

SPECIFICATIONS

**Rideau Canal National Historic Site of Canada
Parks Canada Agency – Ontario Waterway Unit**

**Old Slys Locks 26 & 27
Heritage Stone Masonry Repairs**

**Project No. 30030400
August 2018**

Prepared By



JCAL Project No. 17019

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Part 1 General

1.1 SUMMARY

.1 Requirements Included

.1 This section outlines the General Requirements that shall be administered by the Contractor. While the specification section establishes the requirements for each trade, the Contractor shall directly supervise and administer all contract requirements to ensure the provision of materials, labour and equipment necessary to complete the work on time and to the quality specified.

.2 Title and description of work: Rideau Canal National Historic Site of Canada, Old Slys Locks 26 & 27 Heritage Stone Masonry Repairs, Smiths Falls, Ontario.

.2 Contractor Responsibilities to Town of Smiths Falls

.1 As this project requires the installation of a downstream cofferdam, the Town of Smiths Falls has granted access to the site across the driveway of the Waste Water Treatment Plant, located at 180 Queen Street, Smiths Falls. The following regulations will strictly apply:

.1 The Town of Smiths Falls authorizes Parks Canada, its employees, contractors and agents, access across the driveway shown on the aerial map on Drawing S00.

.2 Parks Canada is required to maintain site security of the Towns waste water treatment property by ensuring access gates are locked before and after normal business hours. Access will be through the main gate during normal business hours. If access is required after normal business hours, it will be through the secondary gate that will be double padlocked to allow entry by both parties. Secondary access shown on the aerial map on Drawing S00.

.3 Parks Canada, upon the completion of the lock rehabilitation, will ensure the access driveway is repaired to same or better condition should the driveway be damaged during Parks Canada's use by its staff or contractors. Staff from Parks Canada and the Town of Smiths Falls will do a final visual inspection to ensure the driveway is left in a condition suitable to the Town of Smiths Falls.

.4 Parks Canada will repair any damage caused by its staff or contractors to the fence or gates surrounding the waste water treatment plant during access. Any repairs will be done to the satisfaction of the Town of Smiths Falls.

.5 Parks Canada shall not at any time block access to the driveways or entrances surrounding the waste water treatment plant.

.6 Parks Canada will contact the Town of Smiths Falls on a regular basis with any updates to the project schedule or any changes to the access which may be required outside of the rehabilitation period.

.7 The Town of Smiths Falls will at all times indemnify and save harmless Her Majesty or any of Her servants, agents, contractors and all those for whom Her Majesty may at law be responsible, from and against all

claims, demands, losses, costs, damages, actions, suits or proceedings by whomsoever made, brought or prosecuted in any manner based upon, arising out of, related to, occasioned by or attributable to the permission herein granted or any action taken or things done or maintained by virtue hereof, or the exercise in any manner or rights arising hereunder.

.3 Scope of Work

- .1 The general scope of work shall include but not be limited to the following:
 - .1 Provide scaffolding and site protection as necessary to perform work of this Contract. Erect temporary bracing as required to perform the work in a safe manner and conforming with the requirements of Section 01 35 30 – Health and Safety Requirements.
 - .2 Provide all necessary access to complete the work, including the approved cofferdam structures, as indicated on the drawings.
 - .3 Provide protective barricades to the work site to prevent public access to the work area.
 - .4 Provide and maintain a temporary access road to the lower portion of the locks and the downstream approach walls, for the duration of the construction. Remove temporary access road on completion of work and restore the landscaping in this area.
 - .5 Take all necessary precautions to reduce impact on natural environment and waterway surrounding the site.
 - .6 Prior to start of masonry work, clean the lock to remove zebra mussels, algae and debris.
 - .7 Install approved cofferdam structures and turbidity curtains, at location outside of the stop log gain locations, upstream and downstream.
 - .8 Install approved Waste Water Treatment structures/equipment.
 - .9 Dewater floor of lock chamber to allow for concrete and masonry repairs as noted on drawings.
 - .10 Provide enclosure and heating as required.
 - .11 Rake out and remove all loose and deteriorated mortar to the extent noted on the drawings.
 - .12 Repoint as noted on the drawings.
 - .13 Repair/replace quantities of existing stone as necessary.
 - .14 Remove and reset stone at locations noted on drawings.
 - .15 Install specified anchors, as required and as noted on drawings.
 - .16 Remove deteriorated concrete and provide concrete or stone repairs, as noted on drawings.
 - .17 Grout voids in centre core of walls, as noted on the drawing.
 - .18 Remove, clean (sandblast) and galvanize lock ladders. Repair if required.
 - .19 Restore landscaping to original condition, upon completion of project. Re-sod where required.
 - .20 Include for installation and removal of stop logs, or equipment supplied by Contractor, at upstream and downstream log gains, if required, so that work can proceed inside the lock after March 14, 2019.

- .2 Sequence of Work
 - .1 All work that can be started without impact on the Public use of the lock, excluding that Work associated with the lock, is to commence as soon as possible after award of Contract.
 - .2 Coordinate cofferdam staging as indicated on drawings, with Parks Canada Agency.
 - .3 Work to be completed in two Phases:
 - .1 Phase 1: Fall/Winter/Spring 2018/2019.
 - .2 Phase 2: Fall/Winter/Spring 2019/2020.
 - .4 Until after Thanksgiving, for both phases, the Contractor's work area must not impact on the Public. Coordinate with Parks Canada Agency, to transport materials to site via the waterway and set up a staging area.
 - .5 After Thanksgiving, for both phases, expand work area to include lock. Protect against public access, using fencing as per staging plan. Install cofferdams and dewater lock, after October 9, 2018, for Phase 1 and install stop logs and dewater lock after October 15, 2019, for Phase 2.
 - .6 Complete all work at log gains, (2m inside and all approach masonry walls outside) first, then install logs, then work inside of log gains; work on lower two courses of masonry inside lock and remove cofferdam by March 14, 2019, for Phase 1. Work that requires cofferdams and west wall excavation works must be completed in Phase 1. Concentrate work in Phase 1 on downstream approach walls, lower lock walls and mid-gate breast wall. Lock 26 work is recommended to be included in Phase 1. Phase 2 work to concentrate on upstream lock, approach walls, retaining walls and all other work.
 - .7 Do not commence work inside log gains until raking out, backpointing and preparation for stone repairs is completed for areas noted under Item .6 and approved by Departmental Representative.
 - .8 All in-water work is prohibited after March 14, 2019 and 2020. Cofferdams must be removed by that date.
 - .9 Complete all work, if required, including masonry work inside log gains, removal of stop logs, if these have been installed by the Contractor, landscaping and deficiencies by May 3, 2019, for Phase 1 and May 1, 2020 for Phase 2. No extensions of time are possible.

1.2 PROJECT COORDINATION

- .1 Coordination
 - .1 Coordinate work between sub-trades and own forces to ensure that the complete scope of work detailed in the Contract Documents is completed.
 - .2 Coordinate progress of the Work, progress schedules, submittals, use of site, temporary utilities, construction facilities, with the Departmental Representative.
 - .3 Execute the Work to cause minimum interference to adjacent locks, waterway and canal wall structure. Public boat traffic is to take priority over Contractor. Lock will only be operational during business hours. Do not operate the lock under any circumstances.
 - .4 Take reasonable measures to control noise during construction.

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- .5 Working hours other than normal business hours shall be subject to the approval of the Departmental Representative. Coordinate work with the Departmental Representative.
 - .6 Maintain one copy of each of the following at the job site for reference purposes:
 - .1 Drawings
 - .2 Specifications
 - .3 Addenda (if applicable)
 - .4 Change Orders
 - .5 Reviewed Shop Drawings
 - .6 Reports from Independent Inspection/Testing Agencies
 - .7 Health and Safety Standards
 - .8 Environmental Plan
 - .9 Schedule
 - .10 Basic Impact Analysis (BIA)
 - .11 Environmental Management Plan (EMP)
 - .12 Historic Canal Regulations Permit
 - .2 Hours of Operation
 - .1 Work can only be performed in accordance with local by-laws for Smiths Falls, unless specifically authorized by Departmental Representative. Work can be performed on Saturdays between 9:00am and 5:00pm. No work permitted during Sundays and Statutory Holidays unless approved in advance by the Departmental Representative.
 - .3 Noise Control
 - .1 Adhere to local noise by-laws; notify residents of planned activities that may cause disturbance.
 - .2 Take all necessary precautions to reduce impact noise transmitting through structure which may have environmental implications to area wildlife.
 - .4 Health and Safety
 - .1 Refer to Section 01 35 30 Health and Safety Requirements.
 - .5 Hazardous Materials Abatement and Protection Requirements
 - .1 Provide all measures and procedures for hazardous materials abatement in accordance with the Departmental Representative's recommendations.
 - .2 Be responsible for disposing of all hazardous materials, including all effluent, in conformance with Ministry of Environment and Ministry of Labour guidelines, Environmental Standards Guidelines (ESG) and EMP.
 - .3 Provide all equipment required to clean the Work and access stage/platform in conformance with all applicable statutes and guidelines.
 - .6 Taxes
 - .1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

.7 Fees, Permits and Certificates

- .1 Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.3 CUTTING AND PATCHING

.1 Approvals

- .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of the Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Departmental Representative or separate contractor.

.2 Inspection

- .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 Inspect and record photographically, condition of existing landscaping prior to commencement work on site and submit a detailed list of noted defects to the Departmental Representative. On completion of project, ensure the site is returned to a condition which is the same or better than existing condition, prior to start of project.
- .4 Inspect and become familiar with all perimeter conditions of cofferdam, prior to submitting design and shop drawings for approval.
- .5 Beginning of cutting or patching and installation of cofferdams, means acceptance of existing conditions.

.3 Execution

- .1 Execute cutting, fitting, and patching including excavation and fill to complete the Work.
- .2 Remove and replace defective and non-conforming work.
- .3 Execute Work to avoid damage to other work.
- .4 Prepare proper surfaces to receive patching and finishing.
- .5 Restore work with new products in accordance with Contract Documents.
- .6 Refinish work to match adjacent finishes, unless otherwise noted.

.4 Protection

- .1 Provide adequate protection to the public and property.
- .2 Protect existing vegetation, shoreline and waterway from any damages resulting from performing work on this Contract. Incurred damages to be repaired, without cost to the Departmental Representative.
- .3 Protect new work from damages from any cause. All finished surfaces must be protected so that no marks or scratches mar the finished surfaces prior to acceptance of work.
- .4 Protect and be responsible for all new finished and unfinished work which is exposed and susceptible to vandalism or theft.

- .5 Where security has been reduced by work of this Contract, provide temporary means to maintain security.

1.4 EXAMINATION

- .1 The Drawings are, in part, diagrammatic and are intended to convey the scope of work and indicate general and approximate locations and arrangement of the Work.
- .2 Obtain more accurate information from measurements made at the site in conjunction with the Drawings and become familiar with all site conditions before proceeding with the Work. Notify the Departmental Representative immediately, should any discrepancy be discovered. No allowances will be made later for any expense incurred by the Contractor through their failure to make this examination.

1.5 PROJECT MEETINGS

- .1 Administrative
 - .1 The Departmental Representative will schedule and administer biweekly project progress meetings. More frequent meetings will be scheduled, in the event the schedule is not being adhered to.
 - .2 The Departmental Representative will prepare a template for agenda and minutes.
 - .3 The Departmental Representative will record minutes. Include significant proceedings and decisions. Identify “Action By” parties.
 - .4 The Departmental Representative will reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants and affected parties not in attendance.
 - .5 Record the minutes, when the Departmental Representative is not present. Include significant proceedings and decisions. Identify “Action By” parties.

1.6 SUBMITTALS

- .1 Administrative
 - .1 Submit to Departmental Representative submittals listed for review, refer to Section 01 33 00 Submittal Procedures.
 - .2 Do not proceed with Work affected by the submittal until review is complete.
 - .3 Verify field measurements and coordinate affected adjacent Work.
 - .4 Prior to beginning work, submit to the Departmental Representative for approval, proposed pedestrian and vehicular control measures, signing, site security, sediment and erosion control measures. Do not proceed until written approval is given, EMP is approved and a permit under the Historic Canal Regulations is granted. Modify procedures when required by the Departmental Representative and at no cost to the Departmental Representative.
 - .5 Health and Safety Plan: Submit Health and Safety Plan within 10 working days of award of Contract.
 - .6 Environmental Management Plan: Submit Environmental Management Plan within 10 working days of award of Contract. In order to allow for the timely commencement of project activities, the EMP can be submitted as separate components as project details become available.

- .7 Keep record of all HST paid on Labour and Materials. Submit information to Departmental Representative monthly.
- .8 Contract Price Breakdown
 - .1 Provide a complete Contract price breakdown by construction element within five (5) working days from receipt of the Contract or Letter of Intent. The breakdown must be representative of the full contract price as identified in the Contract or Letter of Intent.
- .2 Shop Drawing and Product Data
 - .1 Refer to Section 01 33 00 - Submittal Procedures.
- .3 Samples
 - .1 Samples: examples of materials, equipment, quality, finishes, workmanship. Refer to Section 01 33 00 – Submittal Procedures.
 - .2 Submit for review, samples as requested in respective specification Sections.
 - .3 Deliver samples prepaid to Departmental Representative's business address.
 - .4 Reviewed and accepted samples will become standard of workmanship and material quality, against which installed work will be verified.
- .4 Photographs
 - .1 Submit to the Departmental Representative, colour digital photography in jpg format, fine resolution, detailing the as found condition of the masonry prior to start of construction.
 - .2 Submit progress photographs to Departmental Representative bi-weekly at progress meeting.
- .5 Record Drawings
 - .1 Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by the Departmental Representative.
 - .2 Identify drawings as "Project Record Copy." Maintain in new condition and make available for inspection on site by the Departmental Representative.
 - .3 On completion of Work and prior to final inspection, submit record documents to the Departmental Representative.

1.7 SCHEDULE

- .1 Schedules Required
 - .1 Construction Progress Schedule, in Gantt Chart format. Indicate Critical Path on Schedule. Summarize work activities into work packages and highlight key milestones to satisfaction of Departmental Representative. Incorporate items into schedule, as requested by Departmental Representative.
 - .2 Monthly Cash Flow Document: Submit to Departmental Representative, a breakdown on the Contract Amount in detail as directed by the Departmental Representative and aggregating the total amount of the Contract Price, so as to facilitate evaluation of application for payment.
- .2 Submission

- .1 Submit initial schedules within 5 working days after award of Contract, indicating the timing of the work, including the sequence of all operations involved therein, in order to meet the completion date. Work on site cannot commence until schedule is approved.
- .2 Submit updated Project Schedule at minimum two days prior to the site meeting, or at shorter intervals as changes to schedule dictate.
- .3 Submit initial Cash Flow Document within 10 working days after award of Contract. Progress Claims cannot be authorized until this document has been approved by the Departmental Representative.

1.8 SITE INSTRUCTION

- .1 When a clarification or modification of the work is required which does not require an adjustment of the contract price or contract time, the Departmental Representative will issue a Site Instruction.
- .2 Upon receipt of a Site Instruction, proceed promptly with the work.

1.9 QUALITY CONTROL

- .1 Provide sufficient, safe and proper facilities at all times for review of the Work by the Departmental Representative.
- .2 Independent Inspection Agencies
 - .1 Independent Inspection/Testing Agencies will be engaged by the Departmental Representative for the purpose of inspecting and/or testing portions of Work and regularly inspecting the EMP requirements, as identified in the Specifications. Cost of such services will be borne by the Departmental Representative.
 - .2 Provide equipment, samples of materials, design mix, tools, storage, safe access and assistance as required for executing inspection and testing by the appointed agencies.
 - .3 Cost of reinspection of unacceptable work to be borne by Contractor.
- .3 Reports
 - .1 Submit one copy of inspection and test reports promptly to the Departmental Representative.

1.10 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- .1 Installation/Removal
 - .1 Provide construction facilities and temporary controls in order to execute the work expeditiously.
 - .2 Prior to substantial performance, remove from site all such work.
 - .3 Make good any damage to, or disturbance of existing property caused by such work.
- .2 Site Office
 - .1 Position temporary site office/trailer at location designated by Departmental Representative.
 - .2 Maintain facility in clean and tidy condition.

- .3 Keep access doors closed at all times.
- .4 Provide heating. Arrange Hydro hook-up under separate meter.
- .3 Site Storage/Loading
 - .1 Do not load or permit to be loaded, any part of the Work with a weight or force that will endanger the safety of the Work.
 - .2 Space on site is limited to the boundaries set out by the Departmental Representative. Keep storage requirements to a minimum. Interior storage is not available.
 - .3 Store products, materials, equipment in locations indicated by the Departmental Representative. All construction material and equipment must be stored inside the fenced area.
 - .4 Maintain equipment to avoid leakage of fuels and liquids. Ensure measures are in place to minimize impacts of accidental spills. Keep an emergency spill kit at the site and deploy immediately, should a spill occur. In the case of a spill contact Departmental Representative and notify Ontario Spill Action Center immediately at 1-800-268-6060. All provincial and federal regulations are to be adhered to. Maintain an adequate supply of clean up materials on-site. Include this information in the EMP, following the guidelines of the ESG.
 - .5 Store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads.
 - .6 Conduct refuelling and maintenance of equipment off slopes and away from water bodies on impermeable pads or buried liners to allow full containment of spills at a recommended distance of 30 meters from any watercourse.
 - .7 Do not discharge chemical and cleaning agents in or near aquatic habitats. Dispose of all such substances at a facility licensed to receive them.
- .4 Sanitary Facilities
 - .1 Provide sufficient sanitary facilities for construction personnel in accordance with local health authorities. The Departmental Representative will designate a location for the contractor to place the facility.
 - .2 Maintain the facilities in clean and sanitary condition.
 - .3 Provide hand sanitation station.
 - .4 Do not use public washrooms.
- .5 Water Supply
 - .1 Provide a supply of potable water to facilitate the Work.
 - .2 Running water is not available on site.
- .6 Temporary Power
 - .1 Provide and pay for temporary power as required during construction.
 - .2 There is no power source on site. Provide a generator as required to complete the work.
- .7 Communication Facilities
 - .1 Provide Site Superintendent with a cell phone, to ensure he/she can contact or be contacted by the Departmental Representative at all times during working hours.

- .2 Provide a means of communication on site in the form of a computer with printer or tablet, in order to facilitate the dispatch of Construction Review Reports and Site Instructions directly to the site office.
- .8 Project Cleanliness
 - .1 Maintain the Work in tidy condition, free from the accumulation of waste products and debris.
 - .2 Remove waste material and debris from the site and deposit in waste container at the end of each working day. Do not burn waste materials on site.
- .9 Dust Control
 - .1 Take every precaution to control dust.
 - .2 Keep the surface area damp to minimize dust where removals are in progress.
- .10 No Smoking Environment
 - .1 Comply with existing no smoking laws.
- .11 Security
 - .1 Submit a list of all workers on site.
- .12 Parking
 - .1 There is some parking on site. Allow for parking for up to two Parks Canada service vehicles at all times.
- .13 Loading/Unloading and Garbage Container
 - .1 Do not use the Departmental Representative's garbage container to store or dispose of contract waste.
 - .2 Provide garbage container, sufficient to accommodate contract waste. Locate where directed by Departmental Representative in Laydown Area.

1.11 MATERIAL AND EQUIPMENT

- .1 Product and Material Quality
 - .1 Unless otherwise specified in the Contract Documents, products provided shall be new. Products which are not specified, will be of a quality consistent with those specified, and their use acceptable to the Departmental Representative.
- .2 Storage, Handling and Protection
 - .1 Do not unreasonably encumber site with materials or equipment. Move stored materials or equipment when directed by the Departmental Representative.
 - .2 Handle and store Products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
 - .3 Store packaged or bundled Products in original and undamaged condition with manufacturer's seals and labels intact.
 - .4 Store loose granular materials on solid flat surfaces, in a well drained area. Prevent mixing with foreign matter.
 - .5 Store products subject to damage from weather in weatherproof enclosures.

- .6 Obtain and pay for use of additional storage or work areas if needed for operations.
- .7 Provide trailer for duration of project to be used as meeting room and lunch room for workers. The trailer can be located as noted on Drawings.
- .8 Store products in a heated facility, trailer or container to maintain manufacturer's temperature requirements.
- .3 Manufacturer's Instructions
 - .1 Unless otherwise indicated in the specifications, install or erect Products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
 - .2 Notify the Departmental Representative in writing, of conflicts between the specifications and manufacturer's instructions, so that the Departmental Representative may establish the course of action.
 - .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in Contract Price.
- .4 Workmanship
 - .1 Ensure workmanship is of the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Departmental Representative if required Work is such as to make it impractical to produce required results.
 - .2 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Departmental Representative, whose decision is final.

