in the shop. Touch-up in the field any damage occurring during handling, shipping or installation. Any such touching-up in the field shall be in accordance with these specifications.
- .2 Prevent contamination of surfaces by salt, acid, other corrosive products, grease, oil and solvents before applying coats of paint.
- .3 Apply paint using an airless paint sprayer.
- .4 Apply paint coating in a single pass with a dry film thickness of 200 microns for a minimum of 400 microns (total of paint system).
- .5 Do not handle freshly painted parts. Allow them to dry in accordance with the manufacturer's recommended drying time.
- .6 The colour of the first coat should be slightly different to ensure that the coverage of each successive coat is complete.
- .7 The paint must be applied within the temperature and humidity limits established by the manufacturer of the chosen paint. Painting work must be stopped in the event of a foreseeable drop in temperature to 0°C.

### 3.4 PAINT TOUCH-UPS

- .1 Carry out paint touch-ups in accordance with the requirements specified in these specifications, except for the surface preparation and visual inspection. Carry out surface preparation using mechanical equipment in accordance with SSPC-SP 11.
- .2 The visual inspection must be performed in accordance with the requirements of SSPC-Vis 3.

- .3 Do not apply paint on damp or contaminated surfaces.
- .4 Apply paint touch-ups in accordance with the humidity and temperature limits established by the manufacturer of the selected paint.
- .5 Do not polish surfaces, as this will interfere with the adhesion of the coating.
- .6 Should major field touch-ups be required, the "DR" may require that the surface preparation be carried out by sand blasting.
- .7 The painted surface, in its final state, must be submitted to the "DR" for acceptance.
- .8 Under lighting equivalent to sunlight, touched-up surfaces shall satisfy the following requirements.
  - .1 No defect visible at a distance of 1,000 mm and at an angle of 90° to the surface examined.
- .9 The colour and sheen of the coat of paint shall be uniform over the entire surface examined.
- .10 For future touch-ups, for each colour used, the Vendor shall supply Departmental Representative with 20 litres of the same coating as the one used during fabrication.

### 3.5 GALVANIZATING - QUALITY CONTROL

- .1 After galvanizing, the Vendor shall visually inspect all surfaces for defects.
- .2 The zinc thickness resulting from the galvanization shall be checked on each representative part or sample.
- .3 The thickness of the zinc layer must be such that its minimum mass is not less than the requirements of the applicable standards, depending on the thickness of the basic material.
- .4 The zinc thickness shall be measured in accordance with one of the methods specified in CAN / CSA G164M and a compliance report shall be produced.
- .5 Dirt, burrs, splinters, and other defects should be cleaned. No adhesion defect is acceptable.

### 3.6 GALVANIZING - PREPARATION OF SURFACES

- .1 All surfaces that may be galvanized must be treated with acid in accordance with SSPC-SP 8 after having previously removed all traces of dirt, grease, oil or other contaminants with solvent in accordance with SSPC-SP 1.
- .2 Raw welds and sharp edges shall be ground smooth and any burrs left by the weld shall be removed. All surfaces must be dry, free of oil, rust, grease, slag, dust, etc. before the application of galvanization.
- .3 Surfaces must be inspected in accordance with SSPC-Vis 1 Standard Visual Inspection Standards SA 2 ½.
- .4 Drip holes or openings of sufficient size shall be provided to prevent accumulation of galvanizing compound. Vents must be provided in closed rooms.
- .5 Sufficient hooking points must be provided to allow the suspension of the elements to be galvanized.
- .6 Before shipment to the galvanizer, the Vendor must proceed with the removal of flux (solder), paint, pencil marks, etc.

### 3.7 GALVANIZING - APPLICATION

- .1 Carry out galvanizing in accordance with CAN/CSA G164 and ASTM A385 as well as with the requirements of these specifications.
- .2 Use hot dipping galvanizing to obtain a continuous coat of zinc, of a uniform thickness, which shall adhere perfectly to all steel surfaces and ensure complete protection for the steel after installation.
- .3 Do not proceed with any further fabrication following galvanizing, except where otherwise indicated on the drawings.
- .4 Keep finished surfaces clean and smooth.
- .5 Take into account the possible effects of galvanizing on the rigidity and stability of the structures and reinforce the parts to prevent distortion.
- .6 Each part must be galvanized in a single immersion.

### 3.8 FIELD TOUCH-UPS OF GALVANIZED SURFACES

- .1 Carry out field Touch-ups using a product with a high zinc content in accordance with ASTM A780.
- .2 Under lighting equivalent to sunlight, touched-up surfaces shall satisfy the following requirements.
  - .1 No defect visible at a distance of 1,000 mm and at an angle of 90° to the surface examined.
  - .2 The colour and sheen of the product with a high zinc content shall be uniform over the entire surface examined.

PART 1 - GENERAL

1.1 INTRODUCTION

- .1 These general instructions are intended to supplement and not to replace the requirements of Division 1 General Requirements.
- .2 The requirements of this Section apply to, and form part of all related sections of Division 26 - Electrical.
- .3 The Specifications are divided into sections of work and any section may consist of work of more than one Subcontractor. The responsibility as to which Subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Vendor.
- .4 These Specifications define the requirements of equipment to be provided as part of this contract, including the work necessary to provide power and control for the operation of the new four (4) vertical gates & hoists, the lock/control building extension equipment and associated work.

1.2 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 01 32 16 - Construction Progress Schedules - Bar Chart (GANTT).
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 35 29 - Health & Safety Requirements.
- .4 Section 01 35 43 - Environmental Procedures.
- .5 Section 01 45 00 - Quality Control.
- .6 Section 01 74 21 - Waste Management and Disposal.
- .7 Section 01 78 00 - Closeout Submittals.
- .8 Section 01 79 00 - Demonstration and Training.
- .9 Section 11 10 00 - Dam Gates.
- .10 Section 11 20 00 - Wire Rope Hoists.

- .11 Section 11 50 00 - Shop Painting and Galvanizing - Gates, Hoists.
- .12 Section 26 05 01 - Equipment and Installation
- .13 Section 26 05 21 - Wire and Cables (0-1000 V).
- .14 Section 26 05 22 - Connectors and Terminations.
- .15 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .16 Section 26 05 34 - Conduits, Conduit Fastening and Conduit Fittings.
- .17 Section 26 05 35 - Cable Troughs.
- .18 Section 26 05 36 - Cable Trays for Electrical Systems.
- .19 Section 26 05 43 - Cables in Trench and Ducts.
- .20 Section 26 12 16 - Dry Type Transformers Up To 600 V Primary.
- .21 Section 26 24 16 - Panelboards Breaker Type.
- .22 Section 26 24 16.02 - Main Distribution Cabinet.
- .23 Section 26 24 19 - Motor Control Centres.
- .24 Section 26 24 20 - Control Cabinets for Hoist.
- .25 Section 26 24 21 - Gain and Gate Heating.
- .26 Section 26 29 03 - Controls and Instrumentation.
- .27 Section 26 27 16 - Electrical Cabinets and Enclosures.
- .28 Section 26 36 23 - Manual Transfer Switches.

### 1.3 SCOPE OF WORK

- .1 Provide labour for the following dismantling work:
  - .1 Modification to the existing building to accommodate the new electrical equipment in the existing electrical room.
- .2 Provide labour and materials required for a complete electrical installation in accordance with, but not restricted to this specification and accompanying drawings:
  - .1 Execute the works to ensure the reliability of the power supply during the building extension.
  - .2 Coordinate with and meet the requirements of Hydro One Network to assure proper supply voltage, phase, coordination of protection and performance with standards indicated at the item 1.5 or other provincial distribution standards.
  - .3 Install embedded conduits in the excavation area for the main electric entrance.
- .4 Installed embedded and surface conduits in the piers for the load cell enclosures.
- .5 Supply, installation and connection of one (1) Outdoor Main Distribution Cabinet (MDC) for the 600V distribution. It will include one (1) three phase Main 250A Breaker, one (1) single phase 175A Breaker, four (4) three phase 110A Breaker, one (1) three phase 30A breaker spare and two (2) spaces. These sections will be supplied from one (1) three phase 250 A breaker.
- .6 Supply, installation and connection of four (4) outdoor Motor Control Centre (MCC), one (1) at each gate on the machinery bridge for the control of motor and heating. In each MCC, supply and install one (1) 600 V, 30 A welding outlet of the decontactor type, which is a combination plug, receptacle and disconnect switch in the same device.
- .7 Supply and installation of four (4) gate position control stations, located on the machinery bridge.
- .8 Supply and installation of four (4) 600 V, 30 A isolation disconnect switches for the hoist motors inside the hoisting system enclosures.
- .9 Supply and installation of power and control cables for the dam equipment and the lock/control building.
- .10 Connection of motors, brakes, limit switches and controls required for the vertical gates.

- .11 Supply, installation and connection of junction boxes, flexible electric immersion type heaters (for gains and gates) and control equipment, including the air temperature sensors and thermostats, required for the operation of four (4) gates, their gate and gain heaters and their hoist units.
- .12 Supply and installation of building service equipment for the existing building including one (1) fused disconnect switch, 75 kVA single phase step-down transformer and any other equipment as shown in the single line diagram.
- .13 Supply and installation of 600 V, 300A manual transfer switch (MTS), outdoor, NEMA 4X.
- .14 Supply and installation of one (1) cable between the lock/control building to the Main Distribution Cabinet (MDC), from the disconnect switch in the lock/control building, through the lock 45 underwater chase, to the MDC.
- .15 Installation of one (1) cable from the lock/control building to pedestrian walkway lighting, from the disconnect switch in the lock/control building, through the lock 45 underwater chase, to the pedestrian walkway.
- .16 Supply and installation of a pre-fab cable trench on west side of the dam for passage of cables between the lock 45 chase and the existing cable trench that is routed to the lock/control building.
- .17 Supply and installation of a pre-fab cable trench on the east side of the dam for passage of cables between the Main Distribution Cabinet (MDC) and the embedded PVC sleeves under the pedestrian walkway.
- .18 Supply and Installation of five (5) 103 mm PVC conduits in concrete chase under the lock.
- .19 Supply and installation of a cable tray system, supports and accessories on the dam structure and lock/control building.
- .20 Supply, installation and connection of grounding system, including necessary conductors, rods, hardware and conduits.
- .21 Supply and installation of a concrete base for the equipment installation on the east side of the dam, the MDC, Hydro One metering, Manual Transfer Switch, Generator receptacle. The design of this base will be done by the contractor in function of the

supplied equipment and will include embedded PVC conduit from the equipment to the pre-fab cable trench..24 Supply and installation of a meter receptacle for the hydro-one meter on the east side of the dam attached to the MDC.

- .22 Other work as required, but not mentioned in here to provide a complete installation as intended by this document.

#### 1.4 REFERENCES

The Work covered by this section shall conform to the following standards, except where otherwise specified in the Contract Documents. Where uncertainty exists, the most stringent requirements apply.

- .1 Canadian Standards Association (CSA)
  - .1 CSA C22.1 - Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 Ontario Electrical Safety Code
  - .1 CSA C22.2 No. 0.3 - Test Methods for Electrical Wires and Cables.
  - .2 CSA C22.2 NO. 0.22 - Evaluation methods for arc resistance ratings of enclosed electrical equipment.
  - .3 CAN/CSA C22.2 No. 18 - Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .4 CSA C22.2 No. 38 - Thermoset Insulated Wires and Cables.
  - .5 CSA C22.2 No. 42 - General Use Receptacles, Attachment Plugs and Similar Wiring Devices.
  - .6 CSA C22.2 No. 45 - Rigid Metal Conduit.
  - .7 CSA C22.2 No. 46 - Electric Air Heaters.
  - .8 C22.2 No. 55 - Special Use Switches.
  - .9 CSA C22.2 No. 56 - Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .10 CAN/CSA C22.2 No. 65 - Wire connectors.
  - .11 CSA C22.2 No. 83 - Electrical Metallic Tubing.
  - .12 CSA C22.2 No. 100 - Motors and Generators.
  - .13 CSA C22.2 No. 126.1 - Metal Cable Trays Systems.
  - .14 CAN/CSA-C22.2 No. 126.2-02 - Non-metallic Cable Tray Systems.
  - .15 C22.2 No. 111 - General-Use Snap Switches.
  - .16 CSA C22.2 No. 131 - Type Teck 90 Cables.
  - .17 CSA C22.2 No. 141 - Emergency Lighting Equipment.

- .18 CSA C22.2 No. 182.1 - Plugs, Receptacles and Cable Connectors of the Pin and Sleeve Type.
  - .19 CSA C22.2 No. 211.1 - Rigid Types EB1 and DB2/ES2 PVC Conduit Wiring Products.
  - .20 CSA C22.2 No. 211.2 - Rigid PVC (Unplasticized) Conduit.
  - .21 CSA C22.2 No. 227.3 - Non-metallic Mechanical Protection Tubing (NMPT).
  - .22 CSA C22.2 No. 239 - Control and Instrumentation Cables.
  - .23 CSA C22.2 No. 254 - Motor Control Center.
  - .24 CAN3/CSA No. C235 - Preferred Voltage Levels for AC System, 0 to 50 000V.
  - .25 NEMA MG 1-2016 - Motor and Generator.
  - .26 CSA C22.2 No. 2556 - Wire and Cables Test Methods.
  - .27 EEMAC M2-1 - Lead Marking and Connection for Single-Phase and Polyphase Induction Motor.
  - .28 IEEE C62.41 - IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
  - .29 IEEE 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
  - .30 ISO 3046-1 - Reciprocating internal combustion engines - Performance - Part 1.
  - .31 NEMA ICS 1 - Industrial Control and Systems General Requirements.
  - .32 NFPA 30 - Flammable and Combustible Liquids Code.
  - .33 NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
  - .34 NFPA 110 - Standard for Emergency and Standby Power Systems.
  - .35 UL 142 - Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids.
  - .36 UL 1008 Standard for Automatic Transfer Switches.
  - .37 UL 1236 - Standard for Battery Chargers for Charging Engine-Starter Batteries.
  - .38 UL Subject 2682 «Switch Rated Plugs and Receptacles».
  - .39 NEMA ICS10-2005 Part 1 - AC Automatic Transfer Switches.
  - .40 NEMA VE2 - Cable Tray Installation.
- .3 American Society for Testing and Materials (ASTM)
- .1 A307-04, Standard Specification for Carbon Steel Bolts and

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- Studs, 60 000 PSI Tensile Strength.
- .2 A325-04b, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - .3 A514/A514M-00a, Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
  - .4 A504/A504M-04e1, Standard Specification for Wrought Carbon Steel Wheels.
  - .5 A27/A27M-05, Standard Specification for Steel Castings, Carbon, for General Application.
  - .6 A668/A668M-04, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
  - .7 B584-04, Standard Specification for Copper Alloy Sand Castings for General Applications.
  - .8 A276-05, Standard Specification for Stainless Steel Bars and Shapes.
  - .9 E94-04, Standard Guide for Radiographic Examination.
  - .10 E390-01, Standard Reference Radiographs for Steel Fusion Welds.
  - .11 E709-01, Standard Guide for Magnetic Particle Examination.
  - .12 E165-02, Standard Test Method for Liquid Penetrant Examination.
  - .13 E433-71(2003), Standard Reference Photographs for Liquid Penetrant Inspection.
- .4 American National Standards Institute (ANSI)
    - .1 B4a, Tolerances, Allowances and Gauges for Metal Fits
    - .2 B4.1, Preferred Limits and Fits for Cylindrical Parts
    - .3 B106.1M
  - .5 National Building Code (NBC)
    - .1 Chapter I, Building and National Building Code of Canada 1995 (amended).
  - .6 Ontario Construction regulation
    - .1 Occupational Health and Safety Act, R.S.O. 1990\_2018

- .7 American Iron and Steel Institute (AISI)
- .8 The American Society of Mechanical Engineers (ASME)
- .9 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-48.9712-2000, Non-destructive Testing - Qualification and Certification of Personnel (ISO 9712: 1999, MOD).
- .10 Society of Automotive Engineers (SAE)

#### 1.5 DRAWINGS, DESIGN DATA AND CALCULATION BRIEFS

- .1 Tender drawings: the electrical drawings attached to these documents are not intended to be "shop" or "working" drawings. Sizes and/or arrangements shown are only intended to demonstrate the feasibility of the preliminary design of the required works based on this technical specifications document.
- .2 Submit for review all erection and shop drawings, calculations for main components, technical specifications sheets, shop assembly procedure, site erection procedure and site testing procedure as per Section 01 33 00 - Submittal Procedures.
- .3 Submit shop drawings and design calculations for approval by the "DR" prior to starting manufacture.
- .4 Include in the drawings updates of revisions encountered during manufacture and submit a set of "As Built" drawings upon completion of the work.
- .5 Before beginning the manufacture, submit to the "DR", the mill test certificates, corresponding to the materials to be used. Should these certificates not be available, pay the corresponding tests by a laboratory subject to approval by the "DR".
- .6 Provide manufacturing, assembly, installation and tests procedures.