1.12 PROJECT CLOSEOUT

- .1 Final Cleaning
 - .1 Remove stains, dirt and smudges from finished surfaces.
 - .2 Clean exposed, finished surfaces in accordance with respective material manufacturers' recommendations.
 - .3 Broom clean and wash pathways and surfaces affected by the work.
 - .4 When work is substantially performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris.
 - .5 Restore landscaping and vegetation to as found condition. Re-sod damaged areas, including re-watering until grass has been cut twice. Replace all damaged shrubs, with shrubs of equal or better quality.
- .2 Documents
 - .1 Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers, and manufacturers.
 - .2 Submit material prior to final Application for Payment.
 - .3 Submit operation and maintenance data, record (as-built) drawings.
 - .4 Provide guarantees, warranties, and bonds where requested, fully executed and notarized.
 - .5 Departmental Representative will issue a final Change Order, reflecting approved adjustments to Contract Price for agreed measured quantities for all unit rate items.

.3 Inspection/Takeover Procedures

- .1 Prior to application for certificate of Substantial Performance, the Contractor and all Sub-Contractors shall carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete, defects are corrected and the site is in clean condition. Notify the Departmental Representative in writing, of satisfactory completion of the Work and request an inspection.
- .2 During the Departmental Representative inspection, a list of deficiencies and defects will be tabulated. Correct same.
- .3 When the Departmental Representative considers deficiencies and defects have been corrected and it appears requirements of the Contract have been substantially performed, make application for certificate of Substantial Performance.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .1 Submit Preliminary Schedule within 5 working days of Contract award.
 - .2 Submit Cash Flow Documents, Health and Safety Plan and Environmental Plan within 10 working days of Contract award.
 - .3 Submit Cofferdam Shop Drawings within 15 working days of Contract award.
 - .4 Submit all other required submittals within the first 30 days of Contract award.
- .2 Prepare submittals log, listing all shop drawings, samples and product data sheet submittals required as part of the contract. List status of each submittal, from submission to final approval. Submit updated submittals log at each progress meeting.
- .3 Do not proceed with Work affected by submittal until review is complete.
- .4 Present shop drawings, product data, samples and mock-ups 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 Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements are coordinated with affected adjacent Work.
- .9 Coordinate each submission with requirements of work and contract documents. Individual shop drawings will not be reviewed until all related drawings are available.
- .10 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .11 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review, unless Departmental Representative gives written acceptance of specified deviations.
- .12 Keep one reviewed copy of each submission on site.
- .13 Arrange and pay for all deliveries and pick-ups to and from the office of the Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 A list of all required shop drawings will be provided to the Contractor at the start of the Project. This list will be used to monitor the status of Submittals.

- .2 Provide shop drawings to the Departmental Representative to review in orderly sequence and sufficiently in advance, so as to cause no delay in the Work.
- .3 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .4 Prepare shop drawings using a computer aided drafting program.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Submit drawings stamped and signed by a Professional Engineer registered or licensed in Province of Ontario, where requested.
- .7 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .8 Allow three days for Departmental Representative's review of each submission.
- .9 Make changes to shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative 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 include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Contractor
 - .2 Subcontractor.
 - .3 Supplier.
 - .4 Manufacturer.
 - .5 Separate detailer when pertinent.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Identification of product or material.
 - .6 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.

- .2 Layout, showing dimensions, including identified field dimensions, and clearances.
- .3 Setting or erection details.
- .4 Capacities.
- .5 Performance characteristics.
- .6 Standards.
- .7 Relationship to adjacent work.
- .7 Where Departmental Representative's drawings are used as the base for the shop drawings, delete the Departmental Representative's title block and stamp. Failure to do so will mean that the drawings will be returned without review.
- .12 After Departmental Representative's review, distribute copies.
- .13 Submit one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .14 Submit one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .15 Submit one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 1 year of date of contract award for project.
- .16 Submit one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .17 Submit one electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .18 Submit one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .19 Submit documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .20 Submit one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .21 Delete information not applicable to project.
- .22 Supplement standard information to provide details applicable to project.

- .23 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .24 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that the Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

- .1 A list of all required samples will be provided to the Contractor at the start of the Project. This list will be used to monitor the status of Submittals.
- .2 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .3 Deliver samples prepaid to Departmental Representative's business address.
- .4 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .5 Where colour, pattern or texture is criterion, submit full range of samples.
- .6 Adjustments made to samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .7 Make changes to samples which Departmental Representative may require, consistent with Contract Documents.
- .8 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

- .1 Construct field samples and mock-ups at locations acceptable to the Departmental Representative.
- .2 Construct each mock-up complete, including work of all trades required to finish work.
- .3 Reviewed mock-ups will become standard of workmanship and material quality, against which installed work will be verified.

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic digital photography in jpg format, fine resolution, as directed by Departmental Representative.

- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Submit photographs of as-found condition prior to commencement of the project.
- .4 Submit progress photographs to Departmental Representative, bi-weekly at progress meeting, to document advancement of project.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1 As per the Historic Canal Regulations applicable to lands administered by the Rideau Canal National Historic Site of Canada, a permit signed by Parks Canada's Ontario Waterways Director will be required to authorize the project work prior to commencement of project activities.
- .2 Immediately after award of Contract, submit Workers' Compensation Board status.
- .3 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Health and Safety Regulations.
- .2 Province of Ontario
 - .1 Occupational Health and Safety Act and Regulations 213/91 for Construction Projects, latest edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Complete Parks Canada site-specific Health and Safety Plan Template and submit within 10 working 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 Complete and submit Parks Canada Form, attestation and proof of compliance with occupational Health and Safety.
- .3 Contractor may use own plan format, provided it includes at minimum, the contents of Parks Canada Plan template.
- .4 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
- .5 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.
- .6 Submit copies of incident and accident reports.
- .7 Submit Material Safety Data Sheets (MSDS) to Departmental Representative.
- .8 Personnel training requirements including as follows:
 - .1 Names of personnel and alternates responsible for site safety and health, hazards present on site, and use of personal protective equipment.
- .9 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 2 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 2 days after receipt of comments from Departmental Representative.
- .10 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .11 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

- .12 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.

1.3 SAFETY ASSESSMENT

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

1.4 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Wild Parsnip (noxious weed)
 - .1 Protective clothing, rubber gloves and eye protection is advised.
 - .2 Remove protective clothing carefully to reduce risk of skin coming into contact with sap, which may be on clothing.
 - .3 Launder non-disposable clothing immediately to prevent distribution of sap.
 - .4 If skin comes into contact with sap, thoroughly wash with soap and water.
 - .5 Avoid further exposure of the affected skin to UV/sunlight.
 - .6 If a rash occurs, seek medical attention.
 - .7 If eyes are exposed to direct contact with the sap, immediately flush with water and seek immediate medical attention.
 - .2 Fall Hazards
 - .1 Lock walls are considered a fall hazard. Ensure workers are aware of safety regulations.
 - .3 Work Near Water
 - .1 Adhere to the regulations of Occupational Health and Safety Act and Regulations 213/91 for Construction Projects.
 - .2 Ensure all workers are well informed of the risks of working in the vicinity of a weir.
 - .3 Provide all personnel working on, in or around water with appropriate water safety devices, including the use of life jackets.
 - .4 Ensure an alarm system is in place, in the event that a worker falls in the water.
 - .4 Work Behind Cofferdam
 - .1 Provide means to control flooding of work area.
 - .2 Ensure warning system is in place in case emergency evacuation is required.
 - .3 Provide a means of rapid exit, by way of ramp or walkway. Do not allow this exit to become blocked at any time.
 - .4 Once the waterway is dewatered, it is recommended that worker interaction with sediment (canal substrate) be minimized through the creation of defined walkways and work zones that are isolated from the canal bed.

- .5 Work Upstream of Cofferdam
 - .1 Avoid diving in conditions where pressure differential may exist.
 - .2 Divers to test for suction, using standard DAG test before all diving operations.
- .6 Working around Motorized Watercraft
 - .1 The lock and waterway are actively used by recreational boaters.
- .7 Winter Work
 - .1 Working on the floor of the lock chamber during sub-zero temperatures may cause ice build-up on the soles of work boots. Be alert to ice hazards generated by extreme temperatures.
 - .2 Ensure access paths to area of work are maintained in a safe condition, by spreading gravel as required to prevent fall hazard.
 - .3 Ensure workers are aware of the potential hazards of cold weather work and have adequate insulated clothing to withstand a cold environment.
- .8 Thin Ice
 - .1 Ice thickness on the waterway varies and may be thin approaching the lock.
- .9 Contamination
 - .1 Wear personal protective equipment (PPE) above the Ministry of Labour mandated construction site PPE, in order to minimize potential exposure to contaminated media in project area. Workers who come into contact with subsurface groundwater should wear gloves, long pants, and long sleeves to minimize dermal contact with groundwater in areas containing PHCs. In addition, the wearing of water-proof/chemical-resistant footwear is recommended. In the event that divers are used (e.g., to anchor turbidity curtains), the equipment used (e.g., wetsuit, face mask) should minimize bare skin exposure to the work zone. Provide appropriate wash stations to remove adhered soil and sediments from PPE, as well as hand-wash stations. The wash-off material must be contained and disposed of offsite. Wash water must not be allowed to enter the canal either directly or through a storm sewer.
 - .2 Follow applicable health and safety requirements for workers in regards to the contaminants identified.

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.
- .2 Schedule and administer weekly Health and Safety Toolbox Meetings with workers. Submit minutes of meetings to Departmental Representative at Progress Meetings.

1.6 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until

final demobilization from site. Health and Safety Plan must address project specifications.

- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials and regarding the labelling and provision of MSDS data sheets.

1.8 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and surrounding 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, and local statutes, regulations and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Health and Safety Act and Regulations for Construction Projects.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 CORRECTION OF NON-COMPLIANCE

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

1.11 UNFORSEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, suspend work and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of the Province of Ontario. Advise Departmental Representative verbally and in writing.

1.12 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 working knowledge of occupational safety and health regulations.
 - .2 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.

- .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .4 Be on site during execution of Work and report directly to and be under direction of site supervisor.
- .2 Provide the name of this individual to the Departmental Representative.
- .3 Ensure at least one of the site personnel is trained in CPR, in the event it is required.

1.13 POSTING OF DOCUMENTS

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

1.14 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Assign responsibility and obligation to Health and Safety Officer to stop or start work when, at Health and Safety Officer's Discretion, it is necessary or advisable for reasons of Health and Safety. Departmental Representative may also stop work for Health and Safety considerations.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used

END OF SECTION

Part 1 General

1.1 MEASUREMENT AND PAYMENT

- .1 No measurement for payment will be made for the work of implementing the environmental protection measures indicated on the drawings, specifications, environmental assessment, or as required by applicable legislation and, including water control through the site. Include all costs for the implementation of environmental measures in the “Environmental Measures” lump sum price. Refer to Environmental Standards Guidelines (ESG) for Parks Canada expectations.
- .2 Prior to the first application for progress payment, submit a breakdown of the lump sum price for the various environmental measures called for. Once approved, this will be used as the basis for progress payments.

1.2 RELATED REQUIREMENTS

- .1 Section 32 92 23 – Sodding.

1.3 REFERENCES

- .1 Definitions
 - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
 - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous and liquid waste; radiant energy and radioactive material as well as other pollutants.
- .2 Reference Standards
 - .1 Canadian Council of Ministers for the Environment (CCME).
 - .2 This Section 01 35 43 – Environmental Procedures, to be read in conjunction with Environmental Standards and Guidelines Document – Ontario Waterways (ESG), appended to these Specifications.

1.4 ENVIRONMENTAL ASSESSMENT

- .1 Adhere to the environmental protection measures outlined in the Parks Canada Basic Impact Analysis report attached in the Bid Documents, as well as the measures called for elsewhere in Project Drawings and these Specifications.

1.5 ARCHAEOLOGICAL ASSESSMENT

- .1 Adhere to the requirements outlined in the Parks Canada Archaeological Overview Assessment attached in the Bid Documents and corresponding measures called for elsewhere in the Project Drawings and Specifications.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Management Plan for review and approval by Departmental Representative.
- .3 Environmental Management Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction and the methods of mitigation as well as how compliance will be measured.
- .4 For required permits, refer to Section 01 33 00 – Submittal Procedures.
- .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .6 Environmental Management Plan to be prepared by a qualified environmental Professional, incorporating guidance found in PCA Environmental Standards and Guidelines – Ontario Waterways (2017).
- .7 Include in Environmental Management Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Management Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of person responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .6 Frequency of monitoring and list of high-risk construction activities where an environmental Professional must be on site. Monitoring and testing should be adaptable to changing site conditions and is to capture any event/incident for the length and scope of that event.
 - .7 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material and fuel storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .8 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
 - .1 Plans to include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.

- .9 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .10 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance, including contents and location of spill kit.
- .11 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .12 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off the project site.
- .13 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials. Include in plan methods to address the runoff of water from rain and weather.
- .14 Waste Water Management Plan identifying methods and procedures for management of discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .15 Historical, archaeological, cultural resources, biological resources and wetlands plans may be required for this project where the ground surface is to be disturbed. If it becomes necessary, the plans will define procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands. Should any suspected species at risk be encountered or if there is potential to negatively impact species at risk, or wild life in general, contact PCA Environmental Assessment staff at 613-283-5170, for guidelines on how to proceed.
- .16 Pesticide treatment plan to be included and updated, as required.
- .17 Plan which demonstrates procedures for avoiding disturbance/harm to wildlife.

1.7 PROJECT SPECIFIC MEASURES

- .1 No in-water works permitted between March 15 – June 30 in any given year.
- .2 Throughout dewatering, ensure that the dewatered portion of the Work is cleared of all stranded fish. Use appropriate equipment to remove stranded fish. As water levels drop in the work area, monitor the deeper pool areas where fish are congregating. If safe to do so, seine nets or dip nets may be used to remove fish. Handle fish to prevent their injury and place in buckets with ample fresh water at lake temperature until released. Count and document the fish by species. Release alive as soon as possible downstream of dewatered work area if found near the downstream cofferdam. Release alive as soon as possible upstream of dewatered area if found near the upstream cofferdam.
- .3 Implement required measures to keep work site dry. Pump water from work site upstream of check dam into a silt trap prior to release into natural environment. Do not

pump water directly into the waterway. Send all discharge to a settling pond or filtration area before being released into the waterway. Refer to ESG and BIA for waste water management. Water quality downstream of construction activities and/or released to watercourses not to exceed turbidity readings of 8 nephelometric turbidity units (NTU), or 25 mg/L for suspended solids during any short-term exposure period. For longer term exposure (greater than 24 h), average suspended sediment concentrations shall not be increased by more than 5 mg/L over background levels, up to a maximum of 25 mg/L or an average increase of 2 NTU from background levels, up to a maximum of 8 NTU. If elevated turbidity beyond 25 mg/L or 8 NTU is observed during in-water activity, the Departmental Representative will assess potential impact to the aquatic environment and additional mitigation measures may be required. Refer to CCME guidelines for the protection of aquatic life. Prior to dewatering, submit a Dewatering Plan for approval by the Departmental Representative.

- .4 Ensure all debris from demolition, raking and mortar/grout residue is collected and removed from the site. Develop catchment system and/or work method to ensure all debris is captured and removed from site. Ensure no release of deleterious material from demolition into downstream water courses or other areas adjacent to work site.
- .5 Remove green algae from lock walls prior to start of work. Ensure stone is in clean condition before raking out of joints.
- .6 Zebra Mussels
 - .1 Remove and dispose of zebra mussels found in area of work, in accordance with “Invasive Species Management” section in ESG.
 - .2 Upon completion of project, clean tools, cofferdams and all other equipment used in the execution of the project to remove any attached zebra mussels.
 - .3 Maintain equipment in a dry condition for at least 21 days before placing into another water body.

1.8 FIRES

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

1.9 DISPOSAL OF WASTE

- .1 Do not bury rubbish and waste materials on site. Do not dump excavated fill, waste material or debris in water bodies.
- .2 Do not dispose of waste of volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- .3 Material removed from canal bed, soil removed from land, and material removed during water treatment to be disposed of at an off-site facility capable of handling identified contaminants.

1.10 DRAINAGE, SEDIMENT CONTROL AND AQUATIC PROTECTION

- .1 Develop and submit erosion and sediment control plan as part of the Environmental Management Plan that identifies type and location of erosion and sediment controls. Plan to include monitoring and reporting requirements to assure that control measures are installed properly and functioning.

- .2 Develop a contingency plan (eg. Extra pumps/equipment) in the event of extreme precipitation events or spring flooding at the place of Work.
- .3 Provide temporary drainage and pumping required to keep excavations and site free from water ponding.
- .4 All erosion control methods, including those identified on the drawings, will be installed prior to commencement of any project activities and must remain in place until all work has been completed and disturbed areas have been stabilized. Removal will be permitted only after written approval from the Departmental Representative.
- .5 Sediment, debris and erosion control measures must be inspected daily to ensure that they are functioning properly and are maintained and upgraded as required. Remove accumulated sediment required and dispose off site.
- .6 In the event that sediment and erosion control measures are not functioning, the Departmental Representative will order the work stopped. Do not carry out further work until the sediment control plan is adjusted to address the sediment problem.
- .7 Provide sediment fence in all areas where, due to construction activities, silt or debris may enter the canal or water. This includes, but is not limited to: a sediment fence installed around staging, stockpiles and work areas; access routes where ground is disturbed and locations indicated on drawings.
- .8 Place only washed stone, free of particulate in the water.
- .9 Use of earth or granular material with sand and fines for any required cofferdam construction is not acceptable. Washed gravel with 6 mm minimum aggregate size can be used as cofferdam material. If using sandbags, sand must be washed and free of fines.
- .10 Quickly address and seal any leaks discovered in cofferdam. If leaks persist, create a clean water collection area, to be pumped back to the upstream or downstream receiving waters.
- .11 Upon completion of work, completely remove all debris from work area and stream bed. Restore the area to its original state.
- .12 Treat any water containing a high level of silt or sediment by discharging to settling basins, vegetated areas or sediment traps prior to release to streams. Mechanical filtration ie filterpress or chemical – flocculation may be acceptable to the Departmental Representative. Confirm if this is an option. Flow dissipaters and/or filter bags, or equivalent, shall be placed at water discharge points to prevent erosion and sediment release. Water quality downstream of construction activities and turbidity curtain should not exceed recommended DFO and CCME guidelines on water quality for the protection of aquatic life. Particularly a maximum turbidity reading of 8 nephelometric turbidity units (NTU), or a maximum of 25 mg/L for suspended solids, at any one time for a duration of 24 h in all waters during clear flows or in clear waters. For longer term exposure, longer than 24 h, average suspended sediment concentrations shall not be increased by more than 5 mg/L over background levels, up to a maximum of 25 mg/L or a maximum increase of 2 NTU from background levels up to a maximum of 8 NTU. Information on CCME guidelines can be obtained online at: <http://ceqgrcqe.ccme.ca/download/en/217/>. If NTU readings are found to be non-compliant, PCA will assess potential impact to the aquatic environment, total suspended

- solids (TSS) may be sampled for laboratory analysis, and additional mitigation measures may be required.
- .13 Provide a marine grade medium duty turbidity curtain, US DOT Type 2, across all areas where sediment can enter the watercourse. This includes, but is not limited to, a turbidity curtain located as indicated on drawing. Anchor or weigh down the turbidity curtain along its length to form a continuous seal on the canal bed, with adequate flotation at water surface to prevent over spills or turbid water.
 - .14 In the event of a significant silting or debris caused by construction activities, take appropriate measures to contain and mitigate the problem including the installation of additional downstream turbidity curtains. Investigate the source of the problem and eliminate the activities leading to the issues.
 - .15 Implement additional mitigation measures in accordance with any regulatory requirements and recommendations stipulated by authorities under the Fisheries Act and Historic Canal Regulation Permit.
 - .16 Maintain a standby supply of pre-fabricated silt fence barrier, or an equivalent ready-to-install sediment control device.
 - .17 Cease demolition and excavation during periods of heavy rainfall.
 - .18 Ensure all equipment and temporary access structures such as scaffolding placed in water bodies is free of earth material, and excess loose or leaking fuel, lubricants, coolant and other deleterious material that could enter the water body.
 - .19 As concrete leachate is alkaline and highly toxic to fish and other aquatic life, ensure that all works involving the use of concrete, cement, mortars and other Portland cement of lime-containing materials (concrete) will not deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse. Concrete materials cast in place must remain inside formed structures. Concrete waste water must be removed from site.
 - .20 Use trigger operated spray nozzles for water hoses, when cleaning concrete equipment.
 - .21 Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment and other tools and equipment.
 - .22 Dispose of all concrete wash water in a location where it will not enter subsurface drains, water bodies or storm drains.
 - .23 Prevent any water that contacts uncured or partly cured concrete during activities like exposed aggregate wash-off, wet curing, or equipment washing from directly or indirectly entering any watercourse.
 - .24 Maintain complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 48 hours if ambient air temperature is above 0°C and for a minimum of 72 hours if ambient temperature is below 0°C.
 - .25 In accordance with the ESG, treat any water with pH > 9, until the pH is between 6.5 and 9.0 pH units, and the turbidity levels are acceptable. Water with pH greater or equal to 12.5 is considered toxic and is treated as hazardous waste under Ontario Regulation 347 of the EPA and wastewater in this condition must be removed from site.