#### 1.6 SUPPLIER QUALIFICATIONS

- .1 Design, drawings and manufacturing work to be carried out by qualified technicians, supervised and approved by a professional Engineer recognized by the Professional Association of Engineers in the province where the manufacture takes place. Apply for a permit, from the "Professional Engineers Ontario", to supervise the field work.

- .2 The Professional Engineer shall, at least:
  - .1 Makes and sign all calculations and studies,
  - .2 Checks, seal and sign all shop drawings,
  - .3 Perform site inspections of installed gates, embedded parts and their anchorages and verify in writing that they were properly installed, have all the required components and are safe to operate. The Certificate shall be provided to the Engineer on completion of the site testing.
- .3 The equipment supplier (and/or his subcontractors) shall be qualified in accordance with the requirements of CSA W47.1, Division 1 or 2.1.
- .4 The equipment supplier of the dam gates described in this Section shall also be the supplier of the wire rope hoist, the electrical controls for the hoists, the heating systems and the machinery bridge; described in other Sections of this specification.
- .5 The equipment supplier is in charge to coordinate the design, supply, installation and testing of the dam gates and is also responsible of their Subcontractors works.
- .6 The equipment supplier shall review and validate the content of any deliverable carried out by his Subcontractor and shall apply a validation stamp on the document before issuing to the Engineer for approval.

#### 1.7 DAM OPERATION OVERVIEW

- .1 Gate Hoists:
  - .1 Mechanical features of gate hoists are described in the Mechanical Section 11 20 00 - WIRE ROPE HOISTS.
  - .2 The gates shall be operated locally only. Provision for future remote control is required.
  - .3 On the «Gate Hoist Controls» compartment on the motor control center (MCC) the control circuits associated with the gate opening and closing shall be provided with a three (3) position manual selector switch, «Local-Off» in order for the operator to select the desired operating mode for the gate.

- .4 Gates shall be electrically raised and lowered for the hoist system. An electric motor shall wind a steel cable around two drums via a system of reducers and gears the gate shall be raised under the power of the electric motor. The gate will be lowered under the weight of the gate by gravity with the motor restricting the rate of lowering.
- .5 Gates shall be electrically raised and lowered by actuation of the selector switch located in the gate position control stations located on the dam, adjacent to its corresponding gate. Gate position shall be monitored by an electronic display housed within the control station.
- .6 With appropriate gate «Raise» circuits energized, the motor brake shall be energized and the electromagnetic brake which is holding the gate shall automatically be released and after a time delay, the raise starter shall be energized and rotate the motor to raise the gate.
- .7 Gate shall be raised until stopped by the release of the momentary gate selector switch or by fully raised contact of the rotary limit switch. Overtravel limit switch shall be provided for additional safety. When the hoist is stopped by any means, the electric brake solenoid shall be de-energized to stop and hold the gate in a fixed position.
- .8 To lower the gate, the gate control switch shall be turned to the «Lower» position. That automatically releases the brake and energizes the starter to lower the gate. The gate shall be stopped by the release of the momentary gate control switch or by fully lowered contact «Raised / Lowered» limit switch and by the «slack rope» limit switch.
- .9 The activation of the hoist motor shall be annunciated locally through a red LED on the MCC compartment.
- .10 The local gate control station shall be equipped with an emergency stop push button. Actuation of this push-button will remove the control voltage to the gate motor control circuit and subsequently stop the motor from raising or lowering and apply the electromagnetic brake.

- .11 The hoist motors shall be equipped with an encoder. The encoders shall be connected to a hoist position indicator LED display located on the local gate control station. The position encoder device will convert the pulses from the encoder to display the height of the gate in millimeters.
- .12 A microprocessor-based metering equipment to provide monitoring for voltage and current per phase and provide Volts, Amps, kW, kVAR, PF, kVA and frequency.
- .13 During periods of motor shutdown, 120 V shall be applied to the motor space heater in order to maintain the internal temperature above the dew point. This heater shall provide protection against moisture and against freezing of the motor. The motor space heaters can be switched on or off manually by means of a selector switch located on the motor control center (MCC). When the raise or lower command is applied to the gate motor control circuit, the space heater voltage shall no longer be applied.
- .14 Where it becomes necessary to operate the gate manually, release of the brake shall also be possible by a manual lever, to initiate opening or closing of the gate with hand crank mechanism. The action of the lever shall simultaneously interrupt AC power supply to the motor. The release of the lever shall not initiate the descent of the gate in free fall, but shall allow the operator to lift or lower the gate at a controlled speed.
- .15 Each gate shall be provided with a ground fault protection relay (GFR) with sensor. The motor windings supply cables shall be fed through a ground fault sensor and any imbalance between the phases shall be annunciated locally by a red LED indicator on the MCC compartment. A ground fault override selector switch and a reset push button shall also be provided. Upon the GFR resetting or overriding, the motor shall be allowed to continue to operate

.2 Gain and Gate Heaters

- .1 The sluice gates shall be heated. The heating system shall have sufficient capacity so that ice will not be formed to the upstream face of the gates, nor build up on the vertical seals or vertical end members when the gate is in the closed position.
- .2 Each vertical section of the MCC is associated with a corresponding gate. It shall be divided into compartment units. Two of these compartments will be associated with gate heating controls. The first one shall be associated to «Gains Heaters» and the other compartment to «Gate Heaters».
- .3 Gate and gain heaters are supplied with an internal connection point to permit the two-stage control operation.
- .4 Gate and gain heaters MCC compartment has «High-Off-Low» and «Off-Auto/Man» selector switches. In the automatic mode, heaters are controlled through the outdoor sensors and thermostats. In the manual mode, the operator will choose the heat level required (Hi or Low) during a period of time establish with a time-delay relay.
- .5 Gain and gate heaters are supplied and controlled with separate circuits.
- .6 Each gain and gate has six (6) gate heaters, star connected 347/600 V, with a connection point to permit the two-stage functionality.
- .7 Two (2) new adjustable thermostats, mounted on the outside wall of each MCC shall be provided to detect exterior temperatures for the two-stage (Hi/Low) gate de-icing system. The thermostats shall be mounted on the north facing side of the MCC and not the south face to avoid false high temperature reading.

1.8 DESIGN REQUIREMENTS

- .1 Operating voltages according to CAN3-C235.
- .2 Motors, electric heating, control and distribution services and equipment to operate satisfactorily at 60 Hz within normal operating limits established by the above standard.

- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Verify before energization that equipment supplied under this contract or by PCA is compatible with related electrical power supply system.
- .4 Language operating requirements: provide identification nameplates for control items in English.

#### 1.9 DESIGN OF GATES AND EQUIPMENT

- .1 Refer to Section 11 10 00 Dam Gates.

#### 1.10 INTERFACE POINTS

- .1 Ensure the functional and physical compatibility of supply at each physical interface point among various subcontractor/suppliers in order to ensure efficient, reliable and safe operation of the entire arrangement.
- .2 The limits of supply and the definition of interface indicated by any subcontractor do not release them from the obligation to fulfil the requirements defined in these Specifications.

#### 1.11 INSPECTION

- .1 Furnish certificates of acceptance from inspection authority having jurisdiction on completion of work.

#### 1.12 PERMITS, FEES AND INSPECTION

- .1 Submit to the Electrical Safety Authority (ESA) and Hydro One Network the necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees for review, permits and inspection.
- .3 The Departmental Representative will provide drawings and specifications required by the Electrical Safety Authority at no cost.
- .4 Notify the Departmental Representative of all changes required by the Electrical Safety Authority (ESA) prior to making the change.
- .5 Upon completion of Work, provide certificates of Acceptance from

the Electrical Safety Authority (ESA) to the Departmental Representative.

- .6 Before starting any Work, submit the required number of copies of the drawings and specifications to the ESA. Comply with any changes requested as part of the Contract, but notify the Departmental Representative immediately if such changes for the proper process of these requirements. Prepare and provide any additional drawing as may be required.
  - .1 The Vendor shall submit installation and energization certificates from manufacturers from motor control center, panel boards, emergency power systems, control systems and heating systems.
  - .2 The Vendor shall submit electrical equipment or system warranty certificates.
  - .3 The Vendor shall report motor full load amps, type and size of overloads installed, breaker trip settings, fuse ratings and sizes of fuses in control circuits.
  - .4 The Vendor shall report on coordination of protective devices, including recommended and final fields setting data and certified field test data.
- .7 The Vendor shall furnish certificates of acceptance from inspection authority having jurisdiction on completion of work.

#### 1.13 MATERIALS AND EQUIPMENT

- .1 Provide equipment and materials in accordance with Section 01 61 00 - COMMON PRODUCT REQUIREMENTS.
- .2 All equipment and materials shall be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, the Vendor shall obtain special approval from the Departmental Representative.
- .3 Design, supply and install equipment as indicated in this specification and according the drawings.

#### 1.14 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel for indoor equipment.
- .2 Outdoor electrical equipment are in stainless steel NEMA 4X.
- .3 Standard colours:
  - .1 Standard exterior finish for indoor equipment shall be ANSI 61 Grey.
  - .2 Standard interior finish shall be RAL 9003 (White).
- .4 Clean and touch up any surfaces of shop-painted equipment which have been scratched or marred during shipment or installation, to match original paint finish.
- .5 Clean and prime exposed non-galvanized hangers, racks and fastenings in order to prevent rusting.

#### 1.15 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

#### 1.16 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: lamicoïd 3 mm thick plastic engraving sheet, matt white face, black core, mechanically attached with self-tapping screws, letters accurately aligned and engraved into core. Do not use self-adhesive nameplates. Use rivets and/or nuts and bolts where access may conflict with a protruding screw point.
  - .2 Size as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Issue nameplates list for review prior to manufacturing. The wording on nameplates and labels shall be approved by the Departmental Representative.
- .4 Allow for a minimum of twenty-five (25) letters per nameplate or label.
- .5 Writing shall be in English.
- .6 Nameplates for terminal cabinets and junction boxes shall indicate the system voltage and/or voltage characteristics.
- .7 Nameplates for disconnects, starters and contactors shall indicate equipment being supplied/controlled and the source voltage.
- .8 Nameplates for terminal cabinets and pull boxes shall indicate system and voltage.
- .9 Nameplates for transformers shall indicate capacity, primary and secondary voltages.
- .10 Nameplates shall be installed after all painting has been completed and shall be secured with self-tapping screws except on the inside of panel doors where gluing will be accepted.
- .11 Have manufacturers nameplates affixed to each of the equipment showing minimum the size, name of equipment, serial number, nominal voltage and current, phase and the name of manufacturer and its address. Ensure that all stamped, etched or engraved lettering on plates is perfectly legible. Do not paint over nameplates and where apparatus is to be concealed, attach the nameplate in a location on

the equipment structure which is unobstructed and clearly visible.

- .12 Manufacturer's and CSA labels shall be visible and legible after the equipment is installed.
- .13 Ensure to supply and install «Arc Flash» labeling according to the arc flash study performed by others. The supplied «Arc Flash» labeling shall be in accordance with the requirements of the Departmental Representative, which will correspond to the flash hazard assessment of the electrical equipment in the study. Labelling is required on all equipment that is likely to required examination, adjustment, servicing or maintenance, where a potential for an arc flash hazard exists.

#### 1.17 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch wiring circuits.
- .2 Maintain phase sequence and colour coding according to CSA C22.1.
- .3 Control wiring to have same tag at both ends.

#### 1.18 TRAILING CABLE TERMINATIONS

- .1 Use stainless steel wire mesh cable grips and attachments for sluice gate trailing cables.

#### 1.19 WARNING SIGNS

- .1 Warning signs: in accordance with the requirements of the standard Z462 or the Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.
- .3 Shield and mark live parts «LIVE 600 VOLTS», or with the appropriate voltage in French and in English.

#### 1.20 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1, except where specified otherwise.

1.21 SAFETY

- .1 Protect exposed live equipment during construction in order to ensure the safety of personnel.
- .2 No exposed live parts are acceptable. In unavoidable circumstances during construction, notify the Departmental Representative.

1.22 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: schedule 40 steel pipes, sized for free passage of conduit, and protruding 50 mm.
- .2 If PVC sleeves are used in fire rated walls or floors, remove them before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to a minimum.

1.23 EQUIPMENT LOCATION

- .1 Locate equipment as shown on drawings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm from original location. This information shall be transmitted to the Vendor before the installation of the outlet and its conduits.
- .4 Locate light switches on the latch side of doors.
- .5 The mounting height of equipment to be considered is from the finished floor to the centerline of equipment unless specified or indicated otherwise in the Contract Documents and drawings.
- .6 If the mounting height of equipment is not specified or indicated in the Contract Documents, verify it with the Departmental Representative before proceeding with the installation.
- .7 Install electrical equipment at the following heights, unless indicated otherwise in the Contract Documents.
  - .1 Local switches: 1400 mm.
  - .2 Wall receptacles:

- .1      General: 300 mm.
- .3      Emergency lighting unit: 2000 mm.
- .4      Electrical Cabinets: 1800 mm (top) or as indicated.
- .5      Control Panels: 1800 mm.

#### 1.24 COORDINATION OF PROTECTIVE DEVICES

- .1      Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- .2      Ensure that electrical entrance equipment including the main disconnect switch and the MCC main breaker are coordinated with transformer primary connection and Supply Authority's overcurrent devices and meet their requirements.
- .3      Set adjustable Ground Fault relays to values indicated on drawings.

#### 1.25 FIELD QUALITY CONTROL

- .1      Load Balance:
  - .1      Measure phase voltage at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .2      Provide upon completion of work, load balance report, phase and neutral currents on panel boards, dry-core transformers and motor control centers. Operating under normal load conditions, as well as hour and date on which each load was measured and voltage at time of test.
- .2      Conduct following tests in accordance with Section 01 45 00 - QUALITY CONTROL.
  - .1      Power distribution system from service pole to ultimate point of utilization, including phasing, voltage, grounding and load balancing.
  - .2      Circuits originating from the MCC and the distribution panel.
  - .3      Hoist motors, gate and gain heaters and associated control equipment including sequenced operation of systems where applicable.
  - .4      Lock/Control building equipment.
  - .5      Insulation resistance testing:

- .1 Megger circuits, feeders and equipment up to 350 V with 500 V instrument.
- .2 Megger, 350V - 600 V circuits, feeders and equipment with 1000 V instrument.
- .3 Check resistance to ground before energizing.
- .6 Carry out tests in presence of the Departmental Representative.
- .7 Provide instruments, meters, equipment and personnel required to conduct tests during and at the completion of the project. Calibration certificate to the testing equipment shall be provided.