1.11 PERMIT TO TRANSPORT

- .1 Transport all waste described as subject to Ontario Regulation 347 as amended of the Environmental Protection Act, with a valid “Certificate of Approval for a Waste Management System” to a site approved by the Ontario Ministry of the Environment, to accept that waste.

1.12 WORK ADJACENT TO WATERWAYS

- .1 Prior to commencement of work, install sediment and erosion control measures, such as turbidity curtains, silt fences, drainage swales or other methods necessary to prevent silt or sediment from entering the watercourse.
- .2 Operate construction equipment on land only.
- .3 Keep waterways free of excavated fill, waste material and debris.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 In-water work is not permitted after March 14, to protect fish spawning habitat.

1.13 NOISE CONTROL

- .1 In all cases, comply with local noise by-laws, including the by-laws related to noise and construction. Do not idle equipment.
- .2 Minimize the noise levels from construction activities by using proper muffling devices, in addition to appropriate timing and location of these activities to reduce or minimize the effect of noise on nearby residents, recreationists and wildlife.

1.14 SPILL CONTAINMENT

- .1 Ensure a spill containment kit is on site and available at all times. Provide training to site personnel in the use of the kit.
- .2 During all operations, such as refueling, complete the operations within a secondary environment system capable of preventing release of spills or leaks into the environment.
- .3 Store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads; provide berms and secondary containment systems as necessary.
- .4 Conduct all vehicle/equipment maintenance and refuelling over impermeable surfaces situated at a designated area that is located at least 30 metres away from the nearest water body.
- .5 Clean any equipment which operates in water bodies, prior to entering the water and inspect daily for leaks; never leave equipment in the water outside of working hours.
- .6 Provide drip trays to prevent the discharge of oil, grease, antifreeze or any other deleterious materials into the ground, for any equipment, including pumps, machinery and compressors.

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 Prevent extraneous materials from contaminating air and waterways beyond removal/application area, by providing temporary enclosures or other suitable methods acceptable to the Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .5 Spills of deleterious substances
 - .1 Immediately contain, limit spread and clean up in accordance with Provincial regulatory requirements.
 - .2 Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal.
 - .3 Report immediately to the Ontario Spill Action Centre: 1-800-268-6060 and to the Departmental Representative.
 - .4 Further information on dangerous goods emergency clean-up and precautions, including a list of companies performing this work, can be obtained from the Transport Canada 24-hour number (613) 996-6666 collect.
 - .5 Be responsible for all costs of cleaning up any spills, to the satisfaction of the Departmental Representative.
 - .6 Dispose of contaminated material off site to a licenced facility.
 - .7 Ensure an environmental emergency response plan is in place and a spill kit is readily available. Note location of spill kit on the Site Plan.
 - .8 Should conditions at the work site indicate that there are unforeseen negative impacts to fish or their habitat, cease all work until the problem has been corrected and/or appropriate guidance has been obtained from Parks Canada.
- .6 Leave machinery running only when in actual use, except where extreme temperatures prohibit shutting machinery down.
- .7 Remove concrete debris and dust generated as a result of various concrete/stone work, in such a way that will ensure material does not enter the waterway. Remove unused aggregate, concrete rubble and stone rubble material and restore to original state, upon completion of work.

1.16 MISCELLANEOUS

- .1 Do not use explosives. Sandblasting is not permitted on the site.
- .2 Restore habitat where necessary; completely remove all debris from bed (including unused aggregate/concrete rubble) and restore area to original condition. Wash down all debris from lock area; collect/pump and treat the water.
- .3 Investigate the area for any nests or dens prior to clearing and avoid disturbing any active nests or dens. Minimize operation of machinery in areas where migratory birds are breeding.
- .4 Protect trees and plants on site and adjacent properties as indicated.

- .5 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes and encase with protective wood framework from grade level to height of 2 m.
- .6 Protect roots of designated trees to drip line (outer perimeter of branches) to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .7 Minimize stripping of topsoil and vegetation.
- .8 Reduce soil displacement and compaction by using equipment of low bearing weight and low psi tires, wherever possible. Reinstatement damaged areas with native plants/seeds only. Seed mix to be approved by Departmental Representative.
- .9 Avoid activity during wet weather conditions (rainfall amounts greater than 20 mm predicted) and ensure that a consistent access route is used and maintained throughout the vegetation clearing.
- .10 Restrict tree removal to areas indicated by Departmental Representative.
- .11 Relics and antiquities such as cornerstones and their contents, commemorative plaques, the remains and evidence of ancient persons and peoples, and other objects of historic value and worth will remain the property of the Department. When found, protect such articles and request direction from the Departmental Representative.
- .12 Existing groundwater monitoring wells shall be marked and protected.
- .13 Temporary reptile fencing, such as polythene/woven geotextile secured with timber stakes, or material of similar nature/function, should be installed around gravel stockpiles to prevent turtle nesting and snake egg laying within 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

1.17 HISTORICAL/ARCHAEOLOGICAL CONTROL

- .1 Submit historical, archaeological, cultural and biological resources plan to Departmental Representative for approval.
- .2 Contents of Plan:
 - .1 Procedures for identifying and protecting historical, archaeological, cultural and biological resources known to be on project site.
 - .2 Procedures to be followed if historical, archaeological, cultural and biological resources, not previously known to be on project site or in the area, are discovered during the work.
 - .3 Procedures to assure protection of known or discovered resources.
 - .4 Procedures for communication between Contractor's personnel and Departmental Representative.
- .3 Minimum Procedures:

- .1 Obtain diagrams and maps of previously disturbed areas and areas of concern from Departmental Representative.
- .2 Use previously disturbed areas (eg. lawns, parking lots) immediately adjacent to the locks, to mitigate possible impact of heavy equipment and/or of staging area(s).
- .3 Confine heavy machinery to a minimal area, to mitigate impact on potential archaeological structures.
- .4 Develop proposed approach to cofferdam that has a minimal impact on potential underwater archaeological resources and submit to Departmental Representative for approval.
- .5 After installation of the cofferdam and completion of dewatering process, allow 2 days for Departmental Representative to enter dewatered area to inspect water bed, prior to commencing work.
- .6 Avoid use of heavy equipment on water bed.
- .7 If significant features (eg. structural remains an/or high artifact concentration) are encountered, stop work in immediate area, take photographs and notify Departmental Representative. Departmental Representative will contact Parks Canada Terrestrial Archaeology section for advice. A Parks Canada assessment of significance of the resources will determine required mitigation of the chance find.
- .8 All excavation work may be monitored by Archeologists, who may stop excavations as artifacts or remnants are uncovered. Proceed as directed by Departmental Representative.
- .9 No excavation, staging or road access is allowed in areas noted in Figure 7 of the Archaeological Overview Assessment.

1.18 NOTIFICATION

- .1 Monitor compliance with the accepted environmental plan, logging compliance and non-compliance issues. Present the log to the Departmental Representative for review.
- .2 While the Contractor remains responsible for compliance review, the Departmental Representative may notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Management Plan.
- .3 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .4 Departmental Representative may issue stop order of work until satisfactory corrective action has been taken.
- .5 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.
- .6 Cooperate with the authorities having jurisdiction and correct any non-compliant issues.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Clean up work area as work progresses. Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment from the site.
- .3 Landscaping on site must be returned to its former condition. Regrade and resod damaged areas as per Section 32 92 23 – Sodding.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C185-08, Standard Test Method for Air Content of Hydraulic Cement Mortar.
 - .2 ASTM C270-14a, Standard Specification for Mortar for Unit Masonry.
 - .3 ASTM C780-14b, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- .2 Canadian Standards Association (CSA)
 - .1 CSA A179-14, Mortar and Grout for Unit Masonry.

1.2 TESTING STANDARDS

- .1 Conduct required testing in accordance with the following standards:
 - .1 Flow and Cube strength: to ASTM C270.
 - .2 Vicat Cone test: to ASTM C780.
 - .3 Cube strength: to CSA A179, Annex B.
 - .4 Flexural bond strength: to CSA A179
 - .5 Air content: to ASTM C185.

1.3 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.

1.5 ACCESS TO WORK

- .1 Old Slys Lockstation (Locks 26 & 27) is located at 9 Old Slys Road, Smiths Falls, Ontario.
- .2 Co-ordinate site visits with the Contractor.

1.6 PROCEDURES

- .1 Contractor will notify the Testing Agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REPORTS

- .1 Submit inspection and test reports to Departmental Representative with copies to Contractor at each stage of testing.
- .2 Include note on test report identifying the mortar mix ratio; and the location of mortar use on project (i.e. mortar mix 1:1:6 cement : lime : sand; for northeast approach wing wall on Lock).
- .3 Identify the specific mix which is being tested (i.e. backpointing mortar, finishpointing mortar, grout, repair concrete).

Part 2 Products

2.1 EQUIPMENT

- .1 Air content apparatus for mortar. A concrete test apparatus must not be used to test the air, as it is unsuitable for this application.
- .2 Vicat Cone.
- .3 Compressive Strength Testing: use cube moulds specifically for mortar testing, in accordance with CSA A179.

Part 3 Execution

3.1 TESTING

- .1 Flexural Bond Strength: Prior to commencing project, arrange with Testing Laboratory to construct a section of sandstone and limestone masonry wall, of sufficient size for the lab to test for flexural bond strength, in accordance with CSA A179, when using the specified mortar.
- .2 Prepare mortar cubes on site in accordance with CSA A179 and ASTM C270. Record air temperature and mortar temperature. Ensure mortar cubes set in protected location, at minimum 10°C, for 24 hours minimum.
- .3 Record air content in percent.
- .4 Conduct Vicat Cone test in accordance with ASTM C780. Record cone penetration in millimetres. Vicat Cone testing is not required for grout samples.
- .5 After mortar cubes have set, transport all cubes to the lab for curing. Cure in accordance with ASTM C270 and CSA A179.

3.2 TESTING SCHEDULE

- .1 For each mortar test, cast 9 cubes for testing. Break 3 cubes at each test date. Submit report after each testing date.
- .2 Test mortar cubes at 7, 28 and 56 days, unless otherwise indicated.
- .3 Test grout cubes at 28, 56 and 112 days, unless otherwise indicated.

- .4 Conduct 44 mortar tests (50% for backpointing, 50% for finishpointing), and 6 grout tests. Conduct maximum 2 concrete tests on locks, to be determined, if required. Consultant will provide table showing quantity and location of tests.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 10 – Common Work Results for Masonry.

1.2 REFERENCES

- .1 Definitions
 - .1 Housing: Enclosure placed around work or around scaffolding and work, to provide either protection for the work taking place, or to provide a micro-climate more suitable to the work than ambient atmospheric conditions, or both.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Provide lump sum price to include all costs for labour, materials and equipment necessary to complete the work of installing and removing insulated housing for the work, as well as for all hook-ups/metering (if required) and heater(s).
- .2 Watchperson: No measurement for payment will be made for the work of providing a Watchperson, if required. Include all costs for the provision of a watchperson in the tendered prices for the above lump sum items.

1.4 REGULATORY REQUIREMENTS

- .1 Design and construct temporary housing to resist the snow and wind loads (including uplift), in accordance with the 2015 National Building Code.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings
 - .1 Submit shop drawings for temporary housing. Indicate material specification and all details and information necessary for assembly and erection.
 - .2 Shop drawings for housing to be stamped and signed by a qualified Professional Engineer registered in the Province of Ontario.
- .3 Provide schedule of heater numbers, types, locations and capacities.
- .4 Indicate number and location of fire extinguishers associated with heating equipment.

1.6 INSTALLATION AND REMOVAL

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

1.7 TEMPORARY HOUSING

- .1 Provide weather tight housing for the portions of the Work which must be protected, heated and/or ventilated during the work.

1.8 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside housing enclosure 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.
 - .6 Continue heating operation until all mortar has been adequately cured, or ambient temperature reaches acceptable levels, whichever is first.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction 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.
- .8 Appoint a Watchperson to be in attendance, when workers are not present, to ensure temperatures are maintained and heating equipment is operating safely.

1.9 FIRE PROTECTION

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

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Store heating fuels and gas to the requirements of the Departmental Representative and in accordance with Section 01 35 43 – Environmental Procedures.

Part 2 Products

2.1 MATERIALS

- .1 Use only new materials, unless approved otherwise by the Departmental Representative.
- .2 Materials must comply with the requirements of the 2015 National Building Code.

Part 3 Execution

3.1 TEMPORARY HOUSING

- .1 Install housing enclosure above the lock, extending above all masonry work to be rehabilitated, between the upstream cofferdam and the downstream cofferdam. Location as noted on the Drawings.
- .2 Prior to commencing heating, inform Departmental Representative of the intent and obtain approval prior to starting. The Departmental Representative will make periodic inspections of the housing and heating works throughout the duration of construction. Cooperate with and make adjustments/changes as directed.
- .3 Maintain housing in satisfactory condition for the duration of construction.
- .4 Remove structure on completion of construction and restore areas disturbed during removal.
- .5 Remove all anchors from masonry or concrete. Repair stone or mortar as required.

3.2 HEATING EQUIPMENT

- .1 Use only heating equipment types acceptable to the Departmental Representative.
- .2 Ensure all installation and removals of meters and/or piping is performed by a Fitter/Installer CSA certified for the type of fuel being used. Be responsible to maintain piping and associated heating systems at no additional cost to the Departmental Representative.
- .3 Ensure that the heating requirements are met by providing, at optimum efficiency of the equipment, a capacity of 125% of the heat requirement and a sufficient number of standby heaters ready for use at the site.

- .4 Heating Fuels
 - .1 Use electricity, gas, diesel oil or other fuels approved by the Departmental Representative. Note that electricity availability is limited and an outside source will be required. Be responsible for all arrangements and paying of accounts with Hydro, if this is the selected method of heating.
 - .2 Fuel storage to the requirements of the Fire Commissioner of Canada.
 - .3 Heating fuel usage quantities will be recorded monthly and the Contractor will be billed at cost. Monthly cost shall equal total consumption times the effective volume times rate for the given month, as dictated by the heating fuel provider.
- .5 Provide and maintain temporary fire protection equipment during performance of work, commensurate with fuel source selected.

3.3 REMOVAL OF HEATING AND VENTILATING EQUIPMENT

- .1 Upon receipt of Departmental Representative's approval:
 - .1 Discontinue heating operations.
 - .2 Remove housing and heating equipment from the site.

3.4 FIELD QUALITY CONTROL

- .1 Provide acceptable maximum-minimum thermometers and relative humidity gauges inside the housing and maintain to the satisfaction of the Departmental Representative, and in accordance with Section 04 05 10 – Common Work Results for Masonry. Locate thermometers at lowest and highest levels of scaffold.
- .2 Ensure continuity of protection by posting a Watchperson at Contractor's discretion, when work is not in progress.
- .3 The Watchperson's qualifications must be sufficient to perform, on heating equipment, such duties as:
 - .1 Preventative maintenance and refueling, normally performed during any shift.
 - .2 Emergency repairs of minor complexity.
 - .3 Place standby items in service.
 - .4 Record maximum and minimum temperature at each thermometer on a daily basis and reset the thermometers when requested by the Departmental Representative, or at prescribed intervals.
 - .5 Provide temperature records on a daily basis and certified written records on a weekly basis to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 03 07 – Historic - Masonry Repointing.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA Z797-09 (R2014), Code of Practice for Access Scaffold.
 - .2 Occupational Health and Safety Act Ontario Regulations 213/91 for Construction Projects, latest edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 REGULATORY REQUIREMENTS

- .1 Design and construct scaffolding in accordance with:
 - .1 CSA Z797.
 - .2 Occupational Health and Safety Act Ontario Regulations 213/91 for Construction Projects.

Part 2 Products

2.1 SCAFFOLDING

- .1 Scaffolding in accordance with CSA Z797
- .2 Access ladders and platforms.

2.2 HOISTING

- .1 Hoists for moving of workers, materials and equipment.

Part 3 Execution

3.1 SCAFFOLDING ERECTION

- .1 Supply and install scaffolding sufficient to carry out the scope of work identified on the drawings.
- .2 Set scaffold anchors in horizontal masonry joints only. DRILLING INTO THE FACE STONE IS NOT PERMITTED. Repointing of masonry joints, as scaffold anchors are removed, will be carried out as part of the Masonry Contract.
- .3 Erect scaffolding independent of walls.

- .4 Provide scaffolding with approved configuration for free access of workers, including side brackets at each lift. Install tie-backs at same level as side brackets. Tie-backs must be installed such that they do not create a tripping or other form of hazard to workers using the scaffold.
- .5 Supply and install full width, continuous platform and side brackets, planking, braces, (cross and horizontal), jacks and base plates (with special attention for safety on the adjustable jacks), hangers, guardrails, guardrail posts, coupling pins, safety clips and all clamps for safe installation. Number of fully planked decks required to be determined by Scaffold Design Engineer.
- .6 Do not bear any part of the scaffolding, hoist or construction plant directly against the masonry. Provide isolating material, lumber or plywood with additional padding as required to prevent damage to the existing masonry.
- .7 Provide, operate and maintain hoists and equipment required for moving of workers, materials and equipment.
- .8 Provide access ladders, securely erected, on both sides of Lock chamber.
- .9 Provide safety handrails and fencing as required for safe working conditions.
- .10 Prior to use, provide proof of review and approval of scaffolding erection by a Professional Engineer licensed in the Province of Ontario.
- .11 Maintain the scaffolding in satisfactory condition for the duration of the work.
- .12 Provide security fencing, around scaffolding to prevent access to scaffolding by the public, refer to Section 01 56 00 - Temporary Barrier and Enclosures. Contractor is responsible to maintain security on the scaffold.

3.2 SCAFFOLD DISMANTLING

- .1 Prior to removal of scaffold anchors from masonry walls, see Section 04 03 07 – Historic Masonry Repointing for procedure.
- .2 After repointing has been allowed to cure for a minimum of seven days, relocate all scaffold anchors into fresh horizontal mortar joints. Rake out and repoint all existing mortar at original scaffold anchor locations as specified.
- .3 Work to be reviewed by Departmental Representative prior to removal of scaffold.
- .4 When removing scaffolding at completion of project, remove all scaffold anchors from masonry joints and repair mortar joints.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 19 – Dewatering.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA O86-14, Engineering Design in Wood.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings
 - .1 Submit shop drawings for temporary barriers, cofferdam and enclosures. Indicate material specification and all details and information necessary for assembly and erection of fencing and enclosures.
- .3 Shop drawings for cofferdam to be stamped and signed by a qualified Professional Engineer registered in the Province of Ontario.

1.4 SITE CONDITIONS

- .1 Public Traffic Flow
 - .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.
 - .2 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.
 - .3 Perform work such that public access to the parking lot and boat docking area is not impeded at any time.

Part 2 Products

2.1 MATERIALS

- .1 Construction Fence
 - .1 2300 mm high modular steel construction fence. Provide fence bases that will not present a tripping hazard for the public.
- .2 Cofferdam
 - .1 Refer to Section 31 23 19 – Dewatering.
- .3 Weather Enclosure
 - .1 Design enclosure to withstand wind pressure and snow loading, in accordance with the 2015 Building Code.

Part 3 Execution

3.1 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.
- .3 Install temporary barriers and enclosures as per manufacturer's recommendations.

3.2 CONSTRUCTION FENCE

- .1 Erect and maintain secure construction fence around perimeter of the work area. Fence must be secure at all intersection points with the existing structure.
- .2 Install lockable access gate on secure hinges to provide access for all equipment and personnel to the work area. Provide key to Departmental Representative and Parks Canada staff who will require access for the duration of the project.
- .3 Install fence in accordance with manufacturer's recommendations.

3.3 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around steep changes in grade, such as at the top of lock walls.
- .2 Provide barriers around vegetation, including all trees and shrubs in the work area, designated to remain. Protect from damage by equipment and construction procedures.

3.4 COFFERDAM CONSTRUCTION

- .1 Refer to Section 31 23 19 – Dewatering.

3.5 WEATHER ENCLOSURES

- .1 Provide weather tight enclosure above the lock, extending from the upstream coffer dam to the downstream cofferdam, in accordance with Section 01 51 23 – Temporary Heating, Cooling and Ventilating.
- .2 Construct mortar mixing shelter in accordance with CSA O86.1, of sufficient size to house all mortar materials and mixer in a dry environment.
 - .1 Maintain public side of enclosure in clean condition.
 - .2 Install fastening devices in such a way where clamps or wire ends cannot cause damages to the workers.

3.6 ACCESS TO SITE

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

3.7 SIGNAGE

- .1 Provide common use signs related to traffic control, information, instruction, use of equipment, public safety devices, and other signs as directed by Departmental

Representative in both official languages or by use of commonly understood graphic symbols to approval of Departmental Representative.

- .2 Signage for Contractor advertising, beyond emergency contact details, is not allowed on any element of this project. Size of lettering on emergency contact notice to be approved by Departmental Representative, prior to display of such notice.