#### 1.26 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - CLEANING.
  - .1 Leave Work area clean at the end of each day.
- .2 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - CLEANING.

#### 1.27 ACTIONS 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 review and approval and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit for review single line diagrams, schematic diagrams and wiring diagrams.
  - .1 Include wiring drawings or diagrams showing interconnection with work of sections 11 10 00 - DAM GATES and 11 20 00 - WIRE ROPE HOISTS.
- .4 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional Engineer registered or licensed in Ontario, Canada.
  - .2 Indicate on MCC drawings:

- .1 Outline dimensions.
- .2 Layout of identified compartments.
- .3 Floor anchoring method and dimensioned foundation template.
- .4 Cable entry locations.
- .5 Dimensions, location and size of bus bars and details of provision for future extension.
- .6 Schematic and wiring diagrams.
- .3 For motors, indicate:
  - .1 Overall dimensions of motor.
  - .2 Shaft centerline to base dimension.
  - .3 Shaft extension diameter and keyway, coupling dimensions and details.
  - .4 Fixing support dimensions.
  - .5 Dimensioned position of ventilation openings.
  - .6 Terminal box location, size and arrangement of terminals.
  - .7 Arrangement and dimensions of accessories.
  - .8 Diagram of connections.
  - .9 Starting current and relative data necessary for use in design of motor starting equipment.
  - .10 Speed/torque characteristic.
  - .11 Weight.
  - .12 Installation data.
  - .13 Nameplate.
- .4 For safety switches, submit the following:
  - .1 Dimensioned outline drawing.
  - .2 Conduit entry/exit locations.
  - .3 Switch ratings, including:
    - .1 Short-circuit rating
    - .2 Voltage

- .3 Continuous current
- .4 Fuse ratings and type (if any).
- .5 Maximum cable terminal sizes.
- .6 Product data sheets.
- .5 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, and other items that must be shown to ensure coordinated installation.
- .6 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .7 Indicate on shop drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .8 If changes are required, notify the Departmental Representative of these changes before they are made.
- .5 Manufacturer's instructions: provide to indicate special handling criteria, installation sequence and cleaning procedures.
- .6 Certificates:
  - .1 Provide CSA certified material and equipment
  - .2 Where CSA certified of equipment is not available, submit such equipment certificates to authority having jurisdiction for approval before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation to the Departmental Representative for approval.
  - .4 Submit, upon completion of Work, load balance report as described in item 1.23 Field Quality Control.
  - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to the Departmental Representative.

1.28 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - CLOSEOUT SUBMITTALS.
- .2 Submit As-Built drawings.
- .3 Operation and Maintenance Data
  - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
  - .2 Operating instructions to include following:
    - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
    - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
    - .3 Safety precautions.
    - .4 Procedures to be followed in event of equipment failure.
    - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

1.29 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle material 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 materials.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

1.30 DESIGN CRITERIA

.1 Temperature

- .1 Design the equipment to operate adequately following a prolonged shutdown, and in outdoor temperatures varying between -40 and +40 degrees Celsius with 100% of humidity relative.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 01 32 16 - Construction Progress Schedules - Bar Chart (GANTT).
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 35 29 - Health & Safety Requirements.
- .4 Section 01 35 43 - Environmental Procedures.
- .5 Section 01 45 00 - Quality Control.
- .6 Section 01 74 21 - Waste Management and Disposal.
- .7 Section 01 78 00 - Closeout Submittals.
- .8 Section 01 79 00 - Demonstration and Training.
- .9 Section 11 10 00 - Dam Gates.
- .10 Section 11 50 00 - Shop Painting and Galvanizing - Gates, Hoists.
- .11 Section 26 05 00 - Electrical General Requirements.
- .12 Section 26 05 01 - Equipment and Installation.
- .12 Section 26 05 21 - Wires and Cables (0-1000 V).
- .13 Section 26 05 22 - Connectors and Terminations.
- .14 Section 26 05 31 - Splitters, Junctions, Pull Boxes and Cabinets.
- .15 Section 26 05 34 - Conduits, Conduit Fastening and Conduit Fittings.
- .16 Section 26 05 35 - Cable troughs.
- .17 Section 26 05 36 - Cable Trays for Electrical Systems.
- .18 Section 26 05 43 - Cables in Trench and Ducts.
- .19 Section 26 12 16 - Dry Type Transformers Up To 600V Primary.
- .20 Section 26 24 16 - Panelboards Breaker Type.
- .21 Section 26 24 16.02 - Main Distribution Cabinet.
- .22 Section 26 24 19 - Motor Control Center.
- .23 Section 26 24 20 - Control Cabinet for Hoist.

- .24 Section 26 24 21 - Gain and Gate Heating.
- .25 Section 26 27 16 - Electrical Cabinets and Enclosures.
- .26 Section 26 36 23 - Manual Transfer Switches.

## 1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

## 1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.
- .2 Drawings shall show construction details, dimensions, sizes and types of cables, installation diagrams, electrical power diagrams and electrical control circuits for all electrical equipment for the project.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.
- .2 To ensure a minimum of diversity in the component parts of the systems, materials of the same type such as breakers, contactors, relays, PLCs, drives or other auxiliary equipment shall come from the same manufacturer.

## 2.2 MAIN SERVICE

- .1 Existing equipment for the electrical main service include an Hydro One Network transformer bank (250 kVA) and a revenue meter main fused 250 A disconnect switches.
- .2 Make all the necessary arrangements with Hydro-One for the supply and installation on the east bank, as indicated on the drawings, for a new meter, a three phase distribution transformer, a lightning arresters, a line break switch and the hardware required to provide 250 KVA, 600 V ca, 60 Hz power to the main power entry at the manual transfer switch.
- .3 The existing revenue meter is installed on the south wall and feeds the existing electrical room. The contractor shall remove the meter. The existing connection of the revenue meter shall be removed.
- .4 The existing Hydro One meter, transformer and foundation located in front of the existing building will need to be removed.

## 2.3 LOCK/CONTROL BUILDING

- .1 Modifications to the existing lock building.

To accommodate for the installation of all the required electrical and control equipment for the gate mechanisation, the existing lock building needs to be modified. There is presently an existing electrical room that can be used for the installation of the new equipment. Some modification and upgrade work will be required. The contractor will provide the design and drawings for the changes to be done to the lock building, this shall be done by an accredited Ontario architect. Works to be taken in consideration are:

- .1 Interior Walls

1. The existing floor plan might not give a sufficient space for the new electrical equipment in the room. The new floor plan will need to be done by the contractor with the approbation of a PWGSC representative.

.2      Floor

1. Opening in the floor will need to be done for the passing of the conduit installed under the building going to the transformer disconnect switch. Opening shall be filled with intumescent fire-stop system after installation of the cables.
2. Provide adequate bearing (concrete pads and/or steel supports) at appropriate locations to accommodate the installation of Transformer and other equipment.

2.4      DAM EQUIPMENT

- .1      Install and connect equipment specified in Section 11 10 00 - Dam Gates and Section 11 20 00 - WIRE ROPE HOISTS.
- .2      Motors:
  - .1      Material:
    - .1      Non-hazardous locations: to CSA C22.2 No. 100.
    - .2      Lead markings: to EEMAC M2-1.
  - .2      Corrosion Prevention and Finish Painting:
    - .1      Provide equipment resistant to corrosion from severe moisture conditions.
  - .3      Motors shall be provided as required for the vertical gate and shall be rated at 600 V, 3-phase, 60 Hz. Motor size will be determined by the gate manufacturer.
  - .4      Motors shall be Totally Enclosed Fan Cooled (TEFC), high efficiency, in accordance with CSA C390, squirrel cage induction type A, sized and rated to suit the driven equipment and not having a starting current at rated voltage of less than 600% of rated full load current at normal starting torque.
  - .5      Motors for hoist shall be rated for their special operating conditions. Motors shall be of the «C» torque design, except

that the locked rotor and/or breakdown torque shall be between 190% and 210% of the rated motor torque at rated voltage.

- .6 Motor shall be designed and be suitable for frequent and accurate gate raising and lowering. Motors shall have a high duty cycle to accommodate a large number of gate movements per day (but only a couple days in a year).
  - .7 Motors shall have a Class F non-hygroscopic insulation with a temperature rise limited to class B (80C).
  - .8 Motors shall be shop tested for no-load and short-circuit characteristics, the winding and insulation resistance checked, and a high voltage test performed on the windings. Certificates of these tests shall be completed together with the type test certificate.
  - .9 Motors shall include non-regreasable rolling contact bearings with seals to prevent leakage of lubricant in either direction along the shaft.
  - .10 Motors shall include, where practical, motor end covers, remote from the driving end, having a removable plug to allow the rotating speed to be checked by means of a portable tachometer.
  - .11 Motors shall include lifting lugs or eye bolts if they have a mass of 50 kg or more.
- .3 Electromagnetic Holding Brake:
- .1 The holding brake shall be mounted directly onto the hoist motor without special alignment procedures. The solenoid actuated brake (SAB) shall ensure automatic stopping and holding any time power to the brake is interrupted. The SAB shall be selected to meet the hoist motor horsepower, speed, frame size, mounting requirements, application and load.
  - .2 The SAB shall be provided with a manual release lever with automatic reset in order to release the brake and close the gate without electrical supply. The manual release lever shall be equipped with a limit switch to make the motor

control circuit inoperable when the brake is released.

- .3 The solenoid actuated brake leads shall be brought to a terminal strip inside of the SAB for connection to 120 V, 1-phase supply.
- .4 The SAB shall have a type NEMA 4X enclosure suitable for outdoor wet applications.
- .5 Acceptable manufacturers, but not limited to:
  - .1 Stearns Brakes.
  - .2 Bonfiglioli.
  - .3 Electro Shear.

.4 Motor Space Heater:

- .1 Space heaters shall be provided to maintain the internal air temperature above the dew point during periods of motor shutdown. Space heater capacity shall be according to the size of the motor frame in order to maintain the temperature within the motor approximately 5°C to 10° above the surrounding temperature.
- .2 Space heater leads shall be brought out to an auxiliary terminal box for connection to 120 V, 1-phase supply.

2.5 ENCODERS:

- .1 The position of the gates shall be monitored and displayed locally on a digital position indicator installed on the gate position control station.
- .2 The digital position indicator shall be coupled to an encoder, which shall be mounted on the motor shaft. The position encoder shall be easily accessible for maintenance.
- .3 The encoders shall be rugged, incremental encoders of the rotary pulse generator type. The encoders shall have 500 pulses per revolution (PPR). The encoders may be direct-coupled to the drum shaft by any means or they may be coupled with instrument timing

belts and pulleys or gears. The encoders shall be supplied in a NEMA 4X enclosure, and be able to operate in an environment of mechanical shock and vibration, temperature and humidity variations.

- .4 The encoder pulses shall be proportional to the rotation of the shaft in order to derive the gate position from the number of pulses.
- .5 The encoder shall be mounted on the shaft of the motor. The information produced by the encoder shall be sent to a visual display unit on the local control panel. The encoder shall be capable of signalling the position of the gate at all times. Should a restart be required, it shall be capable of determining the exact position of the gate immediately after the supply power is restored.
- .6 Acceptable manufacturers:
  - .1 Red Lion.
  - .2 Dynapar.

## 2.6 LIMIT SWITCHES:

- .1 Limit switches are needed to establish the normal operating range of a sluicgate. The limit switches are hardwired in the control circuits that they stop the electric motor and apply the brakes at pre-set positions, thereby blocking movement beyond these positions.
- .2 All limit switches shall be easily accessible for maintenance.
- .3 Limit switches are to be supplied in NEMA 4X enclosures, rated to interrupt 10 A, inductive load minimum at 120 Vac, as indicated on the control schematic drawings and further described below.
  - .1 Upper Limit & Lower Limit - Rotary limit switch with two (2) N.C. contacts.
  - .2 Over Travel - one (1) N.C. contact.
  - .3 Slack Rope - four (4) N.C. contact (One per rope).

- .4 Hoist Motor Holding Break - one (1) N.C. contact.
  
- .4 The actuation of an «Upper Limit» or «Lower Limit» switch is considered normal and shall not trigger an alarm on its own.
  
- .5 Additional limit switches are allowed to prevent over travel damage to sluice gate structure or drive components or other adverse consequences if the rotary limit switches are not be effective.
  
- .6 The Vendor is to supply, install and connect the following equipment and devices, complete with all accessories:
  - .1 Motor disconnect safety switches:
    - .1 Provide heavy-duty safety switches as shown on drawings, with the following ratings:
      - .1 600 V a.c., horsepower rated, 3-phase, 3-pole, 60 Hz, non-fusible, complete with mechanical lugs suitable for copper conductors.
  
  - .2 Construction:
    - .1 Switch shall have a full viewing window.
    - .2 Switch blades and jaws shall be visible and plated copper.
    - .3 Switches shall have a red handle that is easily pad-lockable with three 3/8-inch shank locks in the OFF position.
    - .4 Switches shall have defeatable door interlocks that prevent the door from opening when the handle is in the ON position. Defeater mechanism shall be front accessible.
    - .5 Switches shall have deionizing arc chutes.
    - .6 Switch assembly and operating handle shall be an integral part of the enclosure base.
    - .7 Switch blades shall be readily visible in the «ON» and «OFF» position.

- .8 Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type. Bail type mechanisms are not acceptable.
- .9 Switches shall have line terminal shields.
- .10 Factory installed crimp lug pad kits and ground lug kits
- .11 Embossed or engraved ON-OFF indication shall be provided.
- .12 Renewal parts data shall be shown on the inside of the door.
- .3 Enclosures:
  - .1 All enclosures shall be NEMA 4X, in stainless steel, watertight corrosion-resistant.
- .4 Nameplates:
  - .1 Nameplate shall be engraved phenolic type, front cover mounted, containing a permanent record of switch type, ampere rating, and maximum voltage rating.

## 2.7 WELDING RECEPTACLES:

- .1 Provide 600 V a.c., 30 A, 3-phase, 60 Hz receptacles of the decontactor type, which are a combination plug, receptacle and disconnect switch in the same device.
- .2 Switch-rated welding plugs and receptacles shall be CSA listed to UL Subject 2682 «Switch Rated Plugs and Receptacles» and CSA 22.2 182.1.
- .3 Plugs and receptacles shall have constant pressure butt-contacts with solid silver-nickel tips. Pin and sleeve contacts are not permitted.
- .4 Receptacles must have dead front construction: live parts shall be inaccessible to thin tool or wire.
- .5 Plugs and receptacles must be able to close at least once on a conditional short-circuit current of 22 kA.

- .6 Plugs and receptacles must incorporate an integral switching mechanism to ensure the load is broken before the plug is removed from the receptacle.
- .7 Plug and receptacle wire terminals shall be spring-assisted to prevent loosening due to conductor yielding, shocks, vibrations or thermal cycling.
- .8 The minimum environmental rating of plugs and receptacles shall be Type Nema 4X.
- .9 Ingress protection shall be achieved automatically when the plug is fully inserted into the receptacles, without additional manual operation.
- .10 Plugs and receptacles shall have a system of different keying positions in order to discriminate between circuits or incompatible voltages or frequencies.

#### 2.8 120 V GFI RECEPTACLES:

- .1 Duplex receptacles, GFI type, CSA type 5-15 R, 125 V, 15 A, U ground, according to CSA C22.2 No. 42.
- .2 Brown urea moulded housing.
- .3 Suitable for No. 10 AWG for back and side wiring.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and riveted grounding contacts.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles.

#### 2.9 GROUNDING NETWORK

- .1 A buried grounding system and a surface Network grounding system are shown on the drawings.
- .2 All conductors shall be bare copper, tinned and stranded, 4/0 AWG size, for the main circuit conductors as well as for the ground electrode interconnections. They shall be 2/0 AWG size for branch

circuits towards connection points such as equipment, motors, transformers, distribution panels, tracks, encased metal structures, fences, guard rails, walkways, etc. as shown on the drawings.

- .3 Except where otherwise indicated, all buried connection points shall be made using aluminothermic welds. Splices shall not be accepted for a buried grounding circuit. Types of welds required are shown on the drawings.
- .4 Provide and install coppered steel grounding I electrodes, 19 mm in diameter over a 3 m length, on the right bank of the dam, and connect them to the main grounding system with a 4/0 AWG size tinned bare copper wire. These electrodes shall be planted in damp soil where conductivity is best.
- .5 Accessible grounding conductors shall be protected mechanically with channels during construction.

#### 2.10 DETECTION OF GROUND FAULT

- .1 Provide type 50G systems for detecting a ground fault on the various circuits of the following systems:
  - .1 Main circuit for the dam power supply coming from the Hydro-  
One pole.
  - .2 Supply circuit of heating elements for the upstream and  
downstream guides.
  - .3 Heating circuits of gates.
  - .4 Power supply for the heating the cabinets.
  - .5 Power supply for each of the hoist circuits.
- .2 Should there be a ground fault, the type 50G detection system shall immediately cause the system on which the fault occurs to stop, generate an audible alarm and activate a ground fault indicator light-on the control panel corresponding to each circuit or system.
- .3 The audible alarm shall be capable of being reset only for the circuit at fault, without resetting the alarms for the other systems.
- .4 One dry contact shall be provided for each of the systems for retransmitting the alarm to the Engineer control station. See schematic diagrams.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Provide full factory tests for all the equipment supplied.

#### 3.2 GENERAL

- .1 Provide four (4) heated dam gates.
- .2 Provide four (4) sets of heated gate's embedded parts.
- .3 Provide four (4) electric-driven hoist with control cabinets and all accessories

#### 3.3 PERMITS

- .1 Comply with Federal, Provincial and local laws, regulations and ordinances.
- .2 Comply with the Electrical Safety Authority (ESA) requirements and approvals.
- .3 Obtain and pay for permits required for electrical work.

#### 3.4 MEASUREMENTS

- .1 Verify all elevations and dimensions prior to installation of equipment.

#### 3.5 WORK STANDARDS

- .1 Do work in accordance with rules and regulations of the Canadian Electric Code, C22.1.
- .2 Use properly qualified tradesmen, supervised by qualified foremen.
- .3 Execute work to approval of Departmental Representative and provincial electrical authorities and inspection department having jurisdiction.

### 3.6 MAIN SERVICE POWER SUPPLY

- .1 Consult with and fulfill requirements of Hydro One Network and pay for services as required for the complete electrical installation, including the Hydro One Network revenue metering, transformers and instruments if required.
- .2 Inform Hydro One Network about the general arrangement near the electrical line post (with the transformer bank) and coordinate all other works required for the electrical main power supply.
- .3 For installation of underground trench from Hydro One electrical line post to the main electrical service entrance on the east side of the dam, coordinate with owner of parking lot adjacent to the Parks Canada property for permission and access.

### 3.7 EQUIPMENT INSTALLATION

- .1 Install and connect the following equipment:
  - .1 In the Lock/Control Building:
    - .1 Cable trays, conduits, channel and supports.
    - .2 Firestop material.
    - .3 Dry Type Transformer with disconnect.
  - .2 Outdoor
    - .1 Main Distribution Cabinet (MDC).
    - .2 Motor Control Center (MCC) (One per Gate).
    - .3 Concrete Foundations.
    - .4 Cable trays, conduits, channel and supports.
    - .5 Manual Transfer Switch.
    - .6 Receptacles - outdoor.
    - .7 Hydro One meter socket.

- .8      Grounding
- .3      Limit switches.
- .4      Gate Control Stations.
- .5      Junction boxes, cable trays and conduits.
- .6      Gain heaters and gain heating control.
- .7      Gate heaters and gate heating control.
- .8      600 V welding receptacle.
- .9      120 V GFI receptacles.
- .10     Motor isolating switches, motors and brakes.
- .11     Bridge/Road and pedestrian walkway lighting.

### 3.8    GROUNDING SYSTEMS

- .1      Install continuous grounding system components including ground rods, conductors, connectors and accessories as indicated on drawings and according manufacturer's recommendations.
- .2      Installation of connectors in accordance with manufacturer's instructions.
- .3      Determine if a grounding system for lock/control building already exists, if it does, make necessary grounding connections of new equipment to existing grounding system. If grounding system does not exist, install a grounding system as indicated on grounding drawing.

### 3.9    MOTORS

- .1      Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2      Install motor on structure of driven machinery, rigid plumb and square, using only lifting facilities provided.

- .3    Make wiring connections. Use liquid tight PVC jacketed flexible conduit between rigid conduit and motor.
- .4    Make flexible conduit long enough to permit movement of motor.
- .5    Check for correct direction of rotation, with motor uncoupled from driven equipment.
- .6    Align and couple motor to driven machinery to manufacturer's instructions, using only correct parts such as couplings, belts, sheaves, as provided by manufacturer.

### 3.10 MOTOR DISCONNECT SAFETY SWITCHES

- .1    Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards:
- .2    The equipment shall be installed per the manufacturer's recommendations and all CEC and local code requirements.

### 3.11 WIRING DEVICES

- .1    Switches:
  - .1    Install single throw switches with handle in "UP" position when switch closed.
  - .2    Install switches in gang type outlet box when more than one switch is required in one location.
  - .3    Mount toggle switches at height [as indicated].
- .2    Receptacles:
  - .1    Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2    Mount receptacles at height [as indicated].
- .3    Cover Plates:
  - .1    Install suitable common cover plates where wiring devices are grouped.

- .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

### 3.12 WIRE AND BOX CONNECTORS (0-1000V)

- .1 If applicable, apply coat of zinc joint compound on aluminium cable splices prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA C22.2 No. 65.

### 3.13 SPARE PARTS AND SPECIAL TOOLS

- .1 All spare parts and accessories shall be identical electrically and mechanically to corresponding parts in the equipment supplied and shall be suitably packed and clearly marked, ready for long term indoor storage.
- .2 The Vendor shall supply the following spare parts:

Item	Component	Nb. of spares required
1	MCC starter size 1, forward-reverse	1
2	Pilot-lamp	2 of each colour
3	Selector switch 3 positions with spring return	2
4	Selector switch 3 positions	2
5	Selector switch 2 positions	1
6	Selector switch 2 position with wing lever-type operating handle for local control stations	1
7	Gate level indicator for local control stations	1
8	Gain and gate heaters	1 of each model
9	Rotary limit switch	1
10	Standard limit switch	2
11	MCC breaker 30A	1
12	MCC breaker 15A	1
13	MCC breaker 25A	1

- .3    The Vendor shall also provide a list of recommended spare parts, complete with their recommended quantities. Each item shall be clearly identified with its unit price indicated.
  
- .4    The Vendor shall also provide a list of special devices, handling tools and instruments required for erection, testing and maintenance and shall include such special tools and instruments detailed in the bid.

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 06 31 - Diesel Electric Generating Units.
- .3 Section 26 12 16- Dry Type Transformers Up To 600 V Primary.
- .4 Section 26 24 16- Panelboards Breaker Type.
- .5 Section 26 24 16.02 - Main Distribution Cabinet.
- .6 Section 26 24 19 - Motor Control Centres.
- .7 Section 26 24 20 - Control Cabinets for Hoist.
- .8 Section 26 24 21 - Gain and Gate Heating.
- .9 Section 26 27 16 - Electrical Cabinets and Enclosures.
- .10 Section 26 36 23 - Manual Transfer Switches.

### 1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

### 1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

- .1 The Vendor is to determine the lengths required and provide cables and wires as indicated or necessary for a complete electrical installation.
- .2 Building Wires
  - .1 Conductors shall be stranded for 10 AWG and larger. Minimum wire size accepted: 12 AWG.
  - .2 Use copper conductors, size as indicated, 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, jacketed.
- .3 Teck90 Cable
  - .1 Conductors:
    - .1 Grounding conductor: copper.
    - .2 Circuit conductors: copper, size as indicated.
  - .2 Insulation:
    - .1 Cross-linked polyethylene XLPE.
    - .2 Rating: 1000 V
    - .3 Inner jacket: polyvinyl chloride material.
    - .4 Armour: aluminum.
    - .5 Overall covering: thermoplastic polyvinyl chloride.
    - .6 Fastening:
      - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
      - .2 Channel type supports for two or more cables.
      - .3 Threaded rods: 6 mm diameter to support suspended channels.

.7 Connectors: Watertight, approved for Teck90 cable.

.4 Control and Instrumentation Cables

- .1 Control cables shall be in accordance with CSA C22.2 No. 131 or C22.2 No. 239 and comprise of 600 V rated, armoured, multi-conductor, Teck90 or ACIC cables.
- .2 Control cables: 600 V stranded annealed copper conductors, sizes as indicated.
- .3 Instrumentation cables: 300 V stranded annealed copper conductors, sizes as indicated
- .4 Insulation: RW90 (EP or XLPE).
- .5 Shielding: overall spiral-wound copper shield if applicable.
- .6 Interlock armour.
- .7 Overall covering: low-acid-gas-emitting PVC outer jacket, FT4, rated -40°C to 90°C.

.5 Flexible Power Cables

- .1 The two flexible cables for supplying power to the gates are extra-flexible. Shall include 4 copper conductors 6 AWG size and one shielded twisted pair minimum 16 AWG size for 4-20 mA signals.

These cables shall be held at the ends by supports and a stainless steel wire mesh cable grip, with springs, fasteners and hooks.

- .2 Control cables: 1000 V copper conductors, sizes as indicated on cable schedule.
- .3 Insulation: W90 Round (extra-flexible).
- .4 Overall covering: rated -40°C to 90°C.

PART 3 - EXECUTION

3.1 GENERAL CABLE INSTALLATION

- .1 Install wires and cables required as indicated and comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation/termination instructions, and datasheet.
- .2 Wiring and cables shall not be installed when ambient temperature is  $-10^{\circ}\text{C}$  or lower.
- .3 Wire and cables shall not be installed in conduit or cable tray until the cable support system has been satisfactorily completed and cleaned.
- .4 The Vendor shall pull wire and cable into conduits and trays with sufficient length provided at the ends to conveniently form, terminate and make connections to all equipment and devices without stress on the wire or cable or connection.
- .5 Cables shall be pulled with equipment designed for this purpose, including power-driven winch, cable-feeding flexible tube guide, cable grips, and personnel, equipment and manufacturer's recommended lubricants. A sufficient number of trained personnel, equipment and hardware shall be employed to ensure the careful and proper installation of the cable. Pulling force shall not exceed manufacturer's recommendation and a dynamometer shall be used in the pulling line to ensure that the pulling force is not exceeded.
- .6 When cables are installed directly on walls or ceilings, group them wherever possible on channels.
- .7 Woven-wire cable grips shall be used to grip cable ends when pulling small cables and short straight lengths of heavier cables. Pulling eyes shall be attached to the cable conductors to prevent damage to the cable structure. Pulling eyes and cable grips shall be used together for non-metallic sheathed cables to prevent damage to the cable structure.
- .8 A non-conducting lubricant or cable-pulling compound, non-injurious

to the insulation or sheath, shall be used as a lubricant to aid in pulling wire or non-metallic sheathed cable, where required. Oil or grease shall not be used for lubrication and excessive pulling stresses shall not be permitted.

- .9 The minimum radius to which an insulated conductor shall be bent, either permanently or temporarily during installation, shall be according to the CEC requirements and to the manufacturers recommendation whichever is greater. Rollers, sheaves, or tube guides for cable pulling shall conform to the minimum bending radius of the cable.
- .10 Wiring for lighting and receptacle circuits may contain splices in outlet boxes and junction boxes by the use of approved crimp-type connectors. Splices are not permitted within conduit bodies.
- .11 Power, control, communication and instrumentation cable shall be continuous with no splice permitted.
- .12 If field cuts or other damage occurs to the cable jacket, the jacket shall be repaired using an Engineer approved wraparound heat shrink cable repair sleeve to maintain the integrity of the jacket. If the cable fails any of the continuity or insulation resistance tests, it shall be replaced in its entirety at no extra cost to the Purchaser.
- .13 Number and tag wires and conductors at terminals.
- .14 Where required on gate, orient cable and fix with wire mesh cable grips to relieve strain at cable terminations and eliminate possibility of damaging cable or waving due to wind.
- .15 Cables between MCC and gain heater shall be hidden under the bridge but also in the concrete. Cables shall not be visible outside the extension of embedded parts. Refer to section 11 10 00 - Dam Gates article 3.2.5.8.
- .16 In cable trays:
  - .1 Install cables individually.
  - .2 Cables shall be neatly straightened and positioned to present an orderly appearance and to aid in tracing cable circuits

- .3 Lay cables into cable tray. Use rollers when necessary to pull cables.
- .4 Secure cables in cable tray at 3 m centres, with nylon ties.
- .5 Identify cables at both ends.
- .17 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .18 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .19 Building wires shall be installed in accordance with CEC.
- .20 After completion of cable installation, install fire-stop material at the lock/control building openings.
- .21 Conduit ends shall be sealed at both ends with foam duct sealant to seal out water, gases and rodents.

### 3.3 FIELD QUALITY CONTROL

- .1 Perform tests using method appropriate to site conditions and to approval of the Departmental Representative and the local authority having jurisdiction over installation.
- .2 Perform tests before energizing electrical system.
- .3 Provide full factory tests for all the equipment supplied.

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 12 16- Dry Type Transformers Up To 600 V Primary.
- .3 Section 26 24 16- Panelboards Breaker Type.
- .4 Section 26 24 16.02 - Main Distribution Cabinet.
- .5 Section 26 24 19 - Motor Control Centres.
- .6 Section 26 24 20 - Control Cabinets for Hoist.
- .7 Section 26 24 21 - Gain and Gate Heating.
- .8 Section 26 27 16 - Electrical Cabinets and Enclosures.
- .9 Section 26 36 23 - Manual Transfer Switches.

### 1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

### 1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

## PART 2 - PRODUCTS

### 2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors to CSA C22.2 No. as required sized for conductors.

## 2.2 TERMINAL BLOCKS AND CONNECTORS

- .1 Terminal blocks shall have 600 V insulation.
- .2 Acceptable manufacturers
  - .1 Weidmuller
  - .2 Entrelec
  - .3 Wieland
- .3 Terminal block strips containing different voltage levels shall be separated using a partition wall.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Install terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

- .1 Section 26 05 21 - Wire and Cables (0-1000 V).
- .2 Section 26 05 22 - Connectors and Terminations.
- .3 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .4 Section 26 05 34 - Conduits, Conduit Fastening and Conduit Fittings.

### 1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

### 1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

## PART 2 - PRODUCTS

### 2.1 JUNCTION AND PULL BOXES

- .1 Design, factory assemble and supply junction boxes for complete electrical installation. Size to accommodate material and allowing for 10% future increase in contents. Include nameplate, fasteners, terminal blocks and hardware.
- .2 Construction: welded stainless steel enclosures, NEMA 4X.
- .3 Covers Flush Mounted: 25 mm minimum extension all around.
- .4 Covers Surface Mounted: screw-on turned edge covers.