3.8 FIRE ROUTES

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

3.9 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 due to lack of proper protection.

3.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with local Waste Management policies.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA O86-14, Engineering Design in Wood.
 - .3 CSA O121-08 (R2013), Douglas Fir Plywood.
 - .4 CSA O151-09 (R2014), Canadian Softwood Plywood.
 - .5 CSA S269.1-16, Falsework and Formwork.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Store formwork material so that it is not in contact with the ground and protected from water, oil, dirt or other contamination. Support so as to prevent warping or distortion.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with local Waste Management policies.
 - .2 Place materials defined as hazardous or toxic in designated containers.
 - .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
 - .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CSA O86 and CSA O151.
 - .2 Use new materials throughout except for concrete in unexposed locations, where used material is acceptable. Fabricate forms from sound, undamaged sheets with clean true edges, sealed and factory treated with form sealer. Thicknesses as required to support concrete at rate poured with no bowing of forms between supports. If forms are not new, obtain approval before using.
- .2 Grooves, reglets, chamfers and rustification strips: Use White Pine selected for straightness and accurately dressed to size. Provide 1 to 3 draw unless otherwise shown. Provide continuous saw-cut at back of strip. Chamfers at 45° unless noted.

- .3 Form ties:
 - .1 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Maximum spacing 600 mm o.c.
 - .2 Wire ties and wood spacers not permitted.
- .4 Form liner: High density overlay Douglas Fir to CSA O121 or medium density overlay Canadian Softwood Plywood to CSA O151, 2 grade, T and G edge, 16mm thick.
- .5 Joint tape for sealing panel joints: Tape must be capable of preventing leakage of concrete in form joints.
- .6 Caulking for joints between panels: Use grey urethane catalyst cured non-sag or self-levelling sealant, as applicable.
- .7 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, preventing concrete from sticking to forms, non-toxic, biodegradable, low VOC.
- .8 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm²/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Fabricate and erect formwork in accordance with CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.
- .3 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .4 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners and joints, unless specified otherwise.
- .5 Provide access openings as required for cleaning and inspection of forms and embedded items, prior to placing concrete and for verifying that forms are being completely filled during pouring of concrete.
- .6 Clean and prepare formwork in accordance with CSA A23.1/A23.2, before placing concrete. Apply form release agents to formwork in accordance with manufacturer's instructions, prior to placing accessories and reinforcement.
- .7 Re-use formwork and falsework subject to requirements of CSA A23.1. Do not re-use forms if there is any evidence of surface damage or wear which would impair the quality of the concrete surface.

- .8 When formwork is to be re-used, apply non staining parting agent in accordance with CSA A23.1.

3.2 REMOVAL

- .1 Remove forms without damage to concrete surfaces. Repair all blemishes by patching and sacking.

3.3 QUALITY CONTROL ON SITE

- .1 Check elevations, camber and plumbness of formwork continuously during concreting and after, until initial set occurs. Where necessary, make appropriate adjustments promptly. Report all adjustments made after initial set to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM) International
 - .1 ASTM A955/A955M-13, Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts.
 - .2 ASTM A1022/A1022M-16b, Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement
- .2 Canadian Standards Association (CSA)
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA A23.3-14, Design of Concrete Structures.
 - .3 CSA G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations for all materials noted in this Section.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Separate and recycle waste materials in accordance with the Waste Reduction Workplan.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Stainless steel reinforcement bars: 300 MPa, Type 304, to ASTM A955/A 955M.
- .3 Cold-drawn stainless steel wire ties: to ASTM A1022/A1022M.
- .4 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

Part 3 Execution

3.1 FIELD BENDING

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

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement, and removal of rust from existing reinforcement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.
- .4 Before placing, remove all loose scale, dirt, oil or other coatings which would destroy or reduce bond. Place reinforcement within the specified tolerances and secure in position by the use of chairs, spacers and hangers. Tie reinforcement securely together using 16 ga. annealed wire to prevent displacement during concrete placing and vibrating. Turn the ends of all ties towards the interior of the concrete. Use stainless tie wire at all locations.
- .5 For existing concrete repairs, Departmental Representative will verify exact number of required new bars for each location which requires structural strengthening, before concrete is placed.
- .6 Position reinforcing for exposed concrete using snap-on plastic positioners and plastic chairs of the same colour as the concrete. Use concrete chairs for slabs on grade.

- .7 Do not splice reinforcement unless indicated on Drawings. Do not cut reinforcement to permit placing of embedded items.
- .8 Maintain clean cover for reinforcement in accordance with drawings.
- .9 Reset immediately, reinforcing steel displaced during concrete pour.
- .10 For concrete placement, see Section 03 30 00 – Cast-in-Place Concrete.

3.3 QUALITY CONTROL ON SITE

- .1 Reinforcement must be complete, adequately supported, tied and properly positioned for cover in advance of the time scheduled for casting concrete.
- .2 Notify Departmental Representative for inspection of reinforcement prior to enclosing the reinforcement in the forms. Provide adequate time for this inspection to occur.

3.4 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measure cast-in-place concrete in square metres based on site measurements. Average depth as noted on Drawings. Include all formwork, reinforcing and associated accessories.

1.3 REFERENCES

- .1 Abbreviations and Acronyms:
 - .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 - .1 Type GU, GUb and GUL - General use cement.
- .2 Reference Standards:
 - .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .2 Canadian Standards Association (CSA)
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA A3000-13, Cementitious Materials Compendium.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Extended Warranties
 - .1 Submit to the Departmental Representative in an acceptable written form, guarantees against defects arising from faulty workmanship or defective materials for the listed items. Upon written notification, Make Good all defects.

1.5 QUALITY ASSURANCE

- .1 Quality Control Plan:
 - .1 Provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .2 Mock-up
 - .1 Construct mock-up in accordance with Section 01 33 00 – Submittal Procedures.

- .2 The first pour for each repair type will be considered the mock-up unless otherwise stated.
- .3 Construct mock-up of one repair, where directed by Departmental Representative.
- .4 Construct mock-up under supervision of Departmental Representative to demonstrate a full understanding of specified procedures, techniques and formulations are achieved before work commences.
- .5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.6 STORAGE AND HANDLING

- .1 Storage
 - .1 Concrete materials: to CSA A23.1.
 - .2 Concrete admixtures: in accordance with manufacturer's directions.
- .2 Waste Management and Disposal
 - .1 Packaging Waste Management: remove for recycling in accordance with local Waste Management laws.
 - .2 Remove excess concrete from site.
 - .3 Designate a cleaning area for tools to limit water use and prevent runoff. As this is an environmentally sensitive site, collect run-off from cleaning area and dispose safely off site.
 - .4 Carefully coordinate the specified concrete work with weather conditions.
 - .5 Ensure emptied containers are sealed and stored safely for disposal away from children.
 - .6 Prevent plasticizers, water-reducing agents and air-entraining agents from entering the waterway. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
 - .7 Choose least harmful, appropriate cleaning method which will perform adequately.

1.7 SITE CONDITIONS

- .1 Existing Conditions
 - .1 Visit the site to determine available access, storage and working areas. Determine any interference from existing services.
 - .2 Use of accelerating or set retarding admixtures during hot or cold weather concrete placing is subject to the Departmental Representatives' approval.
 - .3 Notify the Departmental Representative in accordance with the requirements of the General Conditions of the Contract, if during the execution of the work, subsurface conditions are found to differ materially from those indicated in the Contract Documents or geotechnical report.
 - .4 Keep construction traffic and loads on the adjacent landscaping to a minimum.

Part 2 Products

2.1 MATERIALS

- .1 Portland Cement: to CAN/CSA A3000, Type GU.
- .2 Supplementary cementing materials: to CAN/CSA A3000.
- .3 Water: to CSA A23.1.
- .4 Aggregates: to CSA A23.1/A23.2. Coarse aggregates to be normal density. Aggregate to be suitable for NBC type N concrete. Normal size 20 mm unless noted on Drawings. Obtain coarse and fine aggregate for exposed concrete from the same sources and select from uniformly of colour. Stockpile supplies for project.
- .5 Admixtures:
 - .1 Air entraining admixture: to CSA A23.1.
 - .2 Chemical admixture: to CSA A23.1. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Bonding adhesive: Cement-based epoxy-modified three-component anti corrosive coating and bonding slurry. As an alternative, a two component, multi-purpose high modulus, epoxy bonding agent can be used.
- .7 Polymer modified mortar:
 - .1 Polymer modified mortar shall be latex based, prepackaged, suited for the proposed application
 - .2 For repairs exceeding a thickness of 50mm, extend polymer modified mortar using clean 10mm aggregate in accordance with manufacturer's instructions.

2.2 MIXES

- .1 Proportion normal density concrete in accordance with CSA A23.1, Alternative 1, to give following properties for all concrete.
- .2 Cement:
 - .1 Type GU Portland cement, Class C1 for all concrete repairs as per CSA A23.1.
 - .2 Minimum compressive strength at 28 days: 35 MPa.

Part 3 Execution

3.1 CO-OPERATION

- .1 Provide casual labour to the independent inspection and testing agency's field personnel for the purpose of obtaining and handling sample materials. Provide free access to all portions of work and co-operate with the Testing Agency.
- .2 Cooperate with all engaged on the work.

3.2 PROTECTION OF EXISTING STRUCTURE

- .1 Take precautions necessary to protect the existing structure from damage. Be responsible for damage or claims for damage.

3.3 ALTERATIONS TO EXISTING STRUCTURE

- .1 Undertake cutting, repairs, patching and removal of existing concrete.
- .2 Provide connections between new and existing construction. Make cuts with the proper saws and bits when a clean line is required.
- .3 Install all temporary supports which may be required.
- .4 Supply and install formwork, concrete, reinforcing and accessories.
- .5 Where existing concrete structure is damaged during removals, the existing concrete must be repaired to the Departmental Representative's specifications, at no cost to the Departmental Representative.

3.4 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
- .4 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .5 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 Protect previous Work from staining.
- .7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .8 Do not place load upon new concrete until authorized by Departmental Representative.

3.5 INSTALLATION/APPLICATION

- .1 Cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Concrete Placement:
 - .1 Clean all forms of debris and deleterious materials before placing concrete. Remove all contaminants which lessen bond of concrete to reinforcement prior to placing concrete.
 - .2 Adjust reinforcement immediately before concrete is placed to ensure that all bars are secured in their correct positions. Arrange to have a crew of reinforcing setters on hand as concrete is placed, in order to make any last minute adjustments that are required.

- .3 Use form vibrators for thin sections where rodding, spading or the use of internal vibrators is impractical. Attach vibrators firmly to the forms and so spaced that the complete lift of concrete is visibly affected.
- .4 Do not place concrete in the rain. Protect exposed surfaces from rain or other adverse weather conditions until final set occurs.
- .5 Where concrete is rejected by the Departmental Representative, refer to clause entitled "Field Quality Control".

3.6 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1.

3.7 CURING AND PROTECTION

- .1 Provide curing and protection for concrete to CSA A23.1, Clause 7.4.
- .2 High performance concrete, with strength of 35 MPa or greater, must be wet cured for a minimum of 7 days. Special attention must be paid to thin concrete sections.
- .3 Do not pile, store or transport materials over repaired areas until concrete has been in place for at least 7 days.
- .4 Do not use curing compounds that would have detrimental effect on bonding, adhesion, curing, appearance or similar qualities of materials applied to thin concrete surfaces, where finishes are incompatible with curing compound.
- .5 Do not use combustion heaters of any kind in the presence of new concrete during construction.
- .6 Shrinkage cracking as a result of improper curing will be cause for rejection of the concrete element in question. The concrete must be removed and replaced at no cost to the Departmental Representative.

3.8 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by the Departmental Representative in accordance with CSA A23.1/A23.2.
- .2 Departmental Representative will pay for costs of tests.
- .3 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .4 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
- .5 Notify the Departmental Representative and Testing Laboratory as to the concreting schedule. Provide samples and standard test cylinders.
- .6 Provide sufficient concrete quantity to allow appointed Testing Agency Representative to cast four test cylinders at pours selected by the Departmental Representative, for each standard strength test. One cylinder will be tested at 7 days and two at 28 days. One cylinder to be held as reference in case one cylinder at 7 or 28 days, provides negative results. Reference may also be broken at 56 days, at direction of Departmental Representative.

- .7 Provide sufficient concrete quantity to allow appointed Testing Agency Representative to test concrete for air entrainment, as directed by the Departmental Representative. The percentage of entrained air will be determined and reported for concrete requiring an air entraining agent.
- .8 Concrete Tests:
 - .1 Standard strength tests are required as requested by the Departmental Representative. Appointed Testing Agency Representative will store cylinders cast for testing, within a hoarded curing enclosure and allow to cure in-situ for a period of 72 hours. 7-day strength test shall not show less than 70% of 28 day strength.
 - .2 Test in accordance with CSA A23.2.
 - .3 Make slump tests in accordance with CSA A23.2, with each standard strength test and when so directed by the Departmental Representative.
 - .4 Ship test cylinders with completed shipping tag attached. Provide identification and sufficient information to correlate the cylinder to the information taken by the testing agency, to complete the report form as per Annex B, CSA A23.2.
- .9 Install thermometers for recording temperatures when concrete is placed under cold weather or hot weather conditions.
- .10 Ensure that supervisory personnel are on hand when concrete is being cast so that the placing and curing procedures of the specification will be properly observed.

3.9 RESTORATION

- .1 Restore areas of existing concrete work affected by the Contract.

3.10 CLEANING

- .1 Remove rubbish and surplus materials leaving the work ready for the Trades that follow.
- .2 Dispose of waste in accordance with applicable local, Provincial and National regulations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 03 08 – Historic - Mortaring
- .2 Section 04 05 10 – Common Work Results for Masonry
- .3 Section 04 05 19 – Masonry Anchorage and Reinforcing

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Unit Prices
 - .1 Provide unit rates for each of the masonry repairs identified on the drawings, including grouting work. The unit cost for repair, includes all costs necessary to complete the specific repair, including additional scaffold, where required.

1.3 REFERENCES

- .1 Definitions:
 - .1 Sawcutting: the careful use of a power tool with a fine blade to cut the middle third of the mortar joint, in order to break the surface tension of hard mortar and facilitate the raking out process, without damaging the stone.
 - .2 Raking: removal of loose/deteriorated mortar to a depth suitable for repointing until sound mortar, but not less than a depth of 30 mm. It is assumed that the outer 75 mm of mortar consists of a very hard cementitious mortar, however, it may extend deeper in some areas.
 - .3 Backpointing: filling of masonry joints from which mortar is has been raked out to a point 30 mm from the stone face.
 - .4 Finishpointing: filling of masonry joints from which mortar has been raked out for a depth of 30 mm.
 - .5 Tooling: finishing of masonry joints using tool to provide final contour.
 - .6 Repair: use of adhesives to re-bond sections of fractured masonry.
 - .7 Consolidation: strengthening masonry units to prevent deterioration (spalling).
 - .8 Descaling: the removal of loose portions of the masonry (usually spalled area) through impact with a bush hammer or similar device.
 - .9 Resurfacing: tooling and polishing of stone surface to renew it's texture and finish.
 - .10 Low-pressure water cleaning: water soaking of masonry using less than 350 kPa (50 psi) water pressure, measured at nozzle tip of hose.
- .2 Canadian Standards Association (CSA) International
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA A179-2014, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA A371-2014, Masonry Construction for Buildings.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 04 05 10 – Common Work Results for Masonry.
- .2 Samples:
 - .1 Provide labelled samples of materials used on project for approval before work commences.
- .3 Test and Evaluation Reports:
 - .1 Provide laboratory test reports certifying compliance of mortar ingredients with specifications requirements.
- .4 Record Drawings:
 - .1 Upon completion of project, submit the following:
 - .1 Grout Records: Elevation drawings, recording grout tube numbers, and quantity of grout used in each elevation.

1.5 QUALITY ASSURANCE

- .1 Masonry Contractor:
 - .1 Use single Masonry Contractor for masonry work.
 - .2 Masonry Contractor to have good level of understanding of structural behaviour of masonry walls when masonry work involves replacing or repairing stones which are part of structural masonry work.
- .2 Masons:
 - .1 Principal mason to have certificate of qualification with 10 years minimum experience in historic stone masonry work.
 - .2 Ensure site personnel working on the work of this section, engaged by the Masonry Contractor can pass a hands on test of skills administered by the Departmental Representative where requested. Departmental Representative has right to reject any mason who does not demonstrate appropriate abilities.
- .3 Appoint one thoroughly experienced, reliable and competent worker to be in charge of all mortar mixing for the duration of the project. The experience must include mixing mortar for a minimum of three projects similar to this project.
- .4 Mortar grouting: grouting activities should be undertaken by workers experienced in manipulation and mortar grouting methods.
- .5 Obtain approval from Departmental Representative for changes to qualified personnel.
- .6 Mock-ups:
 - .1 Construct mock-up in accordance with Section 04 05 10 – Common Work Results for Masonry.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .2 Store cementitious materials and aggregates in accordance with CSA A23.1. Keep sand dry, in conformance with CSA A179, Clause 5.3.6. Sand that does not conform will be rejected.
 - .3 Keep material dry. Protect from weather, freezing and contamination.
 - .4 Ensure that manufacturer's labels and seals are intact upon delivery.
 - .5 Remove rejected or contaminated material from site.
- .2 Packaging Waste Management: remove for reuse, in accordance with local Waste Management laws.

1.7 AMBIENT CONDITIONS

- .1 Maintain masonry temperature between 10 degrees C and 25 degrees C for duration of work.
- .2 When ambient temperature is below 5 degrees C:
 - .1 Store mortar materials for immediate use within heated enclosure in accordance with Section 04 03 08 – Historic - Mortaring. Allow mortar materials to reach minimum temperature of 5 degrees C before use.
 - .2 Heat water to minimum 20 degrees C and maximum 30 degrees C.
 - .1 At time of use, temperature of mortar to be minimum of 15 degrees C and maximum of 30 degrees C.
- .3 Maintain sand temperature between 10 degrees C and 30 degrees.
- .4 Do not mix cement/lime with water or with aggregate or with water-aggregate mixtures having higher temperature than 30 degrees C.
- .5 Maintain mortar mix temperature between 10 degrees C and 30 degrees C.

1.8 SITE CONDITIONS

- .1 Existing Conditions
 - .1 Report in writing, to Departmental Representative, areas of deteriorated masonry revealed during work. Obtain Departmental Representative's approval and instructions for repair and replacement of masonry units before proceeding with repair work.
- .2 Protection
 - .1 At end of each working day, cover unprotected work with waterproof membranes. Extend membranes to 0.5 m beyond the perimeter of the work area and install securely to prevent finished work from drying out too rapidly.
 - .2 Protect adjacent finished work against damage which may be caused by on-going work.
 - .3 All methods of enclosure and protection to be approved by the Departmental Representative.
 - .4 Protect newly laid mortar from excessive exposure to rain and full sunlight until the surface is thumb-print hardened.

- .5 Provide and maintain protection for masonry walls at all times when work is suspended, to prevent water from entering partially repointed masonry.
- .6 Protection to consist of non-staining 6 mil polyethylene sheets, or tarpaulins over burlap, secured to prevent lifting in high winds.

Part 2 Products

2.1 MATERIALS

- .1 Mortar: in accordance with Section 04 03 08 - Historic - Mortaring.
- .2 Proportions: in accordance with Section 04 03 08 - Historic - Mortaring.
- .3 Anchorage and Reinforcing: comply with Section 04 05 19 – Masonry Anchorage and Reinforcing.

Part 3 Execution

3.1 GENERAL

- .1 Perform work in accordance with CAN/CSA A371. Extent of raking out and repointing is as noted on the Drawings.
- .2 Work from the top of wall down, unless noted otherwise, or approved by the Departmental Representative.
- .3 Use manual raking tool unless otherwise specified, to remove deteriorated mortar and ensure that no masonry units are chipped/altered/damaged by work to remove mortar. Tools for cutting out must be narrower than the joint.
- .4 Tool and compact using jointing tool to force mortar into joint.
- .5 For backpointing in deep, narrow joints, fabricate long stainless steel packing tools, to force mortar into the joints and provide compaction.
- .6 Finish joints to follow profile of existing joints, except where specified otherwise.
- .7 Use suitable approved jointing tool to form compacted tooled joints. Tool length for finishpointing not to exceed 50 mm.
- .8 Do not sawcut or rake out mortar joints where ambient temperature is below 5°C in the Springtime or 0°C in the Fall, as the mortar in the joints may be frozen. Any attempt to remove frozen mortar will result in damage to the masonry. Damaged masonry resulting from removal of frozen mortar must be replaced at Contractor's cost.

3.2 REPOINTING

- .1 Raking Joints
 - .1 Rake out all joints as noted on drawings.
 - .2 Rake unsound joints free of deteriorated and loose mortar, dirt and other undesirable material.
 - .3 Cutting out of joints is to be done with hammer and chisel, unless otherwise specified. Take great care so as not to damage masonry units adjacent to joints. Cut away from the arrises to prevent spalling of the masonry. The use of power tools is only permitted, as noted.
 - .4 Permission to use power tools will be based on the Contractor's ability to comply with the conditions noted below (sub-paragraph 6), as observed in the mock-up.
 - .5 If these requirements are not complied with, the Contractor will be required to remove all mortar by use of hand tools, at no extra cost to the Departmental Representative.
 - .6 Where the use of power tools is permitted to remove existing mortar, proceed as follows:
 - .1 Grind the centre of the joint only, to a maximum width of half of the joint width. Mortar must remain on each side of the cut. The grinders must not touch the stone.
 - .2 For vertical joints, and discontinuous horizontal joints, stop sawcut 50 to 75mm from end of joint. Do not sawcut stone.
 - .3 Notify the Departmental Representative to inspect the grinding, prior to removing the remaining mortar.
 - .4 Remove the remaining mortar with hand tools.
 - .7 Include removal of all existing excess mortar that may have been applied to stone face due to overpointing. Do not damage arris or finish on stone face.
 - .8 Include removal of all existing high strength cementitious mortar from the joints, to a depth of 75 mm.
 - .9 Clean joints to full depth of deteriorated mortar, but in no case to less than 30 mm. Clean out voids and cavities encountered.
 - .10 Clean surfaces of joints by compressed air, without damaging texture of exposed joints or masonry units.
 - .11 Flush open joints and voids; clean open joints and voids with low pressure water and if not free draining blow clean with compressed air.
 - .12 Fine joints (less than 4mm) need not be raked out more than 10mm, in order to reduce the danger of chipping the masonry edges. Cut these joints with power - saw, if necessary. When saw cutting vertical joints, stop sawcut 50 to 75mm from end of joint. Do not saw cut stone. Use flat-bladed quirks and light hammers, hack-saw blades or similar tools to rake out joints.
 - .13 Leave no standing water.

- .14 Damaged stone includes widening of existing joints, nicks, gouges and chipped or scratched surfaces from cutting out tools, resulting from improper workmanship. Stone damaged as a result of careless raking, or saw cutting, shall be replaced at no cost to the Departmental Representative.
 - .15 Do not rake joints for more than three courses of stone, prior to backpointing, unless approved by the Departmental Representative.
 - .16 If masonry unseats or bond is broken, remove unit, consolidate the back-up masonry and reset.
- .2 Backpointing
- .1 Prior to commencing backpointing, notify Departmental Representative to review masonry, make adjustments to stone repair requirements, identify all Dutchman repairs, stone replacement and stone removals.
 - .2 Where cut out joints are deeper than minimum raking out depths specified above, backpoint joints to bring mortar face to specified depth for raked out joints, in preparation for finishpointing. Where voids exist that conventional backpointing cannot fill, notify Departmental Representative for direction.
 - .3 Immediately prior to pointing, thoroughly wet joints in order to control absorption.
 - .4 Allow water to soak into masonry and mortar, leaving no standing water, but remaining wet.
 - .5 For backpointing, fill all joints full with mortar, compacting firmly into joints to ensure positive adhesion to all inner surfaces. Place mortar in layers, maximum 50 mm thick, minimum 30 mm thick, allowing each layer to set to thumb print hardness before placing next layer. Fill joints to a depth of 400 mm minimum from face of stone. Bring face of mortar in backpointed joint to specified minimum depth for raked out joints, measured from the arris of the masonry unit. Leave ready for final pointing.
 - .6 Form mortar square to stone face, and leave exposed stone each side of joint clean of mortar prior to mortar setting. Roughen surface of mortar when thumbprint hard.
 - .7 For deep joints, provide stainless steel packing tools manufactured to permit the mason to compact mortar deep into the joints.
 - .8 In the event that the vertical joints are too deep to install mortar full depth, install mortar to minimum 400 deep, and install grout tube in order to grout deep voids.
 - .9 Prevent mortar from being placed or smeared onto face of stone. Avoid mortar staining of masonry faces during backpointing.
- .3 Finishpointing
- .1 When all required repair and replacement work is complete, carry out finishpointing.
 - .2 Before finishpointing, wash walls to be finishpointed and allow to dry to damp-dry condition. Ensure that all dust, mortar particles, and other debris is removed from joints and wall surfaces before finishpointing.

- .3 Dampen joints and completely fill with mortar. Fill the joints to approximately 1 mm behind arrises. Avoid feathered edges. Pack mortar solidly into voids and joints, to ensure positive adhesion to all inner surfaces.
- .4 Where stone units have worn rounded edges, keep pointing back from face of stone, as detailed on drawings. If the width of the mortar joint will exceed 35 mm, stop work and notify the Departmental Representative for direction.
- .5 Keep masonry damp while pointing is being performed.
- .6 Do no pointing in freezing weather.
- .7 Build up pointing in layers not exceeding 30 mm in depth. Allow inner layers to become thumbprint hard before applying subsequent layers. Pack and compress mortar into voids to fit approximately, but no less than 15mm thick. Maintain joint width.
- .8 Remove excess mortar from masonry face before it sets. Finish jointing neatly as detailed.
- .9 Allow mortar to set so that there is no excess water which will cause run off on stone faces, then tool to match approved mock-up joints. Tool head joints, followed by horizontal joints. Do not overwork the face of the joints. Ensure joints are uniform in appearance. Do not brush joints until they have set to the extent that brushing will not mark the joint surface.
- .10 When mortar is thumbprint hard, tool joints behind masonry face with tools specifically crafted to replicate weathered joints.
- .11 Retempering of Mortar
 - .1 Portland cement-hydrated lime mortars should only be retempered once, and should be used within 2 hours of adding water to the mix when the air temperature is less than 25 degrees C. (1½ hours for higher temperatures).
- .4 Underwater joints/Joints above waterline with active seepage: Remove all loose material from joints. Repoint using a rapid setting, cement based repair mortar, specifically formulated for underwater use, following manufacturer's instructions. Finish joints as neatly as possible. Installation of this product must be pre-approved by the Departmental Representative, at all locations where it is to be installed. This application is considered to be a last resort.
- .5 Curing
 - .1 Moist cure freshly pointed joints by spraying at intervals and covering with moist burlap enclosure and polyethylene sheeting for minimum of 7 days after finishpointing. Keep wall and burlap misted.
- .6 Protection
 - .1 Protect newly laid mortar from frost, rainfall or rapid drying conditions for 7 days.

3.3 RESETTING

- .1 Prepare slot to receive stones. Clean back all loose and deteriorated core to sound material.

- .2 Repoint all void joints in back-up masonry. Replace deteriorated masonry as directed by Departmental Representative. Shave back-up masonry as necessary to reset stone.
- .3 Build up core where more than 50 mm wide void exists behind stones to be reset. Build up in traditional manner with new stone offsets in mortar. Allow mortar to fully set up.
- .4 Install new stainless steel pin anchors as detailed on drawings; two anchors per stone, top and bottom.
- .5 Install mortar on face of back-up masonry to form continuous collar joint, just prior to resetting stone.
- .6 Arrange dislodged masonry units in same location and orientation as originally set with water soaked hardwood wedges. Reset level, true and square with even mortar joints to exact original thickness.
- .7 Insert and compress firm mortar to within 30 mm of finishpointing surface. Allow mortar to set 24 hours.
- .8 Pull out wood wedges when dried and shrunken.
- .9 Backpoint in layers and leave ready for finishpointing.

3.4 GROUTING

- .1 Where it is determined that there are voids in the centre core of the wall, or joints are void to a depth of 400 mm or greater, install specified grout.
- .2 Clean out void with water until water runs clear. Ensure ambient temperature is to remain above 5°C for at least 24 hours after voids are cleaned out.
- .3 Fill joints and cracks with mortar set back 50 mm from final mortar surface.
- .4 Drill grout holes to a depth of 1200 mm.
- .5 Install grouting tubes in holes spaced at 600 mm on centre horizontally and vertically in joints, as backpointing proceeds. Number each grout hole and note on Master elevation drawings.
- .6 Pour specified mortar, with casein additive through mortar cup until void is full. Record quantity of grout inserted in each tube on Master elevation drawings.
- .7 Grout from the bottom of the wall to the top.
- .8 Do not exceed lifts of 600mm. Allow grout to set for 24 hours, prior to proceeding.
- .9 Remove grout tubes after initial set of grout has occurred. Fill holes with backpointing mortar.

- .10 Proceed with finishpointing only after all grouting is complete.

3.5 FIELD QUALITY CONTROL

- .1 The Departmental Representative will inspect the quality of the work on a regular basis.
- .2 Once the stone masonry is cleaned of mud and debris, notify Departmental Representative prior to sawcutting joints, so that the stone masonry can be recorded photographically. Provide clear access to all points of stone masonry to permit this photography to occur.
- .3 Provide Departmental Representative with a minimum of 48 hours of notice for required inspection.
- .4 Approval of raked out condition of joints, approval of deep backpointing mortar after it is installed to a depth of 150 mm from the stone face, and approval on completion of backpointing, must be received in writing by the contractor, before the next procedure can proceed.
- .5 Where work proceeds to the next phase, without the approval of the Departmental Representative, all unapproved mortar will be removed at contractor cost.

3.6 SCAFFOLDING ANCHORAGE

- .1 As each level of work is completed and cured for a minimum of seven days, remove embedded scaffold anchors.
- .2 Reinstall anchors into alternate freshly pointed masonry joints adjacent to existing anchorage location, until scaffold removal is required.
- .3 Rake out and repoint joints affected by anchors, as detailed.
- .4 Repointed joints must be inspected by Departmental Representative, prior to removal of scaffold deck.
- .5 Upon final removal of anchors, repoint the joints where the anchor has been removed. Ensure mortar colour is uniform with previously repointed joints.

3.7 CLEANING

- .1 Clean surfaces of mortar droppings, stains and other blemishes resulting from work of this contract as work progresses.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Do further cleaning using stiff natural bristle brushes after mortar has attained its initial set and has not fully cured.
- .4 Clean masonry with stiff natural bristle brushes and plain water only if mortar has fully cured.
- .5 Clean stone surface behind scaffold tie-backs, as they are removed.
- .6 Obtain approval of Departmental Representative prior to using other cleaning methods for persistent stains.

- .7 After final cleaning, notify Departmental Representative to complete a final inspection of the wall. Repair all noted deficiencies before dismantling scaffolding.

3.8 PROTECTION OF COMPLETED WORK

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 03 07 - Historic - Masonry Repointing.
- .2 Section 04 05 10 - Common Work Results for Masonry.

1.2 ALTERNATES

- .1 Obtain Departmental Representative's approval before changing manufacturer's brands or sources of supply of mortar materials during entire contract or other methods of mixing mortar specified elsewhere in this specification. This criterion will apply for the duration of the contract.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-13, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm Cube Specimens).
 - .2 ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar.
 - .3 ASTM C185-08, Standard Test Method for Air Content of Hydraulic Cement Mortar.
 - .4 ASTM C207-06 (2011), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .5 ASTM C270-14a, Standard Specification for Mortar for Unit Masonry.
 - .6 ASTM C780-14b, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - .7 ASTM C940-10a, Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
 - .8 ASTM C1324-10, Test Method for Examination and Analysis of Hardened Masonry Mortar.
- .2 Canadian Standards Association (CSA)
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA A179-2014, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA A3000-2013, Cementitious Materials Compendium.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings
 - .1 Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

- .2 Scheduling of Work
 - .1 Submit work schedule indicating anticipated progress stages within time of final completion shown in bid document.
 - .2 Take measures necessary to complete work within approved schedule time. Schedule may not be changed without approval of Departmental Representative.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations for:
 - .1 Aggregate. Include identification of aggregate source.
 - .2 Cement.
 - .3 Lime.
 - .4 Premixed products.
 - .5 Additives.
- .3 Samples:
 - .1 Provide samples in accordance with CSA A179.
 - .2 Submit two 50 mm x 50 mm size samples of mortar to demonstrate colour and texture.
 - .3 Submit sample of sand to demonstrate colour and gradation.
- .4 Action Submittals:
 - .1 Submit recordings of temperature and humidity weekly.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Refer to Section 04 03 07 – Historic – Masonry Repointing.
- .2 Certificates
 - .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Testing Standards
 - .1 Conduct the required testing in accordance with the following standards:
 - .1 Flow and cube strength: to ASTM C 270.
 - .2 Vicat cone test: to ASTM C780.
 - .3 Cube strength: to CSA A179, Annex B.
 - .4 Flexural bond strength: to CSA A179.

- .4 Test reports:
 - .1 Submit test results during site work as directed by Departmental Representative as follows:
 - .1 Sieve analysis: sand, in accordance with CSA A179.
 - .2 Bulking analysis: sand in condition as delivered to site.
 - .3 Air content: mortar mix in plastic state.
 - .4 Vicat cone penetration: mortar mix.
 - .5 Mortar compressive strength: at 7, 28 and 56 days or otherwise required.
 - .6 Flexural bond strength: test during mock-up using masonry units on site.
 - .7 Lime grout compressive strength: at 28, 56 and 112 days, or otherwise required.
 - .5 Mock-ups:
 - .1 Construct mock-up in accordance with Section 04 05 10 – Common Work Results for Masonry.
 - .2 For mortar colour, include five 500 mm long mock-ups of different mortar colours. Departmental Representative to select the colour to be used for the project.
 - .6 Existing Mortars:
 - .1 Verification of compliance with proportion specifications: test original mortar material for aggregate to binder ratio to ASTM C1324.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store cementitious materials and aggregates in accordance with CSA A23.1/A23.2.
 - .3 Protect from weather, freezing and contamination.
 - .4 Remove rejected or contaminated material from site.
- .3 Waste Management and Disposal
 - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with local collection services.

1.8 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Execute work to CSA A179.
 - .2 Provide weather-tight enclosure to store materials and mix mortars, maintain air temperature above 10°C at all times.
 - .3 Maintain maximum/minimum thermometers and relative humidity gauges on site and in enclosures.
 - .1 Maintain a daily record of temperature and humidity.
 - .2 Locate gauges at upper reaches of enclosure, and within 600 mm of floor level at base of enclosure.
 - .4 Execute work when ambient temperature is above 5° Celsius. When ambient temperature is below 5° Celsius, cover and heat Work as directed by Departmental Representative.
 - .5 Prepare and maintain temperature of mortar between 5° Celsius and 30° Celsius until used.

Part 2 Products

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Mortar and grout: to CSA A179.
- .3 Water: potable, clean and free from contaminants.
- .4 Sand: to CSA A179; Gradation to ASTM C144. Use well graded sand passing 4.75 mm down to 150 micron sieve where joints are greater than 6 mm. Use sand passing 1.18 mm down to 300 micron sieve where 6mm thick joints or less are indicated. In the event that the sand does not meet the gradation requirements, carry out additional sieving to meet requirements or provide alternate sand. Provide dry aggregate to CSA A179, Clause 5.3.6.
 - .1 Sharp, screened and washed pit sand, free of organic material, with final grading and colour to approval of Departmental Representative.
- .5 Colour: inorganic oxide pigments only. Colour of sand to match existing shades and tones.
- .6 Portland cement: to CAN/CSA A3000, non-staining, type GU.
- .7 Lime:
 - .1 Hydrated Lime:
 - .1 Hydrated, high calcium, Type "SA" to ASTM C207.
- .8 Casein Additive: Protein polymer to provide fluidity in grout.
- .9 Calcium chloride is not to be used for any mortar.

- .10 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.
- .11 Underwater Grout/Mortar: proprietary formulation of blended Portland cements, finely processed aggregates and chemical additives designed to produce a rapid set in underwater environments. Compressive strength to ASTM C109. Product to be approved in writing by Departmental Representative.

2.2 MORTAR MIXES

- .1 Proportion requirements:
 - Bedding and pointing mortar for stonework: type N based on proportion specifications. Range of compressive strength: 10.0 MPa to 15.0 MPa at 56 days.
 - .1 Limestone: 1:1:6 cement: lime: aggregate mix for all joints.
 - .2 For all joints in walls, add polymer latex admixture as per manufacturer's instructions.
 - .3 Underwater stone joints and stone joints above waterline with active water seepage: use approved rapid setting underwater grout, mixed to manufacturer's requirements. Compressive strength: 41 MPa. at 28 days.
 - .2 Vicat Cone Penetration for Stonework: to ASTM C780.
 - .1 Pointing Mortar: 15-20mm.
 - .2 Bedding Mortar: 20-30mm.
 - .3 Allowable air content for all Lime Mortars: 7% to 15%.
 - .4 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour and not more than 2 hours, then remix with sufficient water to produce mortar of proper consistency for pointing.
 - .5 Do not add air entraining admixture to mortar mix.
 - .6 Grout mix
 - .1 Add casein to the specified mortar mix (1:3:7) at the following ratio: between 0.5 – 2% casein by weight of binder, to increase fluidity of grout.
 - .2 Range of compressive strength at 112 days is 3.0 MPa to 5.5 MPa.

2.3 ALLOWABLE TOLERANCES

- .1 If mortar fails to meet 60% of the specified mortar strength range at 7 days, but meets the 28 day compressive strength requirement, it is acceptable. If mortar fails to meet the 7 day compressive strength requirement, but its strength at 7 days exceeds two thirds of the value required for the 7 day strength, contractor may elect to continue work at his own risk while awaiting the results of the 28 day tests, or to take down the work affected.
- .2 The Departmental Representative reserves the right to reject mortar which falls more than 20% outside of the 56-day compressive strength range required, and to have the contractor remove it from the wall.

Part 3 Execution

3.1 GENERAL PREPARATIONS

- .1 Traditional Mortar:
 - .1 Prepare measuring boxes to ensure accurate proportioning of materials.
 - .2 Maintain separate measuring boxes for each component.
 - .3 Ensure sand is tested and volume corrected for bulking. To avoid bulking, use dry sand.
 - .4 Ensure testing equipment is ready and in working order.
 - .5 Apply Vicat cone test to ensure desirable performance of the mortar and record results.
- .2 Premixed Mortar:
 - .1 Follow manufacturer's written instructions.
 - .2 Whole bag has to be prepared. Mortar prepared using a portion of a bag will be rejected.
 - .3 Apply Vicat cone test to ensure desirable performance of the mortar and record results.

3.2 BULKING OF SAND

- .1 Test sand for bulking:
 - .1 At start of work.
 - .2 After each new delivery of sand.
 - .3 After severe change in weather.
- .2 Verify moisture content in sand conforms to CSA A179.
- .3 The Departmental Representative reserves the right to reject sand if bulked volumes are excessive.
- .4 Test and adjust sand quantities for bulking:
 - .1 Obtain sample of sand which accurately reflects average condition of pile of damp sand, as follows:
 - .1 Take 4 shovels full of sand, each from a different level of the pile, and mix thoroughly.
 - .2 Place sand in a conical pile and divide into 4 quarters with a board. Remove 2 opposite quarters from pile, and combine remaining 2 quarters and mix thoroughly.
 - .3 Repeat quartering and mixing procedure until a sample of size required for testing remains.
 - .2 Fill a 1-litre capacity jar, about two-thirds full with damp sand to be tested. Drop sand in loosely. Do not pack it in. Level off surface, measure depth of damp sand (D).
 - .1 Carefully empty sand into another container, and half fill first container with water.

- .2 Pour back about half of test sample of sand slowly into water so it is entirely saturated. Rod it thoroughly to remove air.
 - .3 Add rest of sand, rodding again to remove air and level off surface. Measure depth of saturated sand (S), which will be less than depth of damp sand.
 - .4 Calculate percentage bulking using formula: $[(D-S) \times 100\%]/S =$ percentage bulking; where D = depth of damp sand, and S = depth of saturated sand.
- .3 Increase volume of sand by percentage bulking shown in test.

3.3 MIXING

- .1 Prepare measuring boxes to ensure accurate proportioning of mortar ingredients. Each box to contain exact volume proportion for each specific mix ingredient.
- .2 Introduce approximately 75% of the total volume of water into the mixer, followed by 50% of the sand and all of the dry hydrated lime and any pigment. Mix for approximately 3 minutes, or until the materials are thoroughly blended and no particles of white lime are apparent in the mix.
- .3 Allow to stand for 5 minutes.
- .4 Add the full volume of Portland cement, the remainder of the sand and water. Mix for further 3-5 minutes until thoroughly blended and mortar has reached consistency determined by Vicat Cone penetration testing.
- .5 Add just sufficient water to obtain workable consistency for setting units. Avoid too wet a mix which stains the face of the work. Vicat Cone penetration may be slightly greater for bedding mixes, but should not exceed maximum value specified by more than 20%.
- .6 Mix Characteristics:
 - .1 Pointing mortar: slightly stiffer than bedding mortar with a consistency such that the mortar can be hand-formed into a stiff ball.
 - .2 Record amount of water required to reach this consistency and use for subsequent mixes.
- .7 Adjust mix proportions based on percentage bulking shown in the test.
- .8 Mortar for reconstruction of dismantled masonry, or new construction, can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes.
- .9 Mixing by hand for repointing mortars must be pre-approved by Departmental Representative as follows:
 - .1 Hand mixing must be carried out using high speed, 2500 Rpm drill, with paddle mixer attachment. Mixing to be completed in sufficiently small container so as to allow full contact of the paddle with the mortar during the mixing process, thus ensuring thorough incorporation of ingredients and air entrainment.
 - .2 Submit masonry tools and container for approval prior to starting pointing work.
- .10 Prepare only enough mortar to be used within two hours. Do not re-temper mortar beyond this time.