## 2.2 CABINETS

- .1 Construction: welded sheet steel hinged door, latch and catch
- .2 Type E Empty: surface return flange mounting as indicated.
- .3 Type T Terminal: surface return flange mounting as indicated containing 19 mm sheet steel backboard.

## PART 3 - EXECUTION

### 3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install and junction pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

### 3.2 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00- ELECTRICAL GENERAL REQUIREMENTS.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.
- .4 Section 26 05 43 - Cables in Trench and Ducts.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

2.1 CONDUITS:

- .1 Supply electrical metallic tubing (EMT) for lock/control building wiring, according to CSA C22.2 No. 83, with couplings and accessories as required.
- .2 Supply rigid metal conduit (RMC) as indicated to CSA C22.2 No. 45, galvanized steel threaded.
- .3 Supply rigid PVC conduit, where indicated, according to CSA C22.2 No. 211.2.

- .4 Supply flexible metal conduit, as required, according to CSA C22.2 No. 56, liquid-tight flexible metal.

## 2.2 CONDUIT FASTENINGS:

- .1 Use one hole steel straps to secure surface conduits 50 mm and smaller.
- .2 Use two hole steel straps for conduits larger than 50 mm.
- .3 Use beam clamps to secure conduits to exposed steel work.
- .4 Use channel type supports for two or more conduits except in precast concrete trench and in dam chases.

## 2.3 CONDUIT FITTINGS:

- .1 Fittings should be according to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Use watertight connectors and couplings for EMT. Set-screws are not acceptable.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference.
- .2 Use rigid galvanized steel threaded conduit except where specified otherwise.
- .3 Use rigid PVC coated conduit underground.
- .4 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury and except in cast concrete.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.
- .6 Minimum conduit size for lighting and power circuits: 21 mm.

- .7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19 mm diameter.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.
- .12 Install nylon wire (6 mm diameter) in empty conduit to facilitate later cable pulling.
- .13 Surface Conduits:
  - .1 Run parallel or perpendicular to building lines.
  - .2 Group conduits wherever possible on surface channels.
- .14 Conduits in cast-in-place concrete
  - .1 Locate to suit reinforcing steel. Install in centre of the first third of slab.
  - .2 Protect conduits from damage where they stub out of concrete.
  - .3 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
  - .4 Encase conduits completely in concrete with minimum 25 mm concrete cover.
  - .5 Organize conduits in slab to minimize cross-overs.
- .15 Conduits in cast-in-place slab on grade:
  - .1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.
- .16 Conduits underground:

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 43 - Cables in Trench and Ducts.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

2.1 CABLE PRECAST TRENCH

- .1 Precast concrete trench
- .2 One piece U-shaped base complete with removable stainless steel cover plate
- .3 Open bottom design for H2O loading
- .4 Interior dimension: 515 mm (H) x 515 mm (W)
- .5 Manufacturer: Oldcastele Plastibeton or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install the precast cable trench according the manufacturer's recommendations.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

2.1 CABLE TRAYS

- .1 Cables trays, clamps and connectors:
  - .1 Supply ladder type, Class D1 cable trays to CAN/CSA C22.2 No.126.1.
  - .2 Trays: galvanized steel, width as indicated on drawings; depth of 100 mm.
  - .3 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable trough supplied.

- .4 Solid covers for complete cable trough system including fittings.
- .5 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.
- .6 Use fire stop material to seal openings.
- .7 Provide splices, supports for a continuously grounded system as required.
- .8 Threaded rods: 6 mm diameter to support suspended cable trays

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Install complete cable tray system in accordance with NEMA VE 2.
- .2 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.
- .3 Install cables individually.
- .4 Lay cables into cable tray. Use rollers when necessary to pull cables.
- .5 Secure cables in cable tray at 3 m centres, with nylon ties.
- .6 Identify cables every 30 m.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 31 23 33.01 - EXCAVATING, TRENCHING AND BACKFILLING.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

2.1 CABLES IN TRENCHES AND IN DUCTS

.1 Cable Protection

- .1 Use 38 x 140 mm planks, pressure treated wood, with clear naphthenate or 5% pentochorophenol solution, water repellent preservative.

.2 Markers

- .1 Supply and install concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

PART 3 - EXECUTION

3.1 INSPECTION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.
  - .2 Visually inspect substrate in presence of the Departmental Representative.
  - .3 Inform the Departmental Representative of unacceptable conditions immediately upon discovery.
  - .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Departmental Representative.
- .2 Direct Burial of Cables
- .1 This item shall be applicable if the cables between the Hydro One Network pole and the lock/control building are not installed in buried conduits for all length. The same if the generator set and the lock/control building are not installed in buried conduits for all length.
  - .2 After sand bed in accordance with Section 31 23 33.01 - EXCAVATING, TRENCHING AND BACKFILLING, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
  - .3 Include offsets for thermal action and minor earth movements. Offset cables shall be 150 mm minimum for each 60 m run.
  - .4 Maintaining minimum cable separation and bending radius requirements.
  - .5 Underground cable splices not acceptable.
- .3 Cable Installation in Conduits
- .1 Install cables as indicated in conduits.

- 
- .2 Install multiple cables in duct simultaneously.
  - .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
  - .4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
  - .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
  - .6 After installation of cables, seal conduits ends with duct sealing compound.
- .4 Markers
- .1 Mark cable every 20 m along cable runs and changes in direction.
  - .2 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .5 Field Quality Control
- .1 Perform tests using qualified personnel.

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.
- .4 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .5 Section 26 05 34 - Conduits, Conduit Fastening and Conduit Fittings.
- .6 Section 26 05 35 - Cable Troughs.
- .7 Section 26 05 36 - Cable Trays for Electrical Systems.
- .8 Section 26 05 43 - Cables in Trench and Ducts.

### 1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

### 1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

2.1 DRY TYPE TRANSFORMER UP TO 600 V

- .1 Use transformers of one manufacturer throughout project.
- .2 Manufacturers: subject to compliance with requirements, provide products by the following acceptable manufacturers:
  - .1 Bemag
  - .2 Delta Transformer
  - .3 Marcus Transformers
- .3 Design
  - .1 Type: ANN.
  - .2 Single phase, 75 kVA, 600 V input, 120/240 V output, 60 Hz.
  - .3 Voltage taps: 2X +/- 2.5%.
  - .4 Insulation: Class 220°C, 80°C temperature rise.
  - .5 Basic Impulse Level (BIL): standard
  - .6 Hipot: standard
  - .7 Average sound level: standard
  - .8 Impedance at 170°C: 3.4% to 3.6%
  - .9 Enclosure: NEMA 1, removable metal front panel
  - .10 Mounting: floor and wall
  - .11 Finish: in accordance with Section 26 05 05 Article 1.14 - Finishes.
- .4 Equipment Identification
  - .1 Provide equipment identification in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Label size: 7.

Write the following information:

- .1 Name of the manufacturer
- .2 Input and output voltages
- .3 Number of phases
- .4 Power
- .5 Impedance
- .6 Number of taps
- .7 Class
- .8 Temperature Rise
- .9 BIL
- .10 Frequency
- .11 Weight
- .12 Connection diagram
- .13 Model and Serial number

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Mount dry type transformers above 75 kVA on floor.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformer in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Neoprene bases shall be fixed under the transformer to help reduce ambient noise.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformer after installation is complete.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

2.1 PANELBOARD

- .1 Distribution panel:

- .1 All distribution panels shall be produced by a single manufacturer.

- .1 The distribution panels shall be in accordance with CSA C22.2, n9 29-M1989(R2004).

- .2 Breakers and spare breakers shall be mounted in the panels before the latter are delivered to site.

- .3 In addition to CSA requirements, the manufacturer's

nameplate shall indicate the permissible fault current for the panels and breakers.

- .2 For 600 V panels, busbars and breakers shall have a nominal interrupting capacity of 14000 A (symmetrical) or as indicated.
  - .3 For 240 V panels, busbars and breakers shall have a nominal interrupting capacity of 10000 A (symmetrical) or as indicated.
  - .4 Busbars shall be energized in succession, with the breakers mounted on odd-number circuits installed on the left, and those mounted on even-numbered circuits on the right. The circuit number and the number of phases shall be indelibly marked on each breaker.
  - .5 Distribution panels shall include the main buses required as well as number of circuits and branch breakers needed, with ratings as indicated.
  - .6 All distribution panels shall be fitted with the same type of locking system; two keys shall be provided for each panel.
  - .7 Use copper busbars; the neutral bar shall have the same continuous rating as the main bars.
  - .8 Main bars for the distribution panels shall be suitable for "bolt-in" circuit breakers.
  - .9 Door frames for the panels shall be mounted with bolts and hinges concealed behind the door.
- .2 Circuit breaker:
- .1 Except where otherwise indicated, distribution panels shall be equipped with Thermal-Magnetic moulded case breakers.
  - .2 The main breaker shall be installed separately in the lower or upper portion of the panel, depending on the location of the cable entry. When the breaker is mounted vertically, lowering the hand lever shall break the circuit.
  - .3 Locking devices suitable for padlocks shall be included, at

the locations indicated, for 100% of 600 V breakers. All unused locking devices shall be returned to the Departmental Representative.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Install panels at the planned locations, as indicated, and mount them solidly, plumb, square and level with adjacent surfaces.
- .2 Surface mount distribution panels on 42 mm galvanized steel slotted channels, fixed on the walls of the building. See drawings.
- .3 Mount the distribution panels at the height prescribed in Section 260500 - Electrical General Requirements or at the height indicated.
- .4 Connect all circuits to their respective loads.
- .5 Connect all neutral conductors to the common neutral busbar; each neutral conductor shall carry the appropriate designation.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.
- .3 Section 26 24 16 - Panelboards breaker type.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

- .1 Design, factory assemble and supply one (1) main distribution cabinet for mounting outside and adjacent to the dam on the east side as indicated on the drawings.
- .2 The main distribution cabinet shall be assembled from one (1) Stainless steel NEMA 4X hinged door lockable enclosure following the section 26.27.16 - ELECTRICAL CABINETS AND ENCLOSURES.
- .3 Dimensions sufficient to enclose the distribution panel and breakers. Provide size 3 nameplate engraved «MAIN DISTRIBUTION CABINET».

## 2.2 PANELBOARD

### .1 Distribution panel:

- .1 All distribution panels shall be produced by a single manufacturer.
  - .1 The distribution panels shall be in accordance with CSA C22.2, n9 29-M1989(R2004).
  - .2 Breakers and spare breakers shall be mounted in the panels before the latter are delivered to site.
  - .3 In addition to CSA requirements, the manufacturer's nameplate shall indicate the permissible fault current for the panels and breakers.
- .2 For 600 V panels, busbars and breakers shall have a nominal interrupting capacity of 14000 A (symmetrical) or as indicated.
- .3 Busbars shall be energized in succession, with the breakers mounted on odd-number circuits installed on the left, and those mounted on even-numbered circuits on the right. The circuit number and the number of phases shall be indelibly marked on each breaker.
- .4 Distribution panels shall include the main buses required as well as number of circuits and branch breakers needed, with ratings as indicated.
- .5 All distribution panels shall be fitted with the same type of locking system; two keys shall be provided for each panel.
- .6 Use copper busbars; the neutral bar shall have the same continuous rating as the main bars.
- .7 Main bars for the distribution panels shall be suitable for "bolt-in" circuit breakers.
- .8 Door frames for the panels shall be mounted with bolts and hinges concealed behind the door.

.2 Circuit breaker:

- .1 Except where otherwise indicated, distribution panels shall be equipped with Thermal-Magnetic moulded case breakers.
- .2 The main breaker shall be installed separately in the lower or upper portion of the panel, depending on the location of the cable entry. When the breaker is mounted vertically, lowering the hand lever shall break the circuit.
- .3 Locking devices suitable for padlocks shall be included, at the locations indicated, for 100% of 600 V breakers. All unused locking devices shall be returned to the Departmental Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install the main distribution cabinet at the planned locations, as indicated, and mount them solidly, plumb, square and level with adjacent surfaces to the cast in place foundation. See drawings.
- .2 Surface mount distribution panels on 42 mm galvanized steel slotted channels, fixed on the inside of the outdoor cabinet.
- .3 Mount the distribution panels at the height prescribed in Section 260500 - Electrical General Requirements or at the height indicated.
- .4 Connect all circuits to their respective loads.
- .5 Connect all neutral conductors to the common neutral busbar; each neutral conductor shall carry the appropriate designation.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

- .1 New MCC
  - .1 Design and supply four (4) MCC rated 600/347 V, 600 A, 3-phase, 4-wire, grounded neutral, 60 Hz, fabricated in accordance with CSA Std. C22.2 No. 254.
  - .2 MCC shall be of compartmentalized vertical sections with common power bus bar as indicated on the main single line diagram.
  - .3 Compartments with hinged doors and containing combination starters, contactors, circuit breakers, relays and auxiliary equipment as indicated and as further described herein and below.

- .4 Floor mounting, free standing, enclosed dead front and complete with continuous channel sills.
  - .5 The MCC shall be build inside a lockable Stainless Steel Outdoor CSA gasketed enclosure, front mounting, NEMA 4X. The enclosure is to be at a maximum 1500mm(H)x 2050mm(W) x 500mm(D). The MCC shall be custom built to accommodate the dimension limits.
- .2 Vertical Section Construction:
- .1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.
  - .2 Each vertical section divided into compartment units, minimum 305 mm high.
  - .3 Each unit to have complete top and bottom steel plate for isolation between units.
  - .4 Horizontal wire ways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from bus bars by steel barriers.
  - .5 Vertical wire ways complete with doors for power and control conductors extending full height of vertical sections, and equipped with cable tie supports. Wiring to units accessible with doors open and units in place.
  - .6 Openings, with removable cover plates, inside each vertical section for horizontal wiring between sections.
  - .7 Allow a bottom hat connection box for the entrance of incoming TECK90 cables to enter. This box shall measure a maximum of 8 in. high and not covered all the section in order to permit the exit of other cables
  - .8 Provision for outgoing TECK90 cables to exit via bottom of the MCC.
  - .9 Removable lifting means.

- .10 All MCC openings shall be rodent proof and water tight.
- .3 Busbars:
  - .1 Main horizontal and branch vertical, three phase high conductivity tin plated copper busbars in separate compartment self-cooled, extending width and height of the MCC, be supported on insulators and rated to:
    - .1 Main horizontal busbars: 600 A.
    - .2 Branch vertical busbars: 300 A.
  - .2 Branch vertical busbars to be used for distribution of power to units in vertical sections.
  - .3 No other cables, wires, equipment in main and branch bus bar compartments are permitted.
  - .4 Brace bus work to withstand effects of short-circuit current of 22 kA rms symmetrical.
  - .5 Bus supports with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.
- .4 Ground Bus:
  - .1 Copper ground bus to be extended entire width of the MCC.
- .5 Starter and Contactor Unit Compartments:
  - .1 Units NEMA size 1, circuit breaker units 30 A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
  - .2 Unit mounting:
    - .1 Engaged position - unit stabbed into vertical bus.
    - .2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for

- electrical testing of starter.
- .3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
  - .4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.
  - .5 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "ON" position. Provision for padlocks to lock operating handle in "OFF" position and lock door closed.
  - .6 Hinge unit doors on same side.
  - .7 Overload (for starter units) and ground fault relays are manually reset from front with door closed.
  - .8 Pushbuttons and indicating lights mounted on door front.
  - .9 Devices and components by one manufacturer to facilitate maintenance.
  - .10 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.
  - .11 Terminal blocks shall have 600 V insulation. Acceptable manufacturers:
    - .1 Weidmuller
    - .2 Entrelec.
    - .3 Wieland.
- .6 Design of MCC Compartments:
- .1 Each MCC shall have compartments to house the following:
    - .1 Hoist controls
    - .2 Ground fault protection
    - .3 Gain heater section 1
    - .4 Gate heater section 2

- .5 One (1) 10 kVA, 600 V/120-208 V transformer
  - .6 One (1) distribution panel, 100 A bus, 24 circuits with (1) 60 A main breaker.
  - .7 One (1) temperature control sensor cabinet
  - .8 Supply and installation of one (1) 600 V, 30 A welding outlet of the decontactor type, which is a combination plug, receptacle and disconnect switch in the same device.
- .7 Supply four (4) MCC sections with four (4) compartments as indicated on drawings and further described below :
- .1 HOIST CONTROLS - Provide a compartment with:
    - .1 One (1) NEMA size 1, combination type motor starter complete with thermal magnetic circuit breaker. Voltage, phase and capacity as indicated, with standard reversing magnetic type starter for «across-the-line» starting with 120 V coil, four (4) auxiliary contacts - two (2) N.O. and two (2) N.C., three (3) thermal overload protective devices correctly related to motor full load current.
    - .2 Ground fault protection (GFP) sensor and monitor to detect 0.2-2.4 A on sensitivity LOW and 2-24 A on sensitivity HIGH with adjustable time range of 0.1-1.2 seconds.
    - .3 Relays, timers, control transformers as per typical gate hoist schematic diagram.
    - .4 One (1) microprocessor-based metering equipment to provide monitoring for voltage and current per phase and provide Volts, Amps, kW, kVAR, PF, kVA and frequency.
    - .5 Control devices:
      - .1 «Local-Off» selector switch.
      - .2 «On-Off» motor heater selector switch.

- .3 Push-to-test pilot light (amber colour) associated with «Motor Heater On» winding circuit.
- .4 Push-to-test pilot light (red colour) associated with «Hoist Motor Running» circuit.
- .2 GROUND FAULT PROTECTION - Provide a compartment regrouping the ground fault protection of the hoist, the gain heaters and the gate heaters:
  - .1 For the hoist, the gain and the gate heaters
    - .1 Three push-to-test pilot lights (red colour) associated with «Ground Fault Trip»
    - .2 Three «On-Off» selector switches for «Ground Fault Override».
    - .3 Three push buttons (black colour) «Reset».
    - .4 Ground Fault contactors.
  - .2 One «On-Off» selector switch «Acknowledge» and contactor.
  - .3 One buzzer.
- .3 GAIN HEATER
  - Provide a compartment with:
    - .1 30 A breaker
    - .2 One (1) microprocessor-based metering equipment to provide monitoring for voltage and current per phase and provide Volts, Amps, kW, kVAR, PF, kVA and frequency.
    - .3 Ground fault protection (GFP) sensor and monitor to detect 0.2-2.4 A on sensitivity LOW and 2-24 A on sensitivity HIGH with adjustable time range of 0.1-1.2 seconds.

- .4 Push-to-test pilot light (red colour) associated with «Gain Heaters High» circuit.
  - .5 Push-to-test pilot light (amber colour) associated with «Gain Heaters Low» circuit.
  - .6 «Off- Auto/Man» selector switch
  - .7 «High-Off-Low» spring return Selector switch
  - .8 ON-Delay timer inside the compartment.
  - .9 All other control devices indicated on drawings.
- .4 GATE HEATER
- Provide a compartment with:
- .1 30 A breaker
  - .2 One (1) microprocessor-based metering equipment to provide monitoring for voltage and current per phase and provide Volts, Amps, kW, kVAR, PF, kVA and frequency.
  - .3 Ground fault protection (GFP) sensor and monitor to detect 0.2-2.4 A on sensitivity LOW and 2-24 A on sensitivity HIGH with adjustable time range of 0.1-1.2 seconds.
  - .4 Push-to-test pilot light (red colour) associated with «Gain Heaters High» circuit.
  - .5 Push-to-test pilot light (amber colour) associated with «Gain Heaters Low» circuit.
  - .6 «Off-Auto/Man» selector switch.
  - .7 «High-Off-Low» selector switch.
  - .8 ON-Delay timer inside the compartment.
  - .9 All other control devices indicated on drawings.
- .5 600 V/120-208 V TRANSFORMER

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- .1 Refer to 26 12 16 Dry Type Transformer up to 600V Primary for details.
  - .6 DISTRIBUTION PANEL
    - .1 Refer to 26 24 16 Panelboards Breaker Type for details.
  - .7 TEMPERATURE CONTROL SENSOR CABINET
    - .1 Refer to 26 24 21 Gain and Gate Heating for details.
  - .8 WELDING OUTLET
    - .1 Refer to 26 05 01 Equipment and Installation for details.
  - .7 Wiring Identification:
    - .1 As indicated at the item 1.17.
  - .8 Equipment Identification:
    - .1 Provide equipment identification in accordance with the requirements stated in Part 1 - General.
    - .2 Motor control center main nameplate: size No.7, engraved
    - .3 Individual compartment nameplates: size No. 5, engraved.
  - .9 Finishes:
    - .1 As indicated at the item 1.14.
  - .10 Source Quality Control:
    - .1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.
    - .2 The Departmental Representative to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for motor control centres installation in accordance with manufacturer's written instructions:
  - .1 Visually inspect substrate in presence of the Departmental Representative.
  - .2 Inform the Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Installation:
  - .1 Set and secure motor control center in place on bases, rigid, plumb and square to machinery bridge floor and structural beams.
  - .2 Make field power and control connections as indicated.
  - .3 Ensure correct overload heater elements are installed.
- .3 Field Quality Control:
  - .1 Ensure moving and working parts are lubricated where required.
  - .2 Operate starters to prove satisfactory performance of motor control center.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.
- .4 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

2.1 HOIST CONTROL STATIONS

- .1 Design, factory assemble and supply four (4) control stations for mounting outside and adjacent to the hoist drum enclosure as indicated on the drawings.
- .2 The control station shall be assembled from two (2) Stainless steel NEMA 4X hinged door lockable enclosure. A larger 10x10 inch enclosure will have the circuits mounted inside and the control and display installed on the front door. A second 8x8 inch enclosure will have the back open and will be installed on the front of the larger enclosure to prevent the access to the controls.

- .3 Dimensions to enclose control devices, complete with viewing window over the control devices and position indicator. Provide size 3 nameplate engraved «SLUICE GATE No» on line 1 and «LOCAL CONTROL PANEL» on line 2.
- .4 Hoist control stations shall contain the following devices:
  - .1 RAISE-OFF-LOWER Switch: Spring return to center with two (2) N.O. contacts as indicated, heavy-duty, oil-tight for 120 V operation, wing lever-type operating handle. Provide size 1 nameplate engraved «RAISE», «OFF» and «LOWER».
  - .2 Emergency STOP switch, HP-rated, maintained contact, mushroom head type.
  - .3 Hoist position indicator and L.E.D display: Veeder Root Co. Ltd. series C628. Provide size 1 nameplate engraved «GATE POSITION INDICATION».
  - .4 Anti-condensation heater.
  - .5 Submit detailed shop drawings showing dimensions, material and wiring for approval prior to fabrication.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Install the control panels on the downstream. Make connections to the different pieces of equipment on the hoist as shown on the drawings. Refer to Section 11 10 00 - Dam Gates article 3.1.12.10 for details.
- .2 Send for approval by the Engineer, the final diagrams for connection of the control panels before they are implemented.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

2.1 GAIN AND GATE HEATING

- .1 Electric heaters and accessories for the gains, gates and junction boxes as follows:
  - .1 Manufacturers: subject to compliance with requirements, provide products by the following acceptable manufacturers:
    - .1 Caloritech.
    - .2 Chromalux.
    - .3 Hynes Co. Ltd.

.2 Electric Heater General Requirements

- .1 Electric heaters are specifically designed to prevent ice build-up on sluice gate guides or body.
- .2 The heaters shall be capable of operating in the dry, partially or completely immersed and shall be constructed so that they may be energized without injury, after prolonged period of de-energization.
- .3 Nominal voltage : 347/600 V, 3 Phase, 4-wires.
- .4 The heating elements are in stainless steel, silver brazed into a watertight terminal housing having recessed base for mounting.
- .5 Element ends are hermetically sealed to prevent moisture ingress over prolonged periods when heaters are not in service.
- .6 Watertight terminal box with maximum O.D. dimension of 70 mm, equipped with three terminals for power connection.
- .7 The Vendor shall determine appropriate length based on gate mechanical shop drawings and by including manufacturing tolerance plus heater expansion.
- .8 Heaters can be coiled to a six (6) feet diameter to facilitate shipping. Also, the heater element shall be easily removable, and the casing shall be spliced as required to facilitate shipping, installation and maintenance.

.3 Specific Gain Heater Requirements:

- .1 The vertical guides for the sluiceway gates shall incorporate ducts for the installation of tubular type gain heaters at the seal path, roller path and wind seal as described in Section 11 10 00 - DAM GATES. The ducts shall terminate in the drainage piping at the bottom of the guides. The top of the duct shall be arranged to provide a weatherproof connection with the duct heaters.
- .2 Flexible electric immersion type gain guide heaters shall extend the full length of the guides and shall have an

element rated at 500 W/m three (3) per side, with dual heat range:

- .1 1000 W for low heat operation.
- .2 3000 W for high heat operation.
- .3 Heating stage would be done using delta-wye heating elements powering configuration, so low stage shall be 33% of high stage
- .4 Specific Gate Heater Requirements:
  - .1 The vertical sluiceways shall incorporate vertical tubular steel beams for the installation of tubular type gate heaters as described in Section 11 10 00 - DAM GATES.
  - .2 Flexible electric immersion type gate heaters shall extend the full length of the guides, except for the bottom 750 mm, and shall have elements rated at 500 W/m - six (6) per gate with dual heat range
    - .1 600 W for low heat operation.
    - .2 2000 W for high heat operation.
  - .3 Heating stage would be done using delta-wye heating elements powering configuration, so low stage shall be 33% of high stage
- .5 Specific Bottom Gate Heater Requirements:
  - .1 The vertical sluiceways shall incorporate horizontal tubular steel beams for the installation of tubular type gate heaters as described in Section 11 10 00 - DAM GATES.
  - .2 Flexible electric immersion type gate heaters shall extend the full length of the guides, and shall have elements rated at 250 W/m - two (2) per gate with dual heat range
    - .1 750 W for low heat operation.
    - .2 1500 W for high heat operation.

- .6 Temperature Sensors and Outdoor Temperature Control Cabinet (located in each MCC).
  - .1 Adjustable remote bulb, two-stage thermostat, sensing outside temperature, shall be provided to automatically control the energization of the heater to provide either low or full heat.
  - .2 RTD are 100  $\Omega$  platinum 3-wire.
  - .3 Thermostats and relay shall be installed on the exterior MCC wall. The thermostats shall not be place in the south facing direction, preferably north facing.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Install the heaters at each location as per manufacturer recommendation.
- .2 Send for approval by the Engineer, the final diagrams for connection of the control panels before they are implemented.

#### 3.2 Testing

- .1 Test each heater as per manufacturer recommendation.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.
- .4 Section 26 05 31 - Splitters, Junctions, Pull Boxes and Cabinets
- .5 Section 26 27 16 - Electrical Cabinets and Enclosures.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.
- .2 The work and services include the engineering, design, manufacturing and shop testing, packaging and transportation, storage, installation and assembly, connection, site testing, training and guaranteeing of the following equipment and components shown on the plans:
  - .1 Local control panels (LCP-N4 to N8, LCP-2 and LCP-3) and MCC panel control boards
  - .2 Instrument
  - .3 Panels, racks, and conduits
  - .4 Grounding, power, analog signal cables
  - .5 Hardware and wiring for mounting and assembly
  - .6 Components, devices, fittings, and services required to ensure that the equipment and systems described in this section operate as a complete and functional whole

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

- 2.1 NOT USED.

PART 3 - EXECUTION

- 3.1 NOT USED.

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.
- .4 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .5 Section 26 05 34 - Conduits, Conduit Fastening and Conduit Fittings.
- .6 Section 26 24 16.02 - Main Distribution Cabinet.

### 1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

### 1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

## PART 2 - PRODUCTS

### 2.1 CUBICLES, PANELS and ENCLOSURES

- .1 Unless noted otherwise in these Specifications, all indoor and outdoor electrical equipment enclosures shall meet NEMA standards. Equipment enclosures with more than one power source shall be labelled with the sources identified.
- .2 All cubicles and panels shall be designed and manufactured in a way

to enable easy access to all elements and particularly to the terminals.

- .3 Panel sections shall be provided with framing, cross bracing and stiffeners to form rigid, self-supporting structures. Each panel shall be securely bolted, in position, to the concrete floor. All necessary bolts, nuts and washers for assembling panel sections shall be supplied with the panel.
- .4 Removable panels shall be provided, where required, to permit convenient access to all internal equipment and power connections. The removable panels shall be supplied with suitable fastening devices, and shall be of a size that can be conveniently handled by one person. All removable panels shall be equipped with a label stating «Warning» and noting the highest voltage level contained therein.
- .5 Enclosures:
  - .1 Interior: NEMA 1
  - .2 Exterior NEMA 4X
- .6 Cubicles and panels shall be equipped with close fitting, gasketed, hinged doors capable of being opened through at least 180 deg, and provided with an integral lock and master key.
- .7 Cubicles and panels shall be adequately ventilated, if required, by vents or louvers, equipped with suitable screens and filters.
- .8 Panels, doors and frames shall match and present a neat and uniform appearance when assembled as a panel alignment.
- .9 All cubicles, boards, panels shall be completely factory wired. Internal control wiring shall be flexible, stranded copper conductors. Minimum wire size shall be 14 AWG, insulated for 600 V. All wiring shall be formed, bundled and supported by straps.
- .10 Provision shall be made for flexibility of wire bundles running to hinged panels.
- .11 All electrical circuits of cubicles shall be properly terminated on terminal blocks.

- .12 All cubicles, boards and panels equipped with indication lamps shall be equipped with a «Lamp Test» momentary push button to allow operators to check for burned out lamps.
- .13 The terminal blocks shall be clearly identified to show a wiring route.
- .14 At least 15% spare terminals shall be provided.
- .15 An insulation barrier shall separate neighbouring terminals of different voltages. All 600 V terminals shall be housed in a separate compartment if possible or, if it not possible, arranged so that they are in same area and protected with a plexi-glass cover.
- .16 Terminal blocks shall be pressure clamping type, Weidmuller or equal, suitable for both copper and aluminum conductors.
- .17 White or other light coloured permanent marking strips shall be provided for circuit designation according to the wiring diagrams.
- .18 Wire and terminal board numbers shall match the manufacturer's drawings.
- .19 All cubicles, boards and panels shall be identified by a permanently attached nameplate showing equipment tag number.
- .20 Externally-visible, permanent nameplates shall be provided identifying each instrument, instrument switch, relay, control switch, indicating lights and other installed equipment.
- .21 Protective relays shall be designated by ANSI device number and by the phase to which they are connected.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Install the cabinet and enclosures at each location as shown on drawings.

PART 1 - GENERAL

1.1 RELATED SECTIONS

This section covers work supplied and installed by the Electrical Section and covered in other sections of this specification.

- .1 Section 26 05 01 - Equipment and Installation
- .2 Section 26 05 21 - Wire and Cables (0-1000 V).
- .3 Section 26 05 22 - Connectors and Terminations.
- .4 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .5 Section 26 05 34 - Conduits, Conduit Fastening and Conduit Fittings.