- .11 Follow manufacturer instructions when premixed mortar is used.
- .12 Appoint one individual to mix mortar for duration of project. If this individual must be replaced, mortar mixing must cease until replacement individual is trained, and mortar mix is tested.
- .13 Ensure mortar does not contain elements detrimental to the original masonry or surrounding materials.

3.4 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CSA A179 except where specified otherwise.

3.5 CLEANING

- .1 Upon completion, remove surplus materials, rubbish, tools, equipment and barriers.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush. For limestone, pressure should be between 276 kPa and 410 kPa. See Section 04 03 07- Historic - Masonry Repointing and Repair.

3.6 PROTECTION OF COMPLETED WORK

- .1 Cover completed and partially completed work, not enclosed or sheltered at end of each work day.
- .2 Enclose and protect work using wetted burlap.
- .3 Cover with waterproof tarps to prevent weather from eroding recently laid material.
 - .1 Maintain tarps in place for minimum of 1 week after laying.
 - .2 Ensure that bottoms of tarps permit airflow to reach mortar in joints.
- .4 Anchor coverings securely in position.

3.7 FIELD QUALITY CONTROL

- .1 Inspection and testing of mortar will be carried out by a Testing Laboratory designated by the Departmental Representative, to CSA A179. The mortar testing company should have the capacity to provide Vicat Cone testing and test the air with a mortar test apparatus. A concrete test apparatus must not be used to test the air, as it is unsuitable for this application.
- .2 Departmental Representative will pay for cost of test as specified.
- .3 Frequency of mortar testing will be specified by Departmental Representative.
- .4 Air content to ASTM C185, and penetration using Vicat Cone to ASTM C780 for mortars used in stonework, must be tested at the same frequency as strength tests to ASTM C109, or more frequently as required by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 03 07 – Historic – Masonry Repointing.
- .2 Section 04 03 08 – Historic – Mortaring.
- .3 Section 04 03 42 – Historic – Replacement of Stone.
- .4 Section 04 05 10 – Common Work Results for Masonry.

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Unit Prices
 - .1 Provide unit prices for each of the repairs identified on the drawings. The unit price for each repair will include all costs necessary to complete the specific repair, including additional shoring and scaffolding, removal and reinstatement of existing stone, core masonry consolidation, all anchorage, mortar and grout work necessary to stabilize adjacent masonry.
 - .2 Allow for waste required to achieve desired size of Dutchman repairs.

1.3 ALTERNATES

- .1 Obtain Departmental Representative's written approval before changing procedures, manufacturer's brands, sources of supply of materials during entire contract.

1.4 REFERENCES

- .1 Definitions:
 - .1 Repair of Stone: mechanical or plastic repair, done to restore original appearance and function of partly deteriorated stones. Repairs include crack repair, Dutchman repair, fracture repairs and descaling.
 - .2 Filling: material used to rebuild broken or deteriorated part of stone.
 - .3 Adhesive: material used to fasten broken/fractured stone elements by direct application at fracture interface and/or by application to added reinforcing elements such as dowels.
 - .4 Mortar: material used to re-bed the stone element being repaired and to repoint adjacent mortar joints.
- .2 Reference Standards:
 - .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar.
 - .2 ASTM A276-15, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA A3000-13, Cementitious Materials Compendium.

- .2 CSA A179-2014, Mortar and Grout for Unit Masonry.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations. Include:
 - .1 Application/installation instructions.
 - .2 Laboratory test reports certifying compliance of products with specification requirements.
 - .3 Manufacturer's material safety data sheets (MSDS) for safe handling of specified materials and products, in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .3 Samples:
 - .1 Submit adhesive and mortar samples for testing.
 - .2 Submit (3) 250 mm x 250 mm x 50 mm stone units, representative of proposed units for work. (This is only necessary, if samples not submitted for replacement stone).
 - .1 New Stone:
 - .1 Departmental Representative reserves the right to request results from tests by an independent testing agency to verify mechanical, physical and aesthetic properties of stone, at no additional cost to Contract.
 - .3 Submit (1) 300 mm x 300 mm x 100 mm stone sample, representing each stone repair type, for review by Departmental Representative. Samples to be completed within six weeks of award of Contract and once approved, to remain in site office for duration of project.
 - .4 Certificates:
 - .1 Submit upon request by Departmental Representative purchase orders, invoices, suppliers test certificates and documents to prove materials used in contract meet requirements of specification. Allow free access to sources where materials were procured.

1.6 CLOSEOUT SUBMITTALS

- .1 Record Documentation:
 - .1 Provide marked up set of drawings to provide referencing system identifying locations of stone repairs.
 - .2 Provide photographic record of dismantle and rebuilt stonework

1.7 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Masonry Contractor:
 - .1 Work of this Section: executed by contractor specializing in historic stone conservation work of this nature, using similar stone repair techniques and with a minimum 10 year record of successful performance.
 - .2 Foreperson:
 - .1 Provide competent trade foreperson specializing in type of work required. Must be present on site throughout Work.
 - .3 Masons:
 - .1 Ensure site personnel working on the work of this section, engaged by the Masonry Contractor, can pass a hands on test of skills administered by Departmental Representative where requested. Departmental Representative has right to reject any mason who does not demonstrate appropriate abilities or experience.
 - .2 All masons employed on this project throughout course of project must meet above requirements. Where, during course of project, masons leave work force, replacement masons must also meet requirements.
 - .3 Apprentices with a minimum of one year certification from a recognized Masonry Program, may work under the direction of a mason as noted above.
- .2 Mock-ups:
 - .1 Construct mock-up in accordance with Section 04 05 10 – Common Work Results for Masonry.
 - .2 Construct mock-up where directed by Departmental Representative.
 - .3 Prepare one mock-up in wall, and one mock-up in sample stone, as noted under Sub-article 1.5.3.3, for each stone repair type.
 - .4 Construct the following stone repair mock-ups:
 - .1 Crack repair
 - .2 Dutchman repair
 - .3 In-situ fracture repair
 - .5 Select locations of mock-ups in consultation with Departmental Representative.
 - .6 Clean mock-up to demonstrate cleaning operations to Departmental Representative.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .1 Identification with grade, batch and production date shown on container or packaging.
 - .2 Store materials in a clean, dry enclosed area and supported free of ground. Maintain a minimum ambient temperature of 10 degrees C in storage area.
- .3 Packaging Waste Management: remove for reuse and return in accordance with Waste Management plan.

1.9 SITE CONDITIONS

- .1 Ambient Conditions
 - .1 Maintain a minimum temperature of 10 degrees C during and 48 hours after repair, throughout thickness of stone.
 - .2 Allow materials to reach minimum temperature of 10 degrees C prior to use.
 - .3 Provide temporary enclosures to maintain specified temperatures. Take precautions to avoid overheating masonry.
 - .4 Remove work exposed to lower temperatures as directed by Departmental Representative.
 - .5 Refer to manufacturer's instructions for environmental requirements of products.
- .2 Record and report to Departmental Representative, site conditions non-conforming to those specified before beginning work.

Part 2 Products

2.1 MATERIALS

- .1 Use materials from same manufacturer throughout the Work.
- .2 Portland cement: to CAN/CSA A3000.
- .3 Sand: cleaned and graded in accordance with ASTM C144.
- .4 Water: clean and free of deleterious materials such as acid, alkali and organic material in accordance to CSA A179.
- .5 Dowels: stainless steel to ASTM A276, Type 304.
 - .1 Diameter: dependent on size and weight of each new stone insert and as noted on Drawings.
- .6 Deformed wire: 2 mm diameter, stainless steel Type 304.
- .7 New stone:
 - .1 Similar mechanical, physical and aesthetic properties to existing stone. See Section 04 03 42 – Historic – Replacement of Stone.
 - .2 To approval of Departmental Representative.

- .8 Hairline Crack Filling: Dispersed Hydrated Lime (DHL) grout and shelter coat, pigmented to match stone colour to approval of Departmental Representative.

2.2 MORTAR MIXES

- .1 Mortar: in accordance with Section 04 03 08 - Historic - Mortaring.

2.3 ADHESIVE MIXES

- .1 Proprietary stone adhesive:
 - .1 Specially formulated for repair of broken stone units.
 - .2 Adhesive mix: NHL 3.5 Hydraulic Lime and Casein. Mix proportions as recommended by manufacturer to obtain specified results.
 - .1 Submit samples for testing.

Part 3 Execution

3.1 SITE VERIFICATION OF CONDITIONS

- .1 Report in writing, to Departmental Representative, areas of deteriorated stone not identified in the documents.
- .2 Notify Departmental Representative to inspect the masonry and mark all Dutchman, new stone and stone removals on the masonry, prior to commencing backpointing of joints.
- .3 Obtain Departmental Representative's approval and instructions for repair and replacement of masonry units before proceeding with repair work.
- .4 Stop work in that area and report to Departmental Representative immediately any evidence of hazardous materials.

3.2 PREPARATION

- .1 Obtain Departmental Representative's approval for repair methodology and tools to be employed prior to commencing work.

3.3 SPECIAL TECHNIQUES

- .1 Temporary Marking and Recording:
 - .1 Mark stone, on face, before removal using marking product which can be completely erased when required without damaging masonry unit:
 - .1 Ball-point pen on diachylon, attached to stone.
 - .2 Waxless chalk directly on stone.
 - .3 Waterproof information card, securely tied to stone.
 - .2 Use numbering, marking, and positioning system shown on drawing or chart specifically prepared for accurate recording of stone location.
 - .3 Ensure that temporary marking will remain in use: resistant to weather, handling and cleaning until final marking of stones.
 - .4 Remove markings and adhesive without damaging units:

- .1 Brush with vegetable fibre brush: either dry or with water.
- .2 Use no solvent, acid or other chemical product.

3.4 PROTECTION

- .1 Prevent damage to stone surfaces, mortar joints, and natural features which are to remain. Make good damage incurred.
- .2 Protect surrounding components from damage during work.
- .3 Take utmost care not to damage historic fabric. Make good damage incurred.
- .4 Obtain Departmental Representative's approval for repair technology.

3.5 CRACK REPAIR

- .1 Drill 5 mm diameter injection ports as per injection adhesive manufacturer's specifications.
- .2 Clean out void with compressed air and potable water until water runs clear. Final flushing to be with 10% ethyl alcohol solution.
- .3 Seal joints and cracks to manufacturer's specifications.
- .4 Complete injection procedure as per manufacturer's instructions. Keep surface of stone clean of spills. Clean off as work progresses.
- .5 Allow adhesive to harden.
- .6 Prepare DHL shelter coat using compatible pigments with the DHL grout. Pigment must match stone colour.
- .7 Inject shelter coat over crack fills. Apply in thin layers to build up to surface.

3.6 REPAIR OF A FRACTURED STONE

- .1 Remove deteriorated portions of stones using low impact removal methods until sound surface is reached.
- .2 Remove elements which require minor repair, without losing pieces or worsening damage. Do not damage existing Work.
- .3 Drill 13 mm diameter holes, 60 mm long in each section at fracture, maximum spacing at 300 mm on centre. Provide minimum two holes per stone. Clean dust out of holes using acetone and cotton swabs.
 - .1 Fractures over 300 mm in length: require additional dowels per 200 mm length of fracture.
- .4 Align holes on each side of fracture.
- .5 Use minimum 2 dowels per fracture, for stones less than 600 mm high and one additional anchor for every 300 mm extra height.
- .6 Dampen stone surfaces prior to application of adhesive and ensure humidity, temperature, cleanliness and finish condition of stone is in accordance with adhesive manufacturer's instructions.

- .7 Insert 12 mm diameter dowels, 100 mm long, and apply specified adhesive to holes and interface. Allow adhesive to cure in accordance with manufacturer's instructions for 24 hours minimum.
- .8 Reinstall consolidated element into work and repoint using specified mortar, in accordance with Section 04 03 07 - Historic - Masonry Repointing. Joint profiles to match existing. If fracture lines up with vertical mortar joints above and below the fractured stone, rotate the stone 180°, if pattern on stone permits, and reinsert.
- .9 Repair surface of fracture to match the surrounding stone, as per Article 3.5 – Crack Repair.
- .10 Finish surface of fracture to match colour and profile of existing stone.

3.7 REPAIR OF FRACTURED STONE IN-SITU

- .1 Drill 11 or 13 mm diameter holes, extend 60 mm beyond fracture, spaced at 300 o/c maximum. Minimum 2 per stone. Minimum length of hole to be 140 mm. Confirm dowel size with Departmental Representative, prior to drilling hole.
- .2 Clean dust out of hole with acetone and cotton swabs.
- .3 Dampen stone surfaces prior to application of adhesive. Insert 10 or 12 mm diameter stainless steel dowels, 100 mm long and apply anchor setting mortar to holes and joints. Confer with Departmental Representative to determine diameter of dowels. Allow to set for 24 hours minimum.
- .4 Drill injection ports and seal fracture as per Article 3.5 – Crack Repair.
- .5 Notify Departmental Representative to inspect the crack injection, prior to proceeding to finish the joint surface.
- .6 Repair fracture as per Article 3.6 – Repair of a Fractured Stone.
- .7 Finish surface of fracture to match existing stone.

3.8 REFACING PARTLY DETERIORATED STONE WITH STONE SLAB (DUTCHMAN REPAIR)

- .1 Remove decayed stone until sound surface is reached. Cut existing stone to achieve a square void in stone as much as possible, with minimum depth 65 mm.
- .2 Where Dutchman size exceeds 40% of the failed stone size, proceed to do full face Dutchman, unless noted otherwise by Departmental Representative. Where there is more than one Dutchman repair required on any single stone, proceed to do full face Dutchman, unless noted otherwise by Departmental Representative.
- .3 Select new stone to match surrounding stone of geological type and colour, free from defects and with bedding to match adjacent work. Where possible, salvage from existing weathered stone on site.
- .4 Cut new stone insert to exactly fit the cut in existing stone.
 - .1 Allow for thickness of stone adhesive.
 - .2 Allow for finished surface slightly projecting from existing masonry face.

- .5 Cutting tolerance for new stone: Allow 1 mm maximum joint tolerance on all sides, between the new stone section and the parent stone.
- .6 Dowels as mechanical fasteners:
 - .1 Drill 11mm diameter holes, 60mm long at interface of existing and new stone slabs. Where stone depth on either side of the interface is less than 100mm, length of hole to be 60% of stone thickness.
 - .2 Fully saturate stone surface, prior to application of adhesive.
 - .3 Insert 10mm diameter dowels, 100mm long into existing stone and apply specified adhesive to holes and interface. Allow to set for 24 hours minimum.
 - .4 Where new or existing stone is less than 100 mm thick, length of dowel to be 50% of the thickness of stone on each side of the interface.
- .7 Dovetailed grooves as mechanical fasteners:
 - .1 Cut horizontal dovetailed grooves 12mm deep at interface of existing and new stone slabs. Cut stone shape by hand using tempered chisels ensuring that the edges are not plucked or spalled.
 - .2 Fully saturate stone surface, prior to application of adhesive.
 - .3 Apply specified adhesive to dovetailed grooves and interface of existing stone.
- .8 Dampen stone surfaces and fill dowel holes and/or dovetailed grooves of new stone slab with specified adhesive. Erect new stone slab into position. Secure stone temporarily to allow adhesive to set. Ensure joint between new and existing stone is filled solid and finished to match existing stone face.
- .9 Position face of Dutchman slightly proud and finish to original profile by rubbing back or tooling as required. Resurface new slab insert as required to make patch unobtrusive. Rubbing back marks on existing stone are not permitted.
- .10 Repoint with specified mortar. Profile of joints to match existing.

3.9 MORTAR JOINT REPAIR

- .1 Do repointing work in accordance with Section 04 03 07 - Historic - Masonry Repointing.
- .2 Make good damage incurred to mortar joints.

3.10 CLEANING

- .1 Obtain Departmental Representative's approval of cleaning operations before starting cleaning work.
- .2 Protect vegetation and adjacent grounds from excessive water accumulation.
- .3 Clean stone work surfaces after repairs have been completed and mortar has set.
- .4 Clean stone surfaces of grout or mortar residue resulting from work performed without damage to stone or joints.
- .5 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

3.11 PROTECTION OF COMPLETED WORK

- .1 Protect finished work from impact damage for period of two weeks.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 03 07 - Historic - Masonry Repointing.
- .2 Section 04 03 08 – Historic – Mortaring.
- .3 Section 04 05 10 – Common Work Results for Masonry.
- .4 Section 04 05 19 – Masonry Anchorage and Reinforcing.

1.2 STONE AVAILABILITY

- .1 Confirm in writing prior to Contract award, that sufficient quantity of stone type included in the bid submission is available to complete the requirements of the project.

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Provide unit prices for replacement of stone. The unit price for each replacement will include all costs necessary to complete the specific replacement, including additional shoring and scaffolding, removal and disposal of existing stone, consolidation of core, all anchorage, mortar and grout work necessary to stabilize adjacent masonry, and to install the new stone.
- .2 For quantity estimation of dressed quoin stones and jamb stones, measure long face only. Allow for waste required to achieve desired size of replacement stone.
- .3 Payment for this work will include all costs associated with supplying materials, and executing work as described herein and reflected in the contract.

1.4 REFERENCES

- .1 Definitions:
 - .1 Lewis: instrument inserted at top of stone as means of attachment in raising and lowering. Holds stone by means of keys or wedges fitted to dovetailed recess.
 - .2 Dogs: metal appliance for securing parts or members together by means of one or more projecting teeth or bent portions, lug, cramp.
 - .3 Fabricator: company having sufficient capacity to quarry, cut, and deliver stonework on schedule.
 - .4 Installer: company or person specializing in commercial stone work. Employ skilled stone masons on site to do necessary field cutting as stones are set.
- .2 Reference Standards:
 - .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C97/C97M-2009, Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
 - .2 ASTM C170/C170M-2009, Standard Test Method for Compressive Strength of Dimension Stone.
 - .3 ASTM C568-10, Standard Specification for Limestone Dimension Stone.

- .4 ASTM C616/C616M-10, Specification for Quartz-Based Dimension Stone.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings for all new stone required, describing method of stone replacement, including removal, shoring and erection. Refer to Drawings for locations.
 - .2 Drawings to show all details for size, section, bedding, jointing, anchor or tying system and finish of stone. Base dimensions on accurate site measurements.
- .3 Samples:
 - .1 Submit samples of replacement stones for approval, prior to purchase of stone.
 - .2 Submit samples from original quarry or from quarry supplying replacement stone and samples of the existing stone salvaged on site, as follows:
 - .1 Two samples: representing full range of colour, pattern and inclusions.
 - .2 One: sized and dressed to match existing stone units.
 - .3 Five: 150 mm x 100 mm x 50 mm for compressive strength test to ASTM C170.
 - .4 One: 150 mm x 150 mm x 12 mm for porosity test to ASTM C97.
 - .5 Select samples from currently worked bed of quarry and accompanied by quarry certification.
 - .6 Samples should be representative of the full range of colour, visible markings, and finish to be supplied for the entire project. Indicate quarry bed or direction of bedding on samples.
 - .7 Submit the following samples to indicate required finishes:
 - .1 1 – 250 mm x 250 mm x 250 mm: bordered and bush hammered.
 - .2 1 – 250 mm x 250 mm x 250 mm: bordered, bush hammered and media blasted to a light sand colour.
 - .8 Submit stone samples to the testing laboratory designated by the Departmental Representative, for conformance with applicable ASTM Standards, prior to fabrication.

1.6 QUALITY ASSURANCE

- .1 Allow Departmental Representative access to mason's workshop for inspection of current work-in-progress.
- .2 Qualifications:
 - .1 Execute work by personnel experienced in conservation of historic masonry.
 - .2 Lead masons engaged by Masonry Contractor to have minimum of 10 years of experience with historic masonry. Remaining mason qualification as per Section 04 03 41 – Historic – Repair of Stone.