1.2 GENERAL

- .1 Supply all materials in compliance with the standards specified in these specifications or with equivalent standards submitted to the Engineer for approval. The material in each component shall be specified on the shop drawings and the approved standard shall be identified, along with the number of this standard, the grade or class being used, the alloy or pertinent chemical analysis, as well as any special requirement regarding treatment and tests.

1.3 SHOP DRAWINGS AND PRODUCT SPECIFICATIONS

- .1 Submit drawings, materials lists and specifications of the proposed products for approval and comments prior to starting the work, as described in Section 01 33 00 of these specifications.

PART 2 - PRODUCTS

.1 MANUAL TRANSFER SWITCH

- .1 Rating of the Manual transfer switch shall be 300 AMP, 600 VAC, 60 Hz, 3 PHASE, 4 WIRE.
- .2 The manual transfer switch shall be rated for Service Entrance applications and shall contain a 300Amp standard or 100% rated over current device for the utility power switching device as indicated on the drawings. The

generator power switching device shall be rated for 100% continuous load without de-rating. The current rating shall be based on all classes of load including resistive, and motor loads.

- .3 The Manual transfer switch assembly shall be rated for 100% continuous load without de-rating. The current rating shall be based on all classes of load including resistive, and motor loads.
- .4 The Manual transfer switch must utilize electrically operated transfer mechanism that have been listed or certified to the following safety standards:
  - UL 1008 Automatic Transfer Switches For Use in Emergency Systems
  - CSA C22.2 No.178-1978 Automatic Transfer Switches
- .5 The completed assembly shall be mounted in a NEMA 4X enclosure suitable for outdoor application with controls mounted on an interior door. Exterior door shall provide additional protection against outside environment and vandalism.
- .6 Finish: All steel parts shall be stainless steel.
- .7 Ground Lugs/Bus: Adequate size and quantity of ground lugs shall be provided and shall conform to NEC/CEC guidelines. Where a ground bus is provided, it shall be a full length copper ground bus bonded to the frame with adequate size and quantity of ground lugs and shall conform to NEC/CEC guidelines.
- .8 Busbars: Where load bus bars are utilized, they shall be tin plated round-edge high conductivity copper and be sized for 100% continuous load rating of the transfer switch, in accordance with NEMA, CSA and UL guidelines. The short circuit withstand rating of the completed bus assembly shall be not less than the short circuit fault current of the system.

- .9 Cable Connections: Provision shall be made to terminate all incoming and outgoing power cables and grounding conductors. Connections shall be via screw type cable lugs.
- .10 The Manual transfer switch shall be constructed to accommodate bottom entry of incoming source 2 power cables, incoming source 1 power cables and bottom exit of outgoing load cables.
- .11 The Power Switching units shall be fix-mounted, utilize fully enclosed contacts and their withstand and closing rating shall be equal to or exceed the required withstand rating of the complete mechanism.
- .12 All materials and parts used in the unit shall be new, of current manufacture, of best industrial grade, and free from defects and imperfections.
- .13 The transfer switch mechanism shall provide a simple means of manual mechanical operation using only components, which are permanently affixed, in the operating position.
- .14 The unit shall permit manual mechanical operation of the transfer switch while the system is energized and carrying rated load.
- .15 All internal control devices used in the Manual transfer switch shall be cable of being de-energized and isolated from the system by use of an accessible isolation plug for servicing procedures as required.
- .16 The Manual transfer switch design shall provide front accessible components and wiring for easy serviceability. Power or control connections, which are not readily serviceable while the transfer switch is mounted in its enclosure, are not acceptable.
- .17 All power contacts used shall operate in a quick-make / quick-break manner, the speed of which shall be independent of supply voltage and / or speed of operation by manual means.

.2 OPERATION

- .1 Three pole switches for three phase service. Neutral conductor terminal lugs shall be provided as required for the power system.
- .2 The service entrance rated manual transfer switch transfer the load to the source 1 supply when an operator selects the "source 1" position on the door mounted source selector switch provided source 1 is energized at nominal rated voltage.
- .3 The Manual transfer switch shall transfer the load to the source 2 supply when an operator selects the "source 2" position on the door mounted source selector switch provided source 2 is energized at nominal rated voltage. The transfer switch shall incorporate an isolating mechanism and over current protection on the utility supply to allow operation as the main service disconnect in accordance with NEC requirements. The transfer switch power switching devices shall be mechanically and electrically interlocked to prevent the utility and generator supplies from being interconnected.

.3 STANDARD CONTROL FEATURES

- .1 The transfer switch shall be rated for use on multiple system voltages. The transfer switch shall be field configurable to operate on the following nominal system voltages; 208V, 240V, 380V, 480V, 600V.
- .2 Transfer switch control power must be obtained from the source being transferred to. The controls shall not require any connection to external power sources. Transfer switches requiring power from the engine starting (or other) battery are not acceptable.
- .3 A control circuit isolation plug shall be provided to isolate all control circuitry inside the transfer switch to facilitate maintenance procedures. When isolated, there shall be no voltage present on the control circuitry.
- .4 Pilot lights shall be provided to indicate load on source 1

status (green) and load on source 2 (green). Pilot lights to be long life LED type.

.5 Source Selector Switch

A 2 position spring-return selector switch shall be provided on the door of the transfer switch to allow an operator to manually select the desired source.

.6 Source 1 Supply Auxiliary Contact (AUX-U)

One (1) auxiliary contact shall be provided which operate when the source 1 is on load. The auxiliary contact shall be supplied with a rating of 10 A, 120/240 VAC, 5 A, 28Vdc resistive, Form C.

.7 Source 2 Supply Auxiliary Contact (AUX-G)

One (1) auxiliary contact shall be provided which operate when the source 2 is on load. The auxiliary contact shall be supplied with a rating of 10 A, 120/240VAC, 5 A, 28 Vdc resistive, Form C.

.8 Certification: Upon request, the manufacturer shall provide a notarized letter certifying compliance with all the requirements of this specification. The certification shall identify, by serial numbers, the equipment involved. No exceptions to the specifications, other than those stipulated at the time of submittal, shall be included in the certification.

.9 Operator's Manual: Each switch shall be furnished with an operator's manual providing installation and operating instructions.

.10 Complete electrical drawings shall provide complete schematics of the control panel and interconnection with the diesel electric sets and any other related components of the installation. Drawings shall provide a complete listing of control panel components under manufacturer part numbers.

.4 EQUIPMENT IDENTIFICATION

- .1 Refer to Section 1.16 EQUIPMENT IDENTIFICATION.
- .2 Control panel:
  - .1 Nameplates for selector switch and manual switch.

.5 MANUFACTURERS

- .1 Manufacturers:
  - .1 ASCO
  - .2 Kohler
  - .3 EATON
- .2 Manufacturers must have qualified local maintenance personnel to maintain and troubleshoot the equipment.

.6 FABRICATION

- .1 Shop assemble transfer equipment including:
  - .1 Transfer switch and operating mechanism.
  - .2 Relays.
  - .3 All accessories.

.7 FACTORY TESTING

- .1 The Manual transfer switch shall be factory tested prior to delivery to the purchaser. The following tests shall be conducted by qualified factory personnel:
  - .1 Visual Inspection: Electrical and mechanical inspections to verify installed components are of correct ratings; meet the requirements of the project specifications and to ensure regulatory and quality requirements are met.
  - .2 Mechanical Tests: As a minimum, the following mechanical tests shall be performed on the transfer switch:

- .1 Power conductor torque verification
- .2 Verification of mechanical interlock
- .3 Manual ATS mechanism operation/adjustment
- .4 All mechanical fasteners/wire connections tight
- .3 Electrical Tests: As a minimum, the following electrical tests shall be performed on the transfer switch:
  - .1 Verification of electrical interlock
  - .2 Function test-normal operation- three (3) complete cycles
  - .3 Mechanism adjustment
  - .4 Dielectric test
- .4 Final Inspection: As a minimum, the following final inspection tasks shall be performed on the transfer switch:
  - .1 Calibration label/equipment labels installed and correct
  - .2 All safety/warning labels attached
  - .3 All wiring straight, neatly bundled and adequately protected.
  - .4 All options supplied as specified
  - .5 Enclosure is clean, no paint imperfections
  - .6 Final documentation is enclosed (Drawing, O&M Manual)
- .5 The transfer switch manufacturer shall provide upon request of the project engineer, four (4) copies of certified Factory Test Reports for the transfer switch supplied.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Locate and install transfer equipment as indicated and following manufacturer's instructions.
- .2 Adjust transfer to Engineer's instructions.
- .3 Check relays and adjust as required.

#### 3.2 TESTS

- .1 Conduct tests to Section 26 05 00 - Common Work Results - Electrical.
- .2 Demonstrate on unit:
  - .1 System start, transfer to load, retransfer to normal power.
  - .2 Manual operation of the transfer equipment on "Manual" control.
  - .3 System start and transfer on System "Test" control.
  - .4 Unit start on "Engine test" control.
  - .5 Operation of automatic alarms and shut down devices.

#### 3.3 COMMISSIONING

- .1 Carry out the Commissioning of manual transfer switch in accordance with the requirements stipulated in the Commissioning Plan as per Section 260500 - General Requirements and sections of Division as applicable.
- .2 Site commissioning shall be done by a factory trained technician. All systems capabilities shall be tested complete with a final 4 hour system test with 100% load banks. A complete report shall be issued to the Consultant verifying complete testing.
  - .1 Inspection of installation verifying normal, emergency and load connections.
  - .2 Inspection of all components of any damage due to

- transportation or abnormal force of installation.
- .3 Inspection of all control relays and components.
  - .4 Inspection of main transfer switch movement for proper contact alignment, deflection, gap, wiping action and pressure.
  - .5 Inspect bypass switch for proper contact alignment, deflection, gap, wiping action and pressure.
  - .6 Inspect isolation contacts and mechanism for proper operation.
  - .7 Inspect all mechanical and electrical interlock for proper operation.
  - .8 Inspect all control wiring internally and externally and tighten if necessary.
  - .9 Inspect all pilot lights and indicators.
  - .10 Remove and accumulated construction dust from complete unit.
  - .11 Check voltage and frequency on normal and emergency.
  - .12 Perform system test and confirm all timing and operational sequencing as described in specification.
  - .13 Operate bypass switch to both sources verifying complete system integrity.
  - .14 Operate transfer switch in test position.
  - .15 Isolate transfer switch and verify interlocks to prevent improper replacement.
  - .16 Provide Departmental Representative with complete written report certifying installation.
- .3 Provide fuel for all testing and commissioning; at end of tests top up fuel tanks prior to job completion.

PART 1 - GENERAL

1.1 DESCRIPTION

- .1 This section specifies requirements for dewatering work areas for the execution of the mechanization works at the Main Dam.
- .2 Work includes but is not limited to:
  - .1 Fabrication, supply, installation, maintenance, and removal of dewatering structures and dewatering systems that remove water from work areas and maintain these areas in dry state for duration of work.
  - .2 Consideration of environmental measures for dewatering system.
  - .3 Continuous operation and monitoring of dewatering structures and dewatering systems to keep dewatering system operational for duration of work.
  - .4 Supply of standby dewatering equipment, installed in position, ready to immediately switch into service when dewatering equipment malfunctions or requires cleaning or maintenance.
  - .5 Removal of dewatering structures and dewatering systems.

1.2 RELATED SECTIONS

- .1 Section 01 35 43 - ENVIRONMENTAL PROCEDURES.
- .2 Section 35 49 25 - TURBIDITY CURTAIN.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

- .1 There will be no measurement of dewatering structures and systems.
- .2 Payment of dewatering structures and systems will be included in Lump Sum Price.

1.4 REGULATORY REQUIREMENTS

- .1 Adhere to local, provincial, and federal requirements relating to:
  - .1 Protection of environment;
  - .2 Safety of construction; and
  - .3 Protection of workers.

- .2 Contractor to engage services of Professional Engineer to design, plan, and certify dewatering structures and dewatering systems.
- .3 Dewatering Plan to be reviewed and accepted by Contract Administrator and Client Department.
  - .1 Client Department will not issue permit to authorize start of work before review and acceptance of Dewatering Plan.
- .4 Obtain and pay costs of required permits.

### 1.5 SUBMITTALS

- .1 Submittals to be in accordance with Section 01 33 00 - SUBMITTAL PROCEDURES.
- .2 Submit Dewatering Plan describing proposed dewatering structures and dewatering systems including:
  - .1 Layout of dewatering structures.
  - .2 Layout of dewatering systems.
  - .3 Layout of environmental features that form part of dewatering systems.
  - .4 Schedule of installation and staging of dewatering structures and dewatering systems.
  - .5 Installation and removal procedures including details for use of divers or cranes if necessary.
  - .6 Backup plan and emergency procedures during operation.
  - .7 If required, design of any structure by the Vendor shall be submitted with shop drawings. It must be completed with Professional Engineers seal and signature.
- .3 Submit Certification of dewatering structures immediately after installation.
- .4 Dewatering Plan, Certification of dewatering structures and dewatering systems and related submittals to bear signature and stamp of Professional Engineer registered or licensed in province of Ontario, Canada.

### 1.6 SCHEDULE

- .1 Schedule work and stage dewatering so that work can be completed in accordance with Section 01 11 00 - SUMMARY OF WORK.
- .2 Submit Dewatering Plan for review, make revisions and obtain acceptance as early as possible.

### 1.7 WATER LEVELS

- .1 Water levels are illustrated on the drawings. Refer to Section 01 11 00 for more information.
- .2 Water levels on Georgian Bay (downstream side of dam) is highly variable and fluctuates regularly with the wind direction.
- .3 The dewatering structures shall be higher than the maximum possible water levels for both sides of the dam.

### 1.8 DESIGNER QUALIFICATIONS

- .1 The designer of the dewatering structures and systems must be a Professional Engineer with considerable expertise and experience in design of similar structures and systems.
- .2 Designer must: make, check and sign all calculations; check, seal and sign all drawings; inspect dewatering structures and systems; and verify their adequacy and safety.

### 1.9 DESIGN CRITERIA

- .1 The Vendor shall elaborate the equipment's layout for the dewatering structures and systems in order to ensure maintenance of work spaces in dry state for duration of work.
- .2 Water which enters dewatered work areas over land during construction to pass through filter, sediment trap, or settling pond before being discharged downstream.
  - .1 Do not discharge water upstream of work areas.
  - .2 Do not allow discharge of water to cause erosion or disturb any permanent or temporary structure.
- .3 Water which enters dewatered work areas through or under dewatering structures is considered to be clean and may be pumped discharged directly downstream.
- .4 Plan and design dewatering structures and dewatering systems considering:
  - .1 Access to reach any portion of Work
  - .2 Space required for scaffolding, stairs, construction equipment, and crews to work in dewatered areas.
  - .3 Sequence of Work and staging of Work and dewatering to speed up Work.
  - .4 Water levels which fluctuate due to rain, snow, snowmelt, surface run-off, storm drains, evaporation, leakage, spring freshet, and operational requirements.

- .5 Hydraulic pressure on structures.
  - .6 Wind, wave, and ice action.
  - .7 Winter conditions such as; build-up of ice and snow, ice pressure, freezing temperatures, fluctuation of temperature, free-thaw cycles, and ice sheets.
  - .8 Environmental requirements.
  - .9 Separation of work areas to be dewatered to limit effect of leakage or unexpected flooding into dry work areas.
  - .10 Add freeboard of 500 mm to maximum expected upstream water level to account for wave action and 1000 mm to the downstream water level to account for wave action and unexpected fluctuations in water levels.
- 
- .5 Plan for dewatering system to include:
    - .1 Initial Dewatering System:
      - .1 Pump capacity to allow dewatering of dewatering zone within 8 hours.
    - .2 Continuous Dewatering System:
      - .1 Continuous dewatering system to be setup in each dewatering zone.
      - .2 Total combined capacity for pumps to be greater than twice expected/observed rate of seepage.
    - .3 Emergency Backup Dewatering System:
      - .1 Emergency backup dewatering system to be setup to rapidly dewater work areas in event of failure of dewatering structures or dewatering systems to minimize water damage and ice forming on work surfaces during winter.
      - .2 Minimum one high capacity pump, typically using same pump as initial drawdown pump, kept in position and ready to be switched into service.
      - .3 Immediately replace pumps that fail to perform continuously and reliably.
- 
- .6 Maintain environmental quality of water to Section 01 35 43 ENVIRONMENTAL PROCEDURES.
  - .7 Ensure that no phase of Work threatens safe performance of dewatering structures and systems.
  - .8 Contractor's Engineer to verify information and select design elevation for dewatering structures.
  - .9 Use meter bags, inflatable rubber dam, concrete blocks, custom fabricated or prefabricated steel, aluminum, timber, or composite frames to construct dewatering structures complete with membrane and apron.
    - .1 Use of earth or gravel fill embankments will not be accepted.

- .10 Stop logs sets, made of wood or steel, can be inserted in the upper stop log gains. The design shall be submitted for approval to CA.

#### 1.10 ENVIRONMENTAL REQUIREMENTS

- .1 Dispose of water so it does not create safety hazard or health hazard, cause damage to environment, to adjacent property, or cause damage to any portion of Work.
- .2 In accordance with Section 01 35 43 - ENVIRONMENTAL PROCEDURES, Install environmental systems to capture sedimentation before release of water into waterways.
  - .1 Filter discharge water using fabric filter, sediment trap, or settling pond before being discharged downstream.
  - .2 Prevent additional erosion when discharging water.
  - .3 Maintain environmental system in good working order.
- .3 Fuel powered pumps to be positioned and protected in accordance with Section 01 35 43 - ENVIRONMENTAL PROCEDURES.
- .4 Turbidity limit: to Section 01 35 43 - ENVIRONMENTAL PROCEDURES and Section 35 49 25 - TURBIDITY CURTAIN.
- .5 Do not release sediment into watercourse during construction or during removal of dewatering structures.
- .6 Comply with the Environmental Standards and Guidelines Document for Ontario Waterways published by Parks Canada in July 2017.
- .7 Comply with any permit conditions imposed by the Ministry of Natural Resources (MNR) and/or the Department of Fisheries and Oceans (DFO).

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Use materials in good condition, accepted by Departmental Representative, and suitable for use in work.
- .2 Do not use materials which may cause environmental damage to waterway or to land at or near work site.
- .3 Materials and methods proposed for use in dewatering structure and dewatering systems, must also be accepted by Client Department.
- .4 Meter bags: Engineered for and suitable for marine and cold-weather use.

- .5 Inflatable Rubber Dam: Design and fabricated by a recognized manufacturer.
- .6 Stop logs: Design and fabricated by a recognized manufacturer and made of wood or structural steel.
- .7 Prefabricated concrete blocks: Engineered for and suitable for marine and cold-weather use.
- .8 Fabricated or prefabricated panels: steel, aluminum, timber, or composite panels: Engineered for and suitable for marine and cold-weather use.
- .9 Earth or granular material embankments are not acceptable for construction of dewatering structures.
- .10 Membranes: Rubberized membranes suitable for marine and cold-weather use.
- .11 Granular materials for use in bags to be clean, washed granular materials free of sand or silty materials.
- .12 Small bags, chains or weights to anchor aprons:
  - .1 Do not use material from bottom of basin to anchor apron.
  - .2 Attach ropes to weights to ensure method of removal at end of work.
- .13 Plastic drum and gravel for pre-filtering of pump inlets.

## 2.2 EQUIPMENT

- .1 Pumps:
  - .1 Supply and install multiple pumps to carry out dewatering operations in accordance with accepted Dewatering Plan.
  - .2 Pumps to be in good working condition.
  - .3 Power source: electric or fuel. Contractor responsible for power supply.
  - .4 Pumps to be able to operate in severe conditions under which work to be executed including; freezing and variable temperatures, silty sediment, construction debris, marine vegetation, and continuous use.
  - .5 Pump inlets to be equipped with screens and filters.
    - .1 Screens in accordance with "Freshwater Intake End-of-Pipe Fish Screen Guidelines", Department of Fisheries and Oceans, Canada, 1995.  
<http://www.dfo-mpo.gc.ca/Library/223669.pdf>

## PART 3 - EXECUTION

### 3.1 GENERAL

- .1 Install and maintain work areas in dry state for duration of work in accordance with accepted Dewatering Plan.
- .2 Evaluate, plan, and execute work in an expert and prudent manner giving due consideration to:
  - .1 Existing strata within and adjacent to work location.
  - .2 Climatic conditions which may occur at work location during period of Work in its entirety.
  - .3 Safety of personnel and general public.
  - .4 Safety of removals.
  - .5 Protection of existing structures and materials.
- .3 Make repairs or improvements and immediately return work areas to dry state in event of leakage or flooding.
- .4 Submit revised Dewatering Plan for review if dewatering system does not maintain work areas in dry state and implement accepted changes immediately.
- .5 Locate and protect marine utilities from damage.
- .6 Dewatered areas are not to be used for parking of machinery or storage of equipment.

### 3.2 PREPARATION AT START OF WORK

- .1 Inspect, clean, prepare, and repair surfaces against which dewatering structures to be attached or placed.
- .2 Inspect, clean, and prepare bottom of work area on which dewatering structures to be constructed.

### 3.3 DEWATERING STRUCTURES

- .1 Supply and install dewatering structures as required in accordance with accepted Dewatering Plan.
- .2 When existing waterway structures are incorporated into dewatering plan, Contract Administrator does not guarantee water-tightness of existing structures.
  - .1 Improve water-tightness of waterway structures as required to control leakage.

### 3.4 DEWATERING

- .1 Dewater work areas and maintain them in dewatered state until work has been completed.
- .2 Repeat entire dewatering procedure immediately and as often as required if flooding or other damage occurs before completion of work.
- .3 Maintain dewatered state with adequate quantity and capacity of pumps.
  - .1 Work areas not to be allowed to become submerged without acceptance by Contract Administrator.
- .4 Ensure that drawdown of water surface due to pumping does not affect:
  - .1 Safety or quality of work.
  - .2 Neighboring property in an adverse manner.
  - .3 Stability of soils.

### 3.5 EQUIPMENT

- .1 General:
  - .1 Provide equipment in safe operating condition and maintain it in safe operating condition for periods of use or when on standby for use as backup.
- .2 Provide skilled operators for equipment.
- .2 Standards and Performance:
  - .1 Provide equipment of such quality and in such quantity as to provide sufficient capability to perform essential functions of work.
  - .2 Provide standby replacement for pumps, generators, and other essential dewatering equipment which may require cleaning, routine maintenance, or break down during Work.
  - .3 Keep this standby equipment available installed in-place on-site for immediate use.

### 3.6 DEWATERING SYSTEM MONITORING

- .1 Ensure continuity of dewatering by providing watch person to make periodic checks including night-time and weekends.
- .2 Watch person to be qualified and trained sufficiently to perform equipment duties such as:

- .1 Preventive maintenance and refueling normally performed during any shift.
- .2 Emergency repairs of minor complexity.
- .3 Placing standby items into service.

### 3.7 DEWATERING STRUCTURE REMOVAL

- .1 Remove materials used to construct dewatering structures and dewatering systems only after acceptance of completed work by Contract Administrator.
- .2 Remove accumulated sediments or debris before removal of dewatering structures and dewatering systems.
- .3 Pump water at low flow or allow leakage to slowly flood dewatered areas to minimize erosion and sedimentation.

### 3.8 CLEAN-UP AT END OF WORK

- .1 Remove materials and clean dewatered work areas to ensure site restored to as-found condition.
- .2 Dispose of unwanted materials in approved manner off-site.
- .3 Do not dispose of materials in lakes or waterway.
- .4 Waste described as subject to Regulation 347, Environmental Protection Act, must be transported with valid "Certificate of Approval for Waste Management System" to site approved by Ontario Ministry of the Environment to accept waste.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 35 43 - ENVIRONMENTAL PROCEDURES.
- .2 Section 35 20 22 - DEWATERING.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 There will be no measurement of Turbidity Curtain.
- .2 Payment of Turbidity Curtain will be included in Lump Sum Price.

1.3 REFERENCES

- .1 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.
    - .5 No.10-94, Filtration Opening Size.
- .2 Canadian Standards Association (CSA)
  - .1 CAN/CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel.
  - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 Department of Transportation (DOT)
  - .1 DOT Turbidity Barrier Design.
- .4 Ontario Provincial Standard Specification (OPSS)
  - .1 OPSS 518 November 2011, Construction Specification for Control of Water from Dewatering Operations.
  - .2 OPSS 805 November 2015, Construction Specification for Temporary Erosion and Sediment Control Measures.

#### 1.4 SUBMITTALS

- .1 Submit details of temporary turbidity curtain system at least 2 weeks prior to commencing work.
- .2 Submission to include:
  - .1 Materials data sheets for geotextile.
  - .2 Installation, monitoring, maintenance, and removal procedures.
  - .3 Installation drawings.
  - .4 Seam details.
  - .5 Anchoring details.

#### 1.5 DELIVERY AND STORAGE

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris, rodents, and damage.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL

- .1 Geotextile:
  - .1 General: New, woven, synthetic fiber fabric geotextile or geomembrane.
  - .2 Width: as indicated.
  - .3 Length: as indicated.
  - .4 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
  - .5 Physical properties:
    - .1 Thickness: 0.8 mm minimum to CAN/CGSB-148.1, No.3.
    - .2 Mass per unit area: 220 g/m<sup>2</sup> to CAN/CGSB-148.1, No.2.
    - .3 Grab Tensile Strength: minimum 990N, wet condition to CAN/CGSB-148.1, No.7.3.
    - .4 Elongation at break: maximum 25%.
    - .5 Seam Strength: minimum 1350N equal to or greater than tensile strength of fabric.
    - .6 Mullen burst strength: 4000N minimum, equal to or greater than tensile strength of fabric to CAN/CGSB-4.2, method 11.2.
  - .6 Hydraulic Properties:
    - .1 Filtration opening size (FOS): 300 µm to CAN/CGSB 148.1, No.10.
- .2 Low Permeability synthetic material or geotextile impregnated with elastomeric spray.

- .2 Securing pins and washers: to CAN/CSA-G40.20/G40.21, Grade 300W, minimum 30% recycled content, hot-dipped galvanized with minimum zinc coating of 600 g/m<sup>2</sup> to ASTM A123/A123M.
- .3 Turbidity Curtain Hardware: to OPSS 805.
- .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.
- .6 Design filter material to consider grain size characteristics, and the principals of maintain sufficient hydraulic flow and prevention of particle movement through the material.
- .7 All materials to conform to U.S. DOT Type 2 requirements or better.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- .1 Install turbidity curtain prior to works considering Section 01 35 43 - ENVIRONMENTAL PROCEDURES
- .2 Supply, install, maintain, and remove turbidity curtains where work may release sediment or materials into waterway.
- .3 Use turbidity curtain during the installation and removal of dewatering structures. Maintain turbidity curtain in water around all working areas during construction.
- .4 Inspect frequently turbidity control measures to ensure proper functioning and maintenance.
- .5 Stop Work in immediate area if control measures are not functioning properly until problem is addressed and accepted by Contract Administrator.
- .6 Take turbidity and total suspended soils measurements of water immediately outside turbidity curtain:
  - .1 Before start of work.
  - .2 Monthly.
  - .3 Whenever spill or noticeable change occurs.
  - .4 As directed by Contract Administrator.
- .7 Background measurements to be taken immediately upstream of project on same day other turbidity measurements are taken.

- .8 Measurements may be taken from wharves.
- .9 Maximum increase of total suspended solids above background levels:
  - .1 25 mg/L in a period of 24 hours in all waters during clear flows or in clear waters.
  - .2 If such a change is observed take immediate corrective action. Work may be stopped to address the problem.
- .10 Turbidity Standards: Water discharged into surface water bodies from dewatering should have a turbidity:
  - .1 <8 NTU above background levels during short term exposure periods not to exceed 24 hours.
  - .2 <2 NTU above background levels for long term exposure.
- .11 Monitor background turbidity levels to assess turbidity increases due to construction activities.
- .12 Submit test results as a part of Water Quality Testing Reports.
- .13 Eliminate unnecessary sources of sediment by ensuring flow is prevented from entering the project site.

### 3.2 INSTALLATION

- .1 Turbidity curtains to consist of turbidity curtain geosynthetic fabric, load line, flotation, ballast, anchors, mooring buoys, mooring lines, adjustment lines, and tie-downs.
- .2 Design turbidity curtain to conform to U.S. DOT Type 2 requirements or better.
- .3 Construct turbidity curtains as follows:
  - .1 Provide flotation support along full length of turbidity curtain.
  - .2 Form heat-sealed or sewn along entire bottom edge of the turbidity curtain geosynthetic to contain ballast.
  - .3 Breaks may be made in sleeve to facilitate pulling, provided they are 100 mm minimum in size and spaced at minimum 3 m intervals.
  - .4 Where turbidity curtain geosynthetic fabric sections are joined to provide continuous run, provide continuous seal to prevent escape of turbid water between sections.
  - .5 Turbidity curtain to be of sufficient width to account for expected variations in water depth and wave or ice action.
  - .6 Place adjustment lines at maximum intervals of 10 m, and encircle turbidity curtain from top to bottom.
  - .7 Prepare turbidity curtain for installation by furling and tying with furling ties every 1.5 m for entire length of the curtain.

- .8 Place turbidity curtain as close as possible to work area to trap sediment in as small an area as possible for clean-up.
- .9 Anchor locations to be established as necessary to maintain turbidity curtain in place and functioning.
- .10 Install turbidity curtains directly outside of dewatering structures where construction activity takes place.

### 3.3 OPERATION AND MAINTENANCE

- .1 Install turbidity curtains to prevent sediment passage, from work areas enclosed by curtain, to remaining water body.
- .4 Operate and maintain turbidity curtains with entire top edge above water or ice surface.
- .5 Curtain to be free of tears and gaps, and bottom edge of curtain to be continuously in contact with bed of water course so that sediment passage from the area enclosed is prevented.
- .6 Regularly monitor folds which form in turbidity curtain next to flotation collar and remove collected sediment.
- .7 Monitor and maintain turbidity curtain booms both during and outside normal working shifts as required.
  - .1 Provide personnel and materials and equipment necessary to maintain, repair, or relocate silt curtain system.
  - .2 Maintain standby supply of geotextile equal to the length of in-place turbidity curtain.
  - .3 Repair turbidity curtain immediately if curtain is not performing correctly.
  - .4 Adjust setup of turbidity curtains as work evolves.
  - .5 Submit proposed changes to turbidity curtains for acceptance by Contract Administrator.
- .8 Carry out construction operations to minimize impact on fish habitat from both disturbed sediments and fill materials.
- .9 Adjust setup of turbidity curtain immediately as work evolves or when curtain is not performing correctly. Submit proposed changes for acceptance by Contract Administrator.
- .10 Replace damaged or deteriorated geotextile to approval of Contract Administrator.
- .11 Remove heavy accumulation of sediments or debris due to heavy leakage of sedimentation from Basin bottom before removal of dewatering structures and dewatering systems.

- .12 Remove turbidity curtain when authorized by Contract Administrator after completion of Work.
- .13 Remove control measures in a way that prevents escape or re-suspension of sediments.