- .3 Departmental Representative has right to reject masons who do not demonstrate appropriate abilities or experience.
- .4 Masons employed on this project throughout course of project must meet above requirements. Where, during course of project, masons leave work force, replacement masons must also meet requirements.
- .3 Mock-ups:
 - .1 Construct mock-up in accordance with Section 04 05 10 – Common Work Results for Masonry.
 - .2 Prepare mock-up of tooling of stone face, to be approved on site by the Departmental Representative prior to commencement of the stone fabrication.
 - .3 Allow one week for inspection of mock-up by Departmental Representative, before proceeding with replacement work.
 - .4 When accepted, mock-up may remain as part of finished work.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver finished stone to site in substantial, purpose made containers, packed to avoid chipping damage or soiling from any means.
- .2 Label each container to clearly indicate contents and location on building.
- .3 Indicate on each stone quarry bed or direction of bedding and location of stone on building, referenced to shop drawings. Mark stones where not exposed with permanent markers.
- .4 Protect and store stones to facilitate their resetting.
 - .1 Store dismantled masonry units on wood pallets, protected from exposure to water, elements, and potential mechanical damage, fully covered under polyethylene.
 - .2 Ventilate shelter to keep condensation from forming on internal surfaces.
 - .3 Lay out storage so that each stone will have its numbered face visible, and be accessible or removable without having to move adjacent stones.
 - .4 Ensure contact between stones is avoided by placing protective, non-staining material between and around each stone.
- .5 Avoid excessive handling, and protect against chipping, damage, soiling or staining.
- .6 Damaged stone, and stone that is repaired prior to reaching site, will be rejected.
- .7 Packaging Waste Management: remove for reuse, in accordance with Waste Management plan.

Part 2 Products

2.1 MATERIALS

- .1 Limestone: to ASTM C568, category III - High Density or better, of uniform colour, texture and strength, free from holes, shakes, cracks or other defects. Buff in colour, to be approved by Departmental Representative.

- .2 Obtain new stone from a single quarry source acceptable to Departmental Representative.
 - .1 Attia Limestone of a similar colour to Kingston limestone (existing stone) is available from Attia Quarry: 6414 County Road, Hwy 169, Township of Ramara, Ontario.
 - .2 Kingston Limestone, a potentially suitable match for the existing stone is available from Rideauview Contractors, Inverary, Ontario.
 - .3 St. Marc Limestone (formerly known as Deschambeau Limestone), Greymont (Portneuf) Inc., 595 Boul. Dussault, St. Marc, Québec.
 - .4 Limberlost Limestone, Bruce Peninsula, Wiarton, Ontario.
 - .5 Montreal Greystone, Ansa Inc., Montreal, Quebec.
- .3 Ensure single quarry source has resources to provide materials of consistent quality and matching existing stone.
- .4 Obtain new sandstone from a single quarry source acceptable to Departmental Representative. Sandstone: to ASTM C616, Category II Sandstone of uniform colour, texture, strength, free from holes, shakes, cracks, or other defects.
 - .1 St. Canut Sandstone from the Laurentides Region or the Montérégie Region.

2.2 STONE BEDDING PLANES

- .1 Supply stone to be laid on its natural quarry bed.
- .2 Face bedded stone will be rejected.

2.3 STONE FABRICATION

- .1 Cut stone to shape and dimensions obtained from accurate measurements and profiles taken from existing stone, and full to square with joints as indicated.
 - .1 Dress exposed faces true.
 - .2 Allow for beds and joints to be the same as average joint thickness in location of new replacement stone, but not to exceed 20 mm thick, and at right angles to face.
- .2 Cut stones for anchors, cramps, dowels and support systems.
 - .1 Provide Lewis pin and clamp holes in pieces which cannot be manually lifted.
 - .2 Do not cut holes in exposed surfaces.
- .3 Fabrication of Replacement Stone
 - .1 Record profile of existing stone.
 - .2 Cut and carve new stone to match existing profile.
 - .3 Obtain approval of new carved stone by Departmental Representative, prior to installation.
- .4 Finish exposed faces and edges of stones to comply with requirements indicated on drawings, for finish and to match approved samples and field-constructed mock-up.

2.4 FABRICATION TOLERANCES

- .1 Fabricate dimension stone to the following tolerances:
 - .1 Unit Length: plus or minus 1.5 mm.
 - .2 Unit Height: plus or minus 1.5 mm.
 - .3 Deviation from Square: plus or minus 1.5 mm, with measurement taken using the longest edge as the base.
 - .4 Deviation from flat surface on any exposed face: plus or minus 1.5 mm.

2.5 EXISTING STONE

- .1 Use hard, sound, and clean existing stone salvaged on site only, with Departmental Representative's approval.

2.6 MORTAR

- .1 Mortar: in accordance with Section 04 03 08 - Historic - Mortaring.

2.7 ACCESSORIES

- .1 Anchors, cramps, dowels: Refer to Section 04 05 19 – Masonry Anchorage and Reinforcing.

Part 3 Execution

3.1 SITE VERIFICATION OF CONDITIONS

- .1 Report in writing, to Departmental Representative areas of deteriorated masonry not previously identified.
- .2 Obtain Departmental Representative's approval and instructions for repair and replacement of masonry units before proceeding with repair work.
- .3 Stop work in that area and report to Departmental Representative immediately evidence of hazardous materials.

3.2 PREPARATION

- .1 Prevent absorption of ground water and water accumulation on stone. Rest stones in their natural bedding during weathering.
- .2 Move and lift stone units using means to prevent damage. Submit stone units dropped or impacted to Departmental Representative for inspection and approval. Do not make holes or indentations for Lewises or dogs on face or top side of stone.
- .3 Indicate bedding planes of stone units. Duplicate bedding marks on usable pieces of cut stone.
- .4 Place safety devices and signs near work area as directed.
- .5 Install and remove temporary shoring or other supports as required.
- .6 Cover adjacent plant material and fragile surfaces.

- .7 Repoint backup masonry, install anchors and install mortar in collar joint as per Section 04 03 07 - Historic-Masonry Repointing.

3.3 EXISTING STONE REMOVAL

- .1 Remove existing deteriorated stone after obtaining approval from Departmental Representative.
- .2 Record photographically from all aspects, those areas allocated for dismantling, prior to start of work.
- .3 Using elevation drawings, accurately number each stone to be removed, and record its position. Numbering must correspond to the shop drawings.
- .4 Where existing stone is to be reset, mark stone on face, before removal, with marking product which can be completely erased when required, or label attached to stone, without damaging masonry unit. Method of marking to the approval of the Departmental Representative.
- .5 Use approved methods to loosen stones which will cause no damage either to stones or to other elements of the lock walls.
- .6 Do not use circular millstone or saw, pneumatic chisel, steel tools exerting concentrated pressure on edge of stone. Obtain Departmental Representative's approval for use of power tools before commencing work.
- .7 Loosen wet masonry only when temperature is above freezing point.
- .8 Remove loose material from deteriorated stones and clean by wet scrubbing with vegetable fibre brush unless otherwise instructed by Departmental Representative. Do not use high pressure water jet.
- .9 Place detached stones on wood surfaces during handling. Prevent contact with metal or vegetation.
- .10 Clean dust, mortar and stone fragments from slot.

3.4 RAKING JOINTS

- .1 Remove mortar in accordance with Section 04 03 07 – Historic – Masonry Repointing.

3.5 CUTTING/SIZING OF STONE

- .1 Use calipers, squares and levels to measure hole for new stone. Allow for mortar joints of 20 mm maximum thickness. Where existing joints are narrower, confirm joint thickness with Departmental Representative prior to cutting stone.
- .2 Provide 1:10 slope on top face of stone unit, sloping down to front face.

3.6 MOVING STONES

- .1 Use Lewises to lift stones to working level.
- .2 Move stones horizontally in wheelbarrows or on sleds.
- .3 Move large stones using nylon belts properly spaced to provide a safe and even bearing for the stone.

- .4 Slide stones into place on wood ramps.
- .5 Protect edges of stone from damage when hoisting and lifting from position. Use wood shims to isolate units from hoisting belts.
 - .1 Incorporate only undamaged stone in Work.

3.7 INSERTING REPLACEMENT STONE

- .1 Clean stone by washing with water and natural fibre brush before laying.
- .2 Dampen surfaces of slot and apply bedding mortar.
- .3 Lay heavy stones and projecting stones after mortar in courses below has hardened sufficiently to support weight.
- .4 Prop and anchor projecting stones until wall above is set.
- .5 Set large stones on water soaked softwood wedges, to support stone in proper alignment until mortar has set. Remove wedges when dry, do not break off.
- .6 Insert and compress firm mortar to within 30mm of pointing surface. Allow mortar to set 24 hours.
- .7 Remove mortar dropping from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses.
- .8 Install stainless steel anchors to fix stone face plates as indicated. Provide minimum of two anchors per stone, top and bottom.
- .9 Set stones plumb, true, level in full bed of mortar with vertical joints buttered and placed full except where otherwise specified. Completely fill anchor, dowel and lifting holes and voids left by removed edges.
- .10 Grout solid all voids behind stone using specified grout.

3.8 FILLING JOINTS/POINTING

- .1 Fill joints and point: in accordance with Section 04 03 07 - Historic - Masonry Repointing.

3.9 PROTECTION OF WORK

- .1 Cover top of completed and partially completed wall, not enclosed or sheltered, with weatherproof coverings at end of each working day.
 - .1 Drape cover over wall and extend 0.5 m down both sides.
 - .2 Anchor securely in position.
 - .3 Prevent finished work from curing too quickly.
 - .4 Protect from drying winds. Pay particular attention at corners.
- .2 Protect adjacent work from marking or damage due to work.
- .3 Protect adjacent finished work against damage which may be caused by on-going work.
- .4 Provide temporary bracing of masonry work during erection until permanent structure provides adequate bracing.

3.10 CLEANING

- .1 Confirm acceptance of mock-up of cleaning operations, as demonstrated to the Departmental Representative, before starting cleaning work.
- .2 Clean stone work surfaces after repairs have been completed and mortar has set.
- .3 Clean stone surfaces of adhesive or mortar residue resulting from work performed without damaging stone or joints.
- .4 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 03 07 – Historic – Masonry Repointing and Repair.
- .2 Section 04 05 19 – Masonry Anchorage and Reinforcing.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA A371-14, Masonry Construction for Buildings.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Conduct pre-installation meeting one week prior to commencing work of this Section, to:
 - .1 Verify project requirements, including mock-up requirements.
 - .2 Verify substrate conditions.
 - .3 Co-ordinate products, installation methods and techniques.
 - .4 Sequence work of related sections.
 - .5 Review manufacturer's installation instructions.
 - .6 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.
 - .7 Coordinate procedures for identifying all stone repairs/replacement, as early as possible in the project, including cutting out, measuring and ordering replacement stone, so as not to affect schedule.
 - .8 Review warranty requirements.

1.4 ACTION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, limitations and colours.
 - .2 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide samples as follows:
 - .1 One sample of mortar and grout.
 - .2 One of each type of masonry anchorage proposed for use, supplemented by specific requirements in Section 04 05 19 - Masonry Anchorage and Reinforcing.
 - .3 One sample of each type of stone to be used to replace existing stone, where stone has not been salvaged from site.

- .3 Submit samples for testing to laboratories employing technicians certified/trained in procedures for testing masonry units.
- .4 The approved samples denote the standard of material to be used.
- .4 Shop Drawings:
 - .1 Provide drawings stamped and signed by Professional Engineer registered or licensed in the Province of Ontario.
 - .2 Where existing masonry becomes unsupported during construction, provide shop drawings detailing temporary bracing required, designed to resist lateral forces during installation.
- .5 Temporary Bracing:
 - .1 Submit stamped engineered drawings for temporary bracing.

1.5 INFORMATION SUBMITTALS

- .1 Certificates: provide manufacturer's product certificates certifying materials comply with specified performance requirements and physical properties.
- .2 Test and Evaluation Reports:
 - .1 Provide certified test reports in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.
 - .3 Provide data for masonry units, in addition to requirements set out in referenced CSA Standards, indicating initial rates of absorption.
 - .4 For stone replacement units, submit test reports confirming compressive strength, density and porosity to requirements set out in referenced CSA Standards.
- .3 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.
- .4 Manufacturer's Reports: provide written reports prepared by manufacturer's on-site personnel to include:
 - .1 Verification of compliance of work with Contract.
 - .2 Site visit reports providing detailed review of installation of work, and installed work.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Manufacturer: capable of providing field service representation during construction and approving application method.
 - .2 Installer: who has specialized in installation of work similar to that required for this project.
 - .3 Masons: company or person specializing in masonry installations with five (5) years documented experience with masonry work similar to this project.
 - .1 Masons employed on this project must demonstrate ability to reproduce mock-up standards.

- .4 The principal stone mason and site superintendent engaged by the Masonry Contractor must have a minimum of ten (10) years of experience with historic masonry conservation similar to this project, and can demonstrate an ability to pass a hands-on test of skills, if so administered by the Departmental Representative. The Departmental Representative has the right to reject either of these individuals, if their qualifications cannot be substantiated, or who does not demonstrate the appropriate abilities or experience on the following tasks:
 - .1 Raking joints by hand.
 - .2 Cutting stone.
 - .3 Dutchman repairs.
 - .4 Pinning techniques
 - .5 Historical repointing.
- .5 All masons employed on this project must meet the above requirements. Where, during the course of the project, masons leave or become unavailable to perform their duties, replacement masons must also possess comparable experience equivalent to the masons being replaced.
- .6 Apprentices: Apprentices may work on the project provided their work is under the direct supervision of an experienced mason, at a ratio of no more than two apprentices for one experienced mason.
- .2 Mock-ups:
 - .1 Construct mock-up panel of masonry wall construction, 1200 x 1800 mm showing masonry colours and textures, use of reinforcement, jointing, coursing, mortar, tooling and workmanship.
 - .2 For repointing, mock-up must include examples of saw-cut joints, raked joints, backpointed joints and finishpointed joints for both horizontal and vertical applications
 - .3 Mock-up used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
 - .2 For testing to determine compliance with performance requirements.
 - .4 Construct mock-up where directed by Departmental Representative.
 - .5 Notify Departmental Representative 48 hours before commencing each mock-up.
 - .6 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with work.
 - .7 When accepted by Departmental Representative, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
 - .8 Start work only upon receipt of written acceptance of mock-up by Departmental Representative.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Only accept materials that have been delivered to site in original, unbroken, undamaged packages. Damaged packages are not to be accepted on site.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Storage and Handling Protection:
 - .1 Keep materials dry until use.

- .2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
- .4 Packaging Waste Management:
 - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.8 SITE CONDITIONS

- .1 Weather Requirements: to CAN/CSA A371.
- .2 Site Environmental Requirements
 - .1 Cold weather requirements: Supplement Clause 6.7.2 of CAN/CSA A371 with following requirements:
 - .1 Maintain temperature of mortar between 5 degrees C and 30 degrees C until batch is used or becomes stable.
 - .2 Maintain ambient temperature between 5 degrees C and 30 degrees C and protect site from wind chill.
 - .3 Cover mortar less than 7 days old with tarpaulins, when temperature is forecast to fall below 5 degrees C, and insulated tarpaulins when temperature is forecast to fall below 0 degrees C.
 - .4 Provide heating of masonry work when the average air temperature falls below -4 degrees C.
 - .5 Maintain mean temperature of masonry above 0 degrees C for a minimum of 28 days, after mortar is installed.
 - .6 Do not repoint if the temperature is forecast to drop below -4 degrees C in the following 24 hours.
 - .7 Each unheated section of wall must be preheated in it's enclosure for a minimum period of 72 hours above 10 degrees C, before any mortar is applied.
 - .2 Hot weather requirements:
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
 - .3 Spray mortar surface at intervals and keep moist for minimum time required for curing as noted in Section 04 03 07 – Historic – Masonry Repointing.
 - .4 Provide hot weather protection against direct sunlight and wind, when air temperature exceeds 20 degrees C.
 - .3 Maintain minimum/maximum thermometers and relative humidity gauges on site and in all enclosures and maintain a daily record of temperature and humidity.

1.9 PERFORMANCE

- .1 The following will be considered deficiencies in the work, in addition to any failure to meet other provisions of these specifications:

- .1 Mortar shrinkage cracks between units.
- .2 Unfilled joints.
- .3 Spalling of units or joints.
- .4 Poor colour or texture blending of joints or units.
- .5 Dusting, efflorescence of joints or units.
- .6 Surface discolouration, discoloration, variance of colour or crumbling of mortar.
- .7 Failure of anchors of built-in items.
- .8 Sloppy fitting, or otherwise poor workmanship in levelling, bedding or jointing of units.
- .9 Failure to match adjacent work or failure to match control test area.
- .10 Failure to adequately cure the mortar.

Part 2 Products

2.1 MATERIALS

- .1 Masonry materials are specified in Related Sections:

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section.
- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.
- .3 Verification of Conditions
 - .1 Verify that:
 - .1 Field conditions are acceptable and are ready to receive work.
 - .2 Commencing installation means acceptance of existing substrates.

3.3 PREPARATION

- .1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.
- .2 Protect adjacent materials from damage and disfiguration.

- .3 Provide temporary bracing of masonry work during and after erection, as required.
- .4 Bracing must be approved by Departmental Representative.
- .5 Winter Heating
 - .1 When average daily temperature is forecast to fall below -4 degrees C, provide winter heat and maintain 55% relative humidity level within the scaffold/housing enclosure.
 - .2 The use of open flame to provide heating is strictly forbidden.

3.4 INSTALLATION

- .1 Masonry work in accordance with CAN/CSA A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.5 CONSTRUCTION

- .1 Jointing:
 - .1 For joint finishing, see Section 04 03 07 - Historic-Masonry Repointing and Repair.

3.6 SITE TOLERANCES

- .1 Conform to Clause 6.2 of CAN/CSA A371, unless otherwise noted.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection:
 - .1 Inspection and testing will be carried out by Testing Laboratory designated by Departmental Representative.
 - .2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.
 - .3 Departmental Representative will pay costs for testing.

3.8 CLEANING

- .1 Perform cleaning after installation and when mortar has fully cured to remove construction dust and accumulated environmental dirt.
- .2 Upon completion of installation and verification of performance of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .3 Ensure all construction debris is removed from the waterways, both upstream and downstream of the locks.

3.9 PROTECTION

- .1 Protect masonry work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 10 – Common Work Results for Masonry.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A276/A276M-15, Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM A666-14, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .3 ASTM A955/A955M-15, Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement.
 - .4 ASTM C1242-15, Guide for Design, Selection, and Installation of Dimension Stone Anchors and Attachment System.
- .2 Canadian Standards Association (CSA)
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA A179-14, Mortar and Grout for Unit Masonry.
 - .3 CSA A370-14, Connectors for Masonry.
 - .4 CAN/CSA A371-14, Masonry Construction for Buildings.
 - .5 CSA S304.1-14, Design of Masonry Structures.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets illustrating specified products to be incorporated into project.
 - .2 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 01 35 30 - Health and Safety Requirements.
 - .3 Submit product data on helical anchors and stainless steel anchors.
- .3 Shop Drawings:
 - .1 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide shop drawings detailing bar bending details, anchorage details, lists and placing drawings.
 - .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.4 Show details of the anchors, specify required hole size to be cored in the stone, and installation procedures. Indicate material specifications for the steel portion of the anchors.

.4 Manufacturer's Instructions:

.1 Provide manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.4 Mock-ups:

.1 Construct mock-ups in accordance with Section 04 05 10 - Common Work Results for Masonry.

1.5 FIELD MEASUREMENTS

.1 Make field measurements necessary to ensure proper fit of members.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle masonry anchorage and reinforcing materials in original packaging until required for installation.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Waste Management plan.

Part 2 Products

2.1 MATERIALS

.1 Bar reinforcement: Stainless steel to ASTM A276 and ASTM A995M, Grade 420.

.2 Connectors: Stainless steel to CSA A370 and CSA S304.1.

.3 Corrosion protection: to CSA S304.1, stainless steel to CSA S304.1 and CSA A370.

.4 Helical Wall Ties: stainless steel helical anchors to Grade 304, sizes as shown on Drawings. Acceptable Manufacturer:

.1 Helifix

.2 Blok-Lok Spira-lok

.3 Thor Helical

- .5 Adhesive Anchors: stainless steel threaded rod anchors, Grade 304, with two part hybrid adhesive system, as used for Hilti type adhesive anchors (HY-70). Supply anchors as per Drawings.
- .6 Stone Anchorage: type 304 stainless steel conforming to ASTM A666. Anchors to be supplied as per Drawings.

2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CSA A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Fabricate connectors in accordance with CSA A370.
- .3 Obtain Departmental Representative's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.
- .2 Upon request, inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Supply and install masonry connectors and reinforcement in accordance with ASTM C1242, CSA A370, CAN/CSA A371, CSA A23.1 and CSA S304.1 unless indicated otherwise.
- .2 Prior to placing concrete, mortar, grout, obtain Departmental Representative's approval of placement of reinforcement and connectors.
- .3 Supply and install additional reinforcement to masonry as indicated.
- .4 The use of expansion type anchors for temporary or permanent applications in stone masonry is prohibited.

3.3 HELICAL WALL TIES

- .1 Install helical wall ties as indicated. Installation as per manufacturer's instructions. Repair mortar joint after installation as per specifications.
- .2 Pre-drill hole for anchor. Drill bit diameter to be one size smaller than the required anchor diameter.
- .3 Install anchors after backpointing has been approved by the Departmental Representative.
- .4 Do not mark face of stone with the drill. Damage as a result of careless use of the drill will be repaired at the Contractor's expense.
- .5 Ensure the head of the anchor will be completely covered by finishpointing mortar.
- .6 Where helical anchors are installed as the outer leaf of the masonry walls is being constructed, drill helical anchors into the backup masonry units and lay in a bed of mortar joint in outer leaf, as reconstruction of the outer leaf proceeds.

3.4 ADHESIVE ANCHORS

- .1 Install adhesive anchors as per manufacturer's instructions.

3.5 ANCHORS

- .1 Supply and install stainless steel anchors as indicated.

3.6 FIELD BENDING

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

3.7 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment and barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A193/A193M-14a, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service.
 - .2 ASTM A276/A276M-15, Specification for Stainless Steel Bars and Shapes.
 - .3 ASTM A307-14, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.181 99, Ready Mixed, Organic Zinc Rich Coating.
- .3 Canadian Standards Association (CSA)
 - .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.
 - .2 CSA S16-14, Design of Steel Structures.
 - .3 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
 - .4 CSA W59-13, Welded Steel Construction (Metal Arc Welding) (Imperial Version).
- .4 Master Painters Institute (MPI)
- .5 The Society for Protective Coatings (SSPC)
 - .1 SSPC-SP 3, Power Tool Cleaning.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations; indicate VOCs for:
 - .1 Finishes
 - .2 Coatings
 - .3 Primers
 - .4 Paints
- .3 Shop Drawings
 - .1 Submit shop drawings to include fabrication, connection and erection details.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

- .3 Submit shop drawings for the following:
 - .1 Lock chamber access ladders.
 - .2 Railing on dam retaining wall, based on records of disassembly.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.
- .3 Waste Management and Disposal
 - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CSA G40.20/G40.21;
 - .1 Plates, Angles and Channels: Grade 300W.
 - .2 Steel Sections: Grade 350W.
- .2 Welding materials: to CSA W59.
- .3 Welding electrodes: to CSA W48 Series.
- .4 Stainless steel bolts: to ASTM A193.
- .5 Stainless steel angles: to ASTM A276, Grade 304.
- .6 Bolts and anchor bolts: to ASTM A307.
- .7 Fixed steel ladder: to suit site measurements, painted finish, one piece welded assembly, complete with associated anchorage accessories.
- .8 Fasteners: Stainless steel, type and size as specified by the structural engineer responsible for the shop drawings. Exposed fasteners to be finished to match the finish on the item being fastened.
- .9 Hot-dip galvanizing: galvanize steel, where indicated to ASTM A123, minimum zinc coating of 705g/m².

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured, and in compliance with approved shop drawings.
- .2 Where possible, fit and shop assemble work, ready for erection.

- .3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .4 Complete welded connections prior to galvanizing.
- .5 Provide effective drainage holes to prevent accumulation of water in hollow section members.

2.3 FINISHES

- .1 Galvanizing: Hot dipped galvanizing for all steel elements, unless detailed otherwise.
- .2 Existing Railings:
 - .1 Disassemble existing railings and clean all pieces individually, in accordance with SSPC Standard SP6, Commercial Blast Cleaning, to an average profile of 1.5 mils.
- .3 Paint for Access Ladders and Railing: Alkyd System: MPI EXT 5.1D in accordance with manufacturer's instructions and applied under shop conditions.
 - .1 Prime Coat: Alkyd anticorrosive metal primer.
 - .2 Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - .3 Topcoat: Exterior alkyd enamel semigloss. Colour to be selected by Departmental Representative.
 - .4 Alternative Systems: Must be approved by Departmental Representative.

2.4 ISOLATION COATING

- .1 Separation sheet as recommended by the stainless steel manufacturer.

Part 3 Execution

3.1 ERECTION

- .1 Welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Departmental Representative such as stainless steel threaded anchor bolts and as per manufacturer's instructions.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Make field connections with stainless steel bolts to ASTM A193.
- .6 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with specified paint.
- .7 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 ACCESS LADDERS

- .1 Remove existing access ladders and dispose off site.
- .2 Install new access ladders on completion of masonry work.

3.3 EXISTING LADDERS

- .1 Prior to commencing work on the dam retaining wall, carefully tag, disassemble and remove the existing railing. Send off site for cleaning and painting in shop conditions.
- .2 Install painted railing on newly rehabilitated retaining wall, based on assembly details recorded during disassembly.

3.4 QUALITY CONTROL

- .1 Final inspection will be carried out by Departmental Representative to ensure the finished product is free from scratches and dents and the Work is cleaned to the Owner's satisfaction, prior to acceptance.

3.5 CLEANING

- .1 Perform cleaning after installation to remove construction waste and accumulated environmental soiling.
- .2 Repair or replace damaged products.
- .3 Make good any damage caused by the work of this Section.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 32 92 23 - Sodding

1.2 REFERENCES

- .1 American Standards for Testing and Materials (ASTM) International
 - .1 ASTM D2434-68 (2006), Standard Test Method for Permeability of Granular Soils (Constant Head).
 - .2 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .2 Environmental Protection Agency (EPA)
- .3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation.
 - .1 OPSS 1010-13, Material Specification for Aggregates – Base, Subbase, Select Subgrade and Backfill Material.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Co-ordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.
 - .1 Pay costs of relocating services.
- .2 Notify Departmental Representative of excavation 48 hrs in advance.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples: submit to designated testing agency, 70 kg sample of backfill for granular fill material proposed for use, no later than 1 week before backfilling or filling work.
- .3 Site Quality Control Submittals: submit in accordance with Quality Control plan.
 - .1 Submit testing and inspection results and report as described in PART 3 – FIELD QUALITY CONTROL.

Part 2 Products

2.1 MATERIALS

- .1 Site excavated material, graded to remove large rocks and organic debris.
- .2 Clean impervious fill, unfrozen and free from large rocks, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Sodium Bentonite (Geoseal): Soil sealing system, available from Canadian Clay Products Inc., Wilcox, Saskatchewan; Ph. 306-732-2085. Permeability testing to ASTM D2434.

- .4 Granular A, B Type I, B Type II to OPSS 1010.
- .5 Woven Geotextile liner, minimum grab tensile strength of 445 kN; minimum tear resistance of 200 kN.

Part 3 Execution

3.1 EXAMINATION

- .1 Evaluation and Assessment:
 - .1 Before commencing work verify locations of buried services on and adjacent to site.

3.2 PREPARATION

- .1 Temporary erosion and sedimentation control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control drawings, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Protection of in-place conditions:
 - .1 Protect excavations from freezing.
 - .2 Keep excavations clean, free of standing water, and loose soil.
 - .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.
 - .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
 - .5 Protect buried services that are required to remain undisturbed.
- .3 Removal:
 - .1 Carefully remove and relocate all man-made features in area of excavation. Store in protected area. Reinstall in same location on completion of work.
 - .2 Remove brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings. Indicate specifically what vegetation is required to be removed and obtain approval from Departmental Representative prior to removal.
 - .3 Remove obsolete buried services within 2 m of lock wall.

3.3 EXCAVATION

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Province of Ontario regulations.

- .2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
 - .1 Stockpile topsoil on site for later use.
- .3 Excavate as required to carry out work.
 - .1 Do not disturb soil or rock beyond scope of work as detailed.
 - .2 In contaminated areas, follow the recommendations outlined in the report titled “Risk Assessment and Environmental Monitoring, Old Slys Lockstation, Smiths Falls, Ontario” by AEL Environmental, dated 2018.
 - .3 Carefully excavate adjacent to rear of block walls, so as not to move or damage the existing masonry.
 - .4 Clean all mud and debris from back face of exposed masonry.
 - .5 Notify the Departmental Representative when excavations are complete.
 - .6 If excavations are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
 - .7 Excavation taken below depths shown without the Departmental Representative's written authorization to be filled with Engineered Fill at Contractor's expense.
 - .8 Complete all masonry conservation at the newly exposed rear of the masonry wall, as detailed.

3.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Dispose excavated contaminated soil at an off-site facility capable of handling identified contaminants.
- .2 Do not stockpile material on site where contaminant escape is possible.

3.5 FIELD QUALITY CONTROL

- .1 Testing of materials and compaction of backfill and granular fill will be carried out by testing laboratory designated by the Departmental Representative.
- .2 Not later than 1 week minimum before backfilling or filling, submit to designated testing agency, samples of backfill as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify the Departmental Representative to allow compaction tests to be carried out by designated testing agency.

3.6 BACKFILLING

- .1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .2 Place geotextile in accordance with manufacturer's instructions.

- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.
 - .1 Fill excavated areas with site excavated fill, compacted as specified.
 - .2 Sodium Bentonite mix as follows: 5% per volume, based on permeability of 1.2×10^{-7} cm/s, tested to ASTM D2434. Due to potential variable composition of the soil, if desired outcome is not achieved, adjust mix and test again.
- .5 Placing:
 - .1 Place backfill, fill and base course material in 300 mm lifts. Add Sodium Bentonite to backfill for a minimum width of 600 mm behind back face of stone masonry wall.
- .6 Compaction: compact each layer of material to following densities for material to ASTM D698:
 - .1 To underside of topsoil: 90%.
 - .2 Base course under concrete pads: 98%.
- .7 Under concrete slab:
 - .1 Use Granular A for base courses, to minimum depth of 300 mm.
- .8 Behind retaining wall:
 - .1 Use Granular Granular A crushed stone or Granular B Type II.
 - .2 Place in maximum 300 mm loose lifts and compact to at least 95% of SPMDD.
- .9 Under seeded and sodded areas: use site excavated material to bottom of topsoil.
- .10 Sodding: Refer to Section 32 92 23 – Sodding.

3.7 GRADING

- .1 Grade so that water will drain away from walls to disposal areas approved by the Departmental Representative.
 - .1 Grade to be gradual between finished spot elevations shown on drawings.

3.8 CLEANING

- .1 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment.
- .2 Waste Management: contractor to submit a waste management and disposal plan for approval by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This Section specifies requirements for dewatering Work spaces described by drawings and specifications.
- .2 Work includes but is not limited to:
 - .1 Engaging a Professional Engineer to design:
 - .1 Temporary cofferdams at the lock entrance.
 - .2 Systems used to remove water from Work spaces
 - .3 Sediment control systems and devices such as turbidity curtains, sediment traps, silt control fences, filter bags, settling basins and other treatment facilities.
 - .2 Constructing and maintaining the temporary cofferdam at the upstream and downstream lock entrances, according to the Professional Engineer’s design, for the duration of the work.
 - .3 Implementing dewatering according to the Professional Engineer’s design.
 - .4 Constructing and maintaining all other dewatering structures for the duration of the work.
 - .5 Providing and maintaining all dewatering equipment for the duration of the work.
 - .6 Removing water from Work spaces and maintaining these spaces in a dry state for the duration of the work.
 - .7 Supplying standby equipment to replace dewatering equipment which malfunctions.
 - .8 Removing the temporary cofferdam and all other temporary dewatering structures at end of Work.
 - .9 Complying at all times with turbidity provisions and aquatic protection of Section 01 35 43 – Environmental Procedures.
 - .10 Complying with Regulatory Requirements.
- .3 Except where noted, all Work described in this specification to be done “in the dry”.
- .4 Install upstream and downstream turbidity curtains, prior to cofferdam installation.

1.2 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 Installation of cofferdams must comply with the regulations and guidelines of the Department of Fisheries and Oceans, in accordance with Fisheries Act, BIA and the approved Environmental Management Plan (EMP).

- .3 Pumping water out of cofferdam enclosure, as required: to Section 01 35 43 – Environmental Procedures.
- .4 No in-water work permitted from March 15 to June 30.
- .5 Ensure that area to be dewatered behind cofferdam is clear of fish before being dewatered. Release alive, immediately downstream of cofferdam into downstream waterway. Also, clear area of other vertebrae animals in area to be dewatered. Catch and release fish that escape process noted above, as dewatering commences.
- .6 Obtain and pay for costs of all required permits.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings of cofferdam and other dewatering systems.
 - .1 Shop drawings must be sealed and signed by a Professional Engineer, licensed to practice in the Province of Ontario.
 - .2 Submit design calculations of flow capacity and stability of cofferdams and dewatering systems uses for each stage of construction.
 - .3 Outline procedure to seal cofferdam on rough bed of canal floor and at side conditions, to prevent leaks.

1.4 QUALITY ASSURANCE

- .1 Qualifications of Designer
 - .1 Designer of cofferdams and other related dewatering structures and systems must be a Professional Engineer, licensed to practice in the Province of Ontario, with considerable expertise and experience in design of similar structures and systems.
 - .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.
- .2 Design Criteria
 - .1 Design cofferdams to ensure maintenance of work spaces in a dry state for duration of work.
 - .2 River flows will be discharged through the adjacent dam. There are no provisions required to have river flows discharged through the temporary cofferdam or work site.
 - .3 Allow for inspection of existing perimeter conditions, by diver, prior to design of cofferdam.
 - .4 Plan and design dewatering system considering:
 - .1 Access to cofferdams and access to reach any portion of work.
 - .2 Space required for crews to work in dewatered areas.
 - .3 Sequence of Work.
 - .4 Water levels at drawdown, navigation and levels anticipated during construction.

- .5 Uneven surface of river bed and perimeter conditions, at intended locations of cofferdam.
- .5 At all times, maintain environmental quality of water to Section 01 35 43 – Environmental Procedures.
- .6 Ensure that no phase of Work threatens safe performance of cofferdams.
- .7 Provide a minimum of 750 mm freeboard to prevent overtopping of cofferdams from normal high water level.

1.5 SITE CONDITIONS

- .1 Water Levels
 - .1 For upstream water elevations at top of cofferdam, refer to drawings.
 - .2 For downstream elevations at top of cofferdam, refer to drawings.
- .2 Existing Soils
 - .1 Information on existing soils condition in the area of the locks is available through the Geotechnical Report prepared by Paterson Group.
- .3 Environmental and Archeological Dewatering Requirements
 - .1 Clean inflow that has not intersected with the work zone may be contained and pumped back into the river. Otherwise, send all discharge to sediment traps in order to satisfy discharge requirements. Dispose of water so that it does not create a safety or health hazard; or cause damage to environment, to adjacent property or to any portion of work or cause erosion.
 - .2 Do not release any silt or other materials into watercourse during construction or removal of cofferdams.
 - .3 Assume that from November 20th to March 25th, water will be freezing, so work must be executed while dealing with ice on the surface.

1.6 PROTECTION

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

Part 2 Products

2.1 MATERIALS

- .1 In good condition, approved by Departmental Representative and suitable for their use in the Work.
- .2 Do not use materials which may cause environmental damage to waterways or to land at or near site.
- .3 Materials and methods proposed for use in cofferdams must comply with the regulations and guidelines of the following:
 - .1 Federal Department of Fisheries and Oceans.

- .4 Earth or granular materials with sand and fines is not acceptable. Where earthen cofferdams are desired, they must be designed to permit overtopping without erosion. Alternate cofferdam types may be better suited to site conditions.
- .5 If using sandbags, sand must be washed of fines before placing in water.
- .6 Use gravel/rock fill with rubber membrane, caissons, rubber dams, sheet piling, bolted pre-engineered frame-type structures, or other types of cofferdams which do not generate turbidity. These approaches are the methods preferred by the Department of Fisheries and Oceans.

Part 3 Execution

3.1 GENERAL

- .1 Evaluate, plan and execute Work in an expert and prudent manner, giving due consideration to:
 - .1 Climatic conditions which may occur at work location, during period of doing work in its entirety, including dealing with ice, as noted.
 - .2 Safety of personnel and of general public.
 - .3 Safety of Work and of adjacent property.
 - .4 Safety of removals.
 - .5 Environmental requirements.
 - .6 Clearance requirements for Work.
 - .7 Access restrictions for Work.
 - .8 Archaeological restrictions for cofferdam location.
 - .9 Changes in water levels.

3.2 COFFERDAM CONSTRUCTION

- .1 Install cofferdam to allow sufficient clearance for scaffolding and access for workers.
- .2 Ensure water tightness by installation of drainage membrane and waterproof sheeting, taped and sealed.
- .3 Secure waterproof membrane at top and bottom with weighted material.
- .4 Make adequate provisions to seal cofferdam at edge conditions, based on pre-design survey by Contractor.
- .5 Prior to use, provide proof of review and approval of cofferdam erection by a Professional Engineer licensed to practice in the Province of Ontario.
- .6 Maintain the cofferdam in satisfactory condition for the duration of the work. Regularly check the perimeter for leakage and take measures to prevent such occurrences.
- .7 If flooding occurs after excessive rainfall, provide pump to remove water.

3.3 DEWATERING

- .1 Dewater work spaces and maintain them in a fully dewatered state until Work is finished.

- .2 Continue dewatering operations, to enable Work to proceed in the dry, for duration of Work.
- .3 Repeat entire dewatering procedure as often as may be necessary, if flooding of other damage occurs before completion of Work.

3.4 WATCHKEEPER

- .1 Ensure continuity of dewatering by designating a Watchkeeper to make periodic checks at times when Work is not in progress. Watchkeeper's qualifications under this Section are to be sufficient to perform, on dewatering equipment, such duties as:
 - .1 Preventative maintenance and refueling of generators, normally performed during any shift.
 - .2 Emergency repairs of minor complexity.
 - .3 Placing standby items in service.

3.5 EQUIPMENT

- .1 General
 - .1 Provide equipment in safe operating condition and maintain it in a safe operating condition for entire period of use and/or standby for use on Work.
 - .2 Provide skilled operators for equipment.
- .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 and other essential dewatering equipment which may break down during Work.
 - .3 Keep this replacement equipment available on site for immediate use.

3.6 COFFERDAM REMOVAL

- .1 At approved stages of Work, remove all cofferdams, temporary structures and dewatering systems, to original channel bottom level.
- .2 Dispose of all unwanted materials in approved manner on Canal Lands. Excavated sediment/soil to be disposed of offsite at an appropriate facility.
- .3 Do not dispose of any materials in watercourses of canal.
- .4 Maintain sediment controls in place during cofferdam removal.
- .5 Cofferdams must be removed and all in-water work complete by March 14, due to Ministry of Natural Resources (MNR) restricted timing window for fish spawnings (March 15 to June 30).
- .6 Notify Parks Canada to review site, once cofferdam removal is complete.
- .7 Turbidity curtains to be left in place until PCA provides approval for removal.

3.7 CLEAN-UP AND RECTIFICATION

- .1 Clean up work area as work progresses. Leave Work area clean at end of each day.
- .2 Provide on-site containers for collection of waste materials and debris.
- .3 Ensure the waterway, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment from the site.
- .5 Broom clean and wash surfaces affected by the work; rake clean other surfaces of grounds.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Samples.
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit:
 - .1 Sod for each type specified.
 - .1 Install approved samples in one square metre mock-ups and maintain in accordance with maintenance requirements during establishment period.
 - .2 Bio-degradable geotextile fabric.
 - .2 Obtain approval of samples by Departmental Representative.

1.2 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.3 SCHEDULING

- .1 Schedule sod laying to coincide with preparation of soil surface. Verify source of sod at least two months prior to installation and confirm date when sod farm will be open. Include these dates in schedule.
- .2 Schedule sod installation when frost is not present in ground.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Waste Management plan.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Turf Grass Nursery Sod types:
 - .1 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivars.
 - .2 Turf Grass Nursery Sod quality:
 - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
 - .3 Mowing height limit: 35 to 65 mm.
 - .4 Soil portion of sod: 6 to 15 mm in thickness.
 - .2 Sod establishment support:
 - .1 Geotextile fabric: biodegradable, 25 mm square mesh.
 - .2 Biodegradable starch pegs: 17 x 8 x 200 mm.
 - .3 Water:
 - .1 Contractor to supply.
 - .4 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65 % of nitrogen content in water-insoluble form. Ensure no runoff of fertilizer to water course.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with recommendations of sod supplier. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.

- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements. Cut sod into existing surface. Do not layer sod on top of soil i.e. flush interface.
- .3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes. Follow horizontal contour of slope, not vertical placement.
- .3 Peg sod on slopes steeper than 3 m horizontal to 1 m vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
 - .2 Not less than 3-6 pegs per square metre.

3.4 FERTILIZING PROGRAM

- .1 Fertilize during establishment and warranty periods to in accordance with sod supplier recommendations.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas as directed by Departmental Representative.
- .4 Maintain sodded areas weed free 95%.

- .5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.6 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.7 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Water sodded Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
- .2 Repair and resod dead or bare spots to satisfaction of Departmental Representative.
- .3 Cut grass and remove clippings that will smother grass, as directed by Departmental Representative to height as follows:
 - .1 Turf Grass Nursery Sod:
 - .1 50 mm during normal growing conditions.
 - .2 Cut grass at 2 week intervals, or as directed by Departmental Representative, but at intervals so that approximately one third of growth is removed in single cut.
 - .3 Fertilize areas in accordance with fertilizing program.
 - .4 Eliminate weeds by mechanical or chemical means, to extent acceptable to Departmental Representative.

3.8 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION