THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 705-2005

HAWTHORNE FLOOD PUMPING STATION UPGRADE

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PART B - BIDDING PROCEDURES

B1. PROJECT TITLE

B1.1 HAWTHORNE FLOOD PUMPING STATION UPGRADE

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, December 22, 2005.

B2.2 Bid Submissions determined by the Manager of Materials to have been received later than the Submission Deadline will not be accepted and will be returned upon request.

B2.3 The Contract Administrator or the Manager of Materials may extend the Submission Deadline by issuing an addendum at any time prior to the time and date specified in B2.1.

B3. SITE INVESTIGATION

B3.1 Further to GC:3.1, the Bidder may view the Site without making an appointment.

B3.2 The Bidder is advised that the Site should be viewed to identify any Site restrictions that could impede the Work progress.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D3.1.

B4.2 If the Bidder finds errors, discrepancies or omissions in the Bid Opportunity, or is unsure of the meaning or intent of any provision therein, the Bidder shall notify the Contract Administrator of the error, discrepancy or omission, or request a clarification as to the meaning or intent of the provision at least five (5) Business Days prior to the Submission Deadline.

B4.3 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator to all Bidders by issuing an addendum.

B4.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator only to the Bidder who made the enquiry.

B4.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B4 unless that response or interpretation is provided by the Contract Administrator in writing.

B5. ADDENDA

B5.1 The Contract Administrator may, at any time prior to the Submission Deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.

B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B5.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt.

B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet Site for addenda shortly before submitting his Bid.

B5.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6. SUBSTITUTES

B6.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:

(a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;

(b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;

(c) identify any anticipated cost or time savings that may be associated with the substitute;

(d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed Work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;

(e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed Work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.

B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an “approved equal” or as an “approved alternative”, or may refuse to grant approval of the substitute.

B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.

B6.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.

B6.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative shall base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B15.

B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B7. BID SUBMISSION

B7.1 The Bid Submission consists of the following components:

(a) Form A: Bid;

(b) Form B: Prices;

(c) Form G1: Bid Bond and Agreement to Bond, or
Form G2: Irrevocable Standby Letter of Credit and Undertaking, or
a certified cheque or draft;

B7.2 All components of the Bid Submission shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely in ink, to constitute a responsive Bid.

B7.3 The Bid Submission shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B7.3.1 Samples or other components of the Bid Submission which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder’s Bid Submission.

B7.4 Bid Submissions submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.5 Bid Submissions shall be submitted to:

The City of Winnipeg
Corporate Finance Department
Materials Management Branch
185 King Street, Main Floor
Winnipeg MB R3B 1J1

B8. BID

B8.1 The Bidder shall complete Form A: Bid, making all required entries.

B8.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in his own name, his name shall be inserted;

(b) if the Bidder is a partnership, the full name of the partnership shall be inserted;

(c) if the Bidder is a corporation, the full name of the corporation shall be inserted;

(d) if the Bidder is carrying on business under a name other than his own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.

B8.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B8.2.

B8.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

B8.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in his own name, it shall be signed by the Bidder;

(b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;

(c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;

(d) if the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

B8.4.1 The name and official capacity of all individuals signing Form A: Bid shall be printed below such signatures.

B8.4.2 All signatures shall be original and shall be witnessed except where a corporate seal has been affixed.

B8.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid Submission and the Contract, when awarded, shall be both joint and several.

B9. PRICES

B9.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

B9.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.

B9.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.

B10. QUALIFICATION

B10.1 The Bidder shall:

(a) undertake to be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba;

(b) be responsible and not be suspended, debarred or in default of any obligation to the City;

(c) be financially capable of carrying out the terms of the Contract;

(d) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract;

(e) have successfully carried out Work, similar in nature, scope and value to the Work;

(f) employ only Subcontractors who:

(i) are responsible and not suspended, debarred or in default of any obligation to the City (a list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt); and

(ii) have successfully carried out Work similar in nature, scope and value to the portion of the Work proposed to be subcontracted to them, and are fully capable of

performing the Work required to be done in accordance with the terms of the Contract;

(g) have a written Workplace safety and health program in accordance with The Workplace Safety and Health Act (Manitoba);

B10.2 Further to B10.1(g), the Bidder shall, within three (3) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder has a Workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

(a) a valid COR certification number under the Certificate of Recognition (COR) Program - Option 1 administered by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or

(b) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association; or

(c) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt.)

B10.3 The Bidder shall be prepared to submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B10.4 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B11. BID SECURITY

B11.1 The Bidder shall provide bid security in the form of:

(a) a bid bond, in the amount of at least ten percent (10%) of the Total Bid Price, and agreement to bond of a company registered to conduct the business of a surety in Manitoba, in the form included in the Bid Submission (Form G1: Bid Bond and Agreement to Bond); or

(b) an irrevocable standby letter of credit, in the amount of at least ten percent (10%) of the Total Bid Price, and undertaking issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form included in the Bid Submission (Form G2: Irrevocable Standby Letter of Credit and Undertaking); or

(c) a certified cheque or draft payable to "The City of Winnipeg", in the amount of at least fifty percent (50%) of the Total Bid Price, drawn on a bank or other financial institution registered to conduct business in Manitoba.

B11.1.1 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

B11.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

B11.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B11.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B11.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B11.3 The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

B12.1 Bid Submissions will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Branch, or in such other office as may be designated by the Manager of Materials.

B12.1.1 Bidders or their representatives may attend.

B12.1.2 Bid Submissions determined by the Manager of Materials, or his designate, to not include the bid security specified in B11 will not be read out.

B12.2 After the public opening, the names of the Bidders and their Total Bid Prices as read out (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt.

B12.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract Amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt.

B12.4 The Bidder is advised that any information contained in any Bid Submission may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B13. IRREVOCABLE BID

B13.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.

B13.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

B14. WITHDRAWAL OF BIDS

B14.1 A Bidder may withdraw his Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B14.1.1 Notwithstanding GC:23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B14.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

B14.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials shall:

(a) retain the Bid Submission until after the Submission Deadline has elapsed;

(b) open the Bid Submission to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and

(c) if the notice has been given by any one of the persons specified in B14.1.3(b), declare the Bid withdrawn.

B14.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B13.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

B15. EVALUATION OF BIDS

B15.1 Award of the Contract shall be based on the following bid evaluation criteria:

(a) compliance by the Bidder with the requirements of the Bid Opportunity (pass/fail);

(b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B10 (pass/fail);

(c) Total Bid Price;

(d) economic analysis of any approved alternative pursuant to B6.

B15.2 Further to B15.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid Submission is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements if the interests of the City so require.

B15.3 Further to B15.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid Submission or in other information required to be submitted, that he is responsible and qualified.

B15.4 Further to B15.1(c), the Total Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.

B15.4.1 If there is any discrepancy between the Total Bid Price written in figures, the Total Bid Price written in words and the sum of the quantities multiplied by the unit prices for each item, the sum of the quantities multiplied by the unit prices for each item shall take precedence.

B16. AWARD OF CONTRACT

B16.1 The City will give notice of the award of the Contract by way of a letter of intent, or will give notice that no award will be made.

B16.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.

B16.2.1 Without limiting the generality of B16.2, the City will have no obligation to award a Contract where:

(a) the prices exceed the available City funds for the Work;

(b) the prices are materially in excess of the prices received for similar Work in the past;

(c) the prices are materially in excess of the City's cost to perform the Work, or a significant portion thereof, with its own forces;

(d) only one Bid is received; or

(e) in the judgment of the Award Authority, the interests of the City would best be served by not awarding a Contract.

B16.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid.

PART C - GENERAL CONDITIONS

C1. GENERAL CONDITIONS

C1.1 The *General Conditions for Construction Contracts* (Revision 2000 11 09) are applicable to the Work of the Contract.

C1.1.1 The *General Conditions for Construction Contracts* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

D1.1 In addition to the *General Conditions for Construction Contracts*, these Supplemental Conditions are applicable to the Work of the Contract.

D1.2 The General Conditions are amended by striking out “The City of Winnipeg Act” wherever it appears in the General Conditions and substituting “The City of Winnipeg Charter”.

D1.3 The General Conditions are amended by striking out “Tender Package” wherever it appears in the General Conditions and substituting “Bid Opportunity”.

D1.4 The General Conditions are amended by striking out “Tender Submission” wherever it appears in the General Conditions and substituting “Bid Submission”.

D1.5 The General Conditions are amended by deleting GC:6.16 and GC:6.17. The City of Winnipeg is now within the jurisdiction of the Manitoba Ombudsman pursuant to The Ombudsman Act.

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of but is not limited, to the following

- Construction of riverbank stability improvement Works consisting of rockfill columns and riprap erosion protection. Installation of erosion control measures for the riverbank related activities
- Upgrade of outfall pipe from the gate chamber to the river. The pipe upgrade includes an HDPE liner from the gate chamber to the point of the existing pipe collapse
- Removal and replacement of concrete approach slab and curbs
- Construction of a concrete flood pump chamber and interconnecting concrete box culverts between the existing gate chamber and the new flood pump chamber.
- Installation of two 50 cfs submersible Flygt propeller pumps and supply and installation of associated electrical controls.
- Modifications to the existing gate chamber to accommodate the transfer of runnoff discharge to the flood pump station and return to the gate chamber at the outfall.
- Concrete surface repairs to locally spalled areas within existing gate chamber.
- Installation of a new flap gate and thimble and a new slide gate, thimble and operator in the modified gate chamber
- Supply and installation of miscellaneous metal components (hatch covers, ladders, trashracks, etc.)
- Construction of a new electrical room addition to the existing sanitary lift station
- Architectural improvements to the combined flood pump station / sanitary lift station including stone cladding and a metal roof over the sanitary lift station

- The electrical and instrumentation portion of this Works consists of the following:

  - Supply and install a new 800 A MDP-1 with all associated accessories, hardware and breakers.
  - Provide all required co-ordination with Manitoba Hydro for the service entrance upgrade (Hydro contribution costs shall be paid by City)
  - Supply and install two new 220 HP soft starters
  - Supply and install the new ultrasonic level controls with all required mounting equipment, accessories and pipe.
  - Supply and install all required phone connection equipment. Co-ordinate phone requirements for SCADA system with City.
  - Supply and install all new sub-distribution equipment and miscellaneous electrical including the transformer, distribution panel 'A', lights and plugs, etc.
  - Supply and install all required shop manufactured pump control cabinets with all accessories as shown in the drawings. (Flygt pump monitors provided by City).
  - Supply and install all required power and controls for the new supply fan.
  - Supply and install new surface mount force-flow heater.
  - Supply and install all required equipment to provide alarms as shown for the City SCADA system. Co-ordinate with the City to install the SCADA pack.
  - Co-ordinate and supply and install all required equipment to transfer the existing SPS Building service over to the MDP.
  - Provide commissioning for new system and support to City during Scada commissioning.

D2.2 Two related contracts for the Hawthorne Flood Pumping Station have been previously awarded as follows:

(a) Bid Opportunity No. 647-2005 "Supply and Delivery of Control Gates for Hawthorne Flood Pump Station" awarded to Mueller Flow Control. The scope of the contract includes support during installation and testing of the gates.

(b) Bid Opportunity No. 660-2005 "Supply and Delivery of Propeller Pumps for Hawthorne Flood Pump Station" awarded to ITT Flygt. The scope of the contract includes supply and delivery of the pump discharge pipes and monitoring equipment as well as support during installation and commissioning of the pumps.

D2.3 The Bid Opportunity documents for previous contracts are available on the Public / Posted Opening & Award Results page at the City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt.

D2.4 The Contractor shall be responsible for the installation, co-ordination, testing and commissioning of the equipment to be supplied under the supply contracts. The installation shall be in accordance with the manufacturer's installation requirements.

D3. CONTRACT ADMINISTRATOR

D3.1 The Contract Administrator is KGS Group, represented by:

Roy Houston, P.Eng.
Manager of Civil/Municipal Services
3rd Flood – 865 Waverley Street, Winnipeg, Manitoba, R3T 5P4

Telephone No. (204) 896-1209
Facsimile No. (204) 896-0754

D3.2 At the pre-construction meeting, Mr. Houston will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D4. CONTRACTOR'S SUPERVISOR

D4.1 At the pre-construction meeting, the Contractor shall identify his designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D5. NOTICES

D5.1 Except as provided for in GC:23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D5.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D5.3, D5.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D3.1.

D5.3 All notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following address or facsimile number:

The City of Winnipeg
Chief Administrative Officer Secretariat
Administration Building, 3rd Floor
510 Main Street
Winnipeg MB R3B 1B9

Facsimile No.: (204) 949-1174

D5.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

The City of Winnipeg
Corporate Services Department
Legal Services Division
185 King Street, 3rd Floor
Winnipeg MB R3B 1J1

Facsimile No.: (204) 947-9155

D6. FURNISHING OF DOCUMENTS

D6.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

SUBMISSIONS

D7. SAFE WORK PLAN

D7.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D7.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg,

Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt.

D8. INSURANCE

D8.1 The Contractor shall provide and maintain the following insurance coverage:

(a) commercial general liability insurance, in the amount of at least five million dollars ($5,000,000.00) all inclusive, with The City of Winnipeg being added as an additional insured, with a cross-liability clause, such liability policy to also contain a contractual liability, an unlicensed motor vehicle liability and a products and completed operations endorsement to remain in place at all times during the performance of the Work and throughout the warranty period;

(b) automobile liability insurance for owned and non-owned automobiles used for or in connection with the Work in the amount of at least two million dollars ($2,000,000.00) at all times during the performance of the Work and until the date of Total Performance;

(c) all risks course of construction insurance in the amount of one hundred percent (100%) of the total Contract Price, written in the name of the Contractor and The City of Winnipeg, at all times during the performance of the Work and until the date of Total Performance.

D8.2 Deductibles shall be borne by the Contractor.

D8.3 The Contractor shall provide the City Solicitor with a certificate of insurance of each policy, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D8.3.1 The certificate of insurance for the commercial general liability insurance must clearly state "operations to include demolition Work".

D8.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator.

D9. PERFORMANCE SECURITY

D9.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

(a) a performance bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H1: Performance Bond), in the amount of fifty percent (50%) of the Contract Price; or

(b) an irrevocable standby letter of credit issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form attached to these Supplemental Conditions (Form H2: Irrevocable Standby Letter of Credit), in the amount of fifty percent (50%) of the Contract Price; or

(c) a certified cheque or draft payable to “The City of Winnipeg”, drawn on a bank or other financial institution registered to conduct business in Manitoba, in the amount of fifty percent (50%) of the Contract Price.

D9.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D9.2 If the bid security provided in his Bid Submission was not a certified cheque or draft pursuant to B11.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of

intent and prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D10. SUBCONTRACTOR LIST

D10.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D11. EQUIPMENT LIST

D11.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D12. DETAILED WORK SCHEDULE

D12.1 The Contractor shall provide the Contract Administrator with a detailed Work schedule at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D12.2 The detailed Work schedule shall consist of the following:

(a) a critical path method (C.P.M.) schedule for the Work;

(b) a Gantt chart for the Work based on the C.P.M. schedule;

(c) a daily manpower schedule for the Work;

all acceptable to the Contract Administrator.

D12.3 Further to D12.2(a), the C.P.M. schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:

(a) Geotechnical / River Bank Stability

(b) Outfall Improvements

(c) Civil / Structural – Flood Pump Station

(d) Civil / Structural - Gate Chamber

(e) Civil / Structural – Control Gates

(f) Electrical Room Addition and Building Modifications

(g) Electrical – Equipment Installation

(h) Electrical – Hydro Service transfer from existing

(i) Electrical – Commissioning of Controls

(j) Mechanical – Propeller Pump Installation

(k) Mechanical – Dewatering Pump (piping, rails, etc.)

(l) Mechanical - Ventilation

D12.4 Further to D12.2(b), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

D12.5 Further to D12.2(c), the daily manpower schedule shall list the daily number of individuals on the Site for each trade.

D13. SECURITY CLEARANCE

D13.1 Each individual proposed to perform the following portions of the Work:

(a) Bank stabilization activities on private property.

shall be required to obtain a Criminal Record Search Certificate from the police service having jurisdiction at his place of residence.

D13.2 Prior to the commencement of any Work, and during the term of the Contract if additional or replacement individuals are proposed to perform Work, the Contractor shall supply the Contract Administrator with a Criminal Record Search Certificate obtained not earlier than one (1) year prior to the Submission Deadline, or a certified true copy thereof, for each individual proposed to perform Work within City facilities or on private property.

D13.3 Any individual for whom a Criminal Record Search Certificate is not provided, or for whom a Criminal Record Search Certificate indicates any convictions or pending charges related to property offences or crimes against another person, will not be permitted to perform any Work on private property.

D13.4 Any Criminal Record Search Certificate obtained thereby will be deemed valid for the duration of the Contract subject to a repeated records search as hereinafter specified.

D13.5 Notwithstanding the foregoing, at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated criminal records search. Any individual who fails to provide a satisfactory Criminal Record Search Certificate as a result of a repeated criminal records search will not be permitted to continue to perform Work under the Contract within City facilities or on private property.

SCHEDULE OF WORK

D14. COMMENCEMENT

D14.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D14.2 The Contractor shall not commence any Work on the Site until:

(a) the Contract Administrator has confirmed receipt and approval of:

(i) evidence that the Contractor is in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba;

(ii) evidence of the Workers compensation coverage specified in GC:6.14;

(iii) the Safe Work Plan specified in D7;

(iv) evidence of the insurance specified in D8;

(v) the performance security specified in D9;

(vi) the Subcontractor list specified in D10;

(vii) the equipment list specified in D11;

(viii) the detailed Work schedule specified in D12; and

(ix) the security clearances specified in D13.

(b) the Contractor has attended a pre-construction meeting with the Contract Administrator, or the Contract Administrator has waived the requirement for a pre-construction meeting.

D14.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

D14.4 The City intends to award this contract by January 13, 2006.

D15. CRITICAL STAGES

D15.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

(a) Gate chamber complete by March 31, 2006

(b) Riprap and Rockfill Column Works complete by March 31, 2006.

(c) Control gate thimbles (supplied by others) will be available for delivery to Hawthorne Flood Pump Station by February 21, 2006.

(d) Control gates and all remaining gate components (supplied by others) will be available for delivery to Hawthorne Flood Pump Station by March 24, 2006.

(e) Propeller pump discharge pipes (supplied by others) shall be available for delivery to Hawthorne Flood Pump Station by January 15, 2006.

(f) Propeller pumps (supplied by others) shall be available for delivery to Hawthorne Flood Pump Station by April 7, 2006.

(g) Pumping station complete by April 15, 2006

D16. SUBSTANTIAL PERFORMANCE

D16.1 The Contractor shall achieve Substantial Performance by April 15, 2006 .

D16.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D16.3 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a certificate of Substantial Performance is the date on which Substantial Performance has been achieved.

D17. TOTAL PERFORMANCE

D17.1 The Contractor shall achieve Total Performance by June 15, 2006 .

D17.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D17.3 The date on which the Work has been certified by the Contract Administrator as being totally performed to the requirements of the Contract through the issue of a certificate of Total Performance is the date on which Total Performance has been achieved.

D18. LIQUIDATED DAMAGES

D18.1 If the Contractor fails to achieve Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for Substantial Performance or Total Performance, the Contractor shall pay the City the following per Business Day for each and every Business Day following the days fixed herein for Substantial Performance or Total Performance during which such failure continues.

(a) Substantial Performance – One Thousand Dollars ($1,000.00)

(b) Total Performance – Five Hundred Dollars ($500.00)

D18.2 The amount specified for liquidated damages in D18.1 is based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve Substantial Performance or Total Performance Substantial Performance or Total Performance by the days fixed herein for same.

D18.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

CONTROL OF WORK

D19. JOB MEETINGS

D19.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

D19.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D20. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D20.1 Further to GC:6.26, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

FORM H1: PERFORMANCE BOND
(See D9)

KNOW ALL MEN BY THESE PRESENTS THAT

_____
(hereinafter called the "Principal"), and

_____ ,
(hereinafter called the "Surety"), are held and firmly bound unto **THE CITY OF WINNIPEG** (hereinafter called the "Obligee"), in the sum of

_____

_____ dollars ($_____.____)

of lawful money of Canada to be paid to the Obligee, or its successors or assigns, for the payment of which sum the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has entered into a written contract with the Obligee dated the

_____ day of _____ , 20____ , for:

BID OPPORTUNITY NO. 705-2005

HAWTHORNE FLOOD PUMPING STATION UPGRADE

which is by reference made part hereof and is hereinafter referred to as the “Contract”.

NOW THEREFORE the condition of the above obligation is such that if the Principal shall:

(a) carry out and perform the Contract and every part thereof in the manner and within the times set forth in the Contract and in accordance with the terms and conditions specified in the Contract;
(b) perform the Work in a good, proper, Workmanlike manner;
(c) make all the payments whether to the Obligee or to others as therein provided;
(d) in every other respect comply with the conditions and perform the covenants contained in the Contract; and
(e) indemnify and save harmless the Obligee against and from all loss, costs, damages, claims, and demands of every description as set forth in the Contract, and from all penalties, assessments, claims, actions for loss, damages or compensation whether arising under "The Workers Compensation Act", or any other Act or otherwise arising out of or in any way connected with the performance or non-performance of the Contract or any part thereof during the term of the Contract and the warranty period provided for therein;

THEN THIS OBLIGATION SHALL BE VOID, but otherwise shall remain in full force and effect. The Surety shall not, however, be liable for a greater sum than the sum specified above.

AND IT IS HEREBY DECLARED AND AGREED that the Surety shall be liable as Principal, and that nothing of any kind or matter whatsoever that will not discharge the Principal shall operate as a discharge or release of liability of the Surety, any law or usage relating to the liability of Sureties to the contrary notwithstanding.

IN WITNESS WHEREOF the Principal and Surety have signed and sealed this bond the

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

By: _____ (Seal)
(Attorney-in-Fact)

FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)
(See D9)

_____
(Date)

The City of Winnipeg
Corporate Services Department
Legal Services Division
185 King Street, 3rd Floor
Winnipeg MB R3B 1J1

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 705-2005

HAWTHORNE FLOOD PUMPING STATION UPGRADE

Pursuant to the request of and for the account of our customer,

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

WE HEREBY ESTABLISH in your favour our irrevocable Standby Letter of Credit for a sum not exceeding in the aggregate

_____

_____ Canadian dollars.

This Standby Letter of Credit may be drawn on by you at any time and from time to time upon written demand for payment made upon us by you. It is understood that we are obligated under this Standby Letter of Credit for the payment of monies only and we hereby agree that we shall honour your demand for payment without inquiring whether you have a right as between yourself and our customer to make such demand and without recognizing any claim of our customer or objection by the customer to payment by us.

The amount of this Standby Letter of Credit may be reduced from time to time only by amounts drawn upon it by you or by formal notice in writing given to us by you if you desire such reduction or are willing that it be made.

Partial drawings are permitted.

We engage with you that all demands for payment made within the terms and currency of this Standby Letter of Credit will be duly honoured if presented to us at:

_____
(Address)

and we confirm and hereby undertake to ensure that all demands for payment will be duly honoured by us.

All demands for payment shall specifically state that they are drawn under this Standby Letter of Credit.

Subject to the condition hereinafter set forth, this Standby Letter of Credit will expire on

_____ .
(Date)

It is a condition of this Standby Letter of Credit that it shall be deemed to be automatically extended from year to year without amendment from the present or any future expiry date, unless at least 30 days prior to the present or any future expiry date, we notify you in writing that we elect not to consider this Standby Letter of Credit to be renewable for any additional period.

This Standby Letter of Credit may not be revoked or amended without your prior written approval.

This credit is subject to the Uniform Customs and Practice for Documentary Credit (1993 Revision), International Chamber of Commerce Publication Number 500.

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM J: SUBCONTRACTOR LIST
(See D10)

HAWTHORNE FLOOD PUMPING STATION UPGRADE

Name	Address

FORM K: EQUIPMENT
(See D11)

HAWTHORNE FLOOD PUMPING STATION UPGRADE

1. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

2. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

3. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

FORM K: EQUIPMENT
(See D11)

HAWTHORNE FLOOD PUMPING STATION UPGRADE

4. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

5. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

6. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.

E1.1.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at http://www.winnipeg.ca/matmgt.

E1.1.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.

E1.1.3 Further to GC:2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.2 The following Drawings are applicable to the Work:

Drawing No.	Drawing Name/Title
Municipal	
705-2005-Drawing_00-R0	Cover Sheet
705-2005-Drawing_LD-3238-R0	Hawthorne Avenue Outfall (RR-98)
705-2005-Drawing_LD-3239-R0	Debris Grate Details
705-2005-Drawing_LD-3240-R0	Silt Fence Details
Geotechnical	
705-2005-Drawing_LD-3241-R0	Existing Site Plan
705-2005-Drawing_LD-3242-R0	Shoreline Protection Plan
705-2005-Drawing_LD-3243-R0	Shoreline Protection Plan Sections A and B
Structural	
705-2005-Drawing_LD-3244-R0	Structural General Arrangement
705-2005-Drawing_LD-3245-R0	Structural – Superstructure Elevations & Details
705-2005-Drawing_LD-3246-R0	Structural – Substructure Elevations & Details
705-2005-Drawing_LD-3247-R0	Structural – Substructure Sections & Details
705-2005-Drawing_LD-3248-R0	Structural – Substructure Sections & Details
705-2005-Drawing_LD-3249-R0	Structural - Misc. Metal Details
705-2005-Drawing_LD-3250-R0	Structural - Misc. Metal Details
705-2005-Drawing_LD-3251-R0	Structural – Substructure Reinforcing Details
705-2005-Drawing_LD-3252-R0	Structural – Substructure Reinforcing Details
705-2005-Drawing_LD-3253-R0	Structural – Substructure Reinforcing Details
Mechanical	
705-2005-Drawing_LD-3254-R0	Mechanical Details
Electrical	
705-2005-Drawing_LD-3255-R0	Electrical Site Plan
705-2005-Drawing_LD-3256-R0	Electrical Single Line Diagram
705-2005-Drawing_LD-3257-R0	Electrical Flood Pump – FP-1 Schematics and Wiring Diagram
705-2005-Drawing_LD-3258-R0	Electrical Flood Pump – FP-3 Schematics and Wiring Diagram
705-2005-Drawing_LD-3259-R0	Electrical Control Indication and Alarm Schematics and Wiring Diagram
705-2005-Drawing_LD-3260-R0	Electrical Power and Lighting
705-2005-Drawing_LD-3260A-R0	Electrical – Miscellaneous Electrical Details

E2. OFFICE FACILITIES

E2.1 The Contractor shall supply office facilities meeting the following requirements:

(a) The field office shall be for the exclusive use of the Contract Administrator.

(b) The building shall be conveniently located near the Site of the Work.

(c) The building shall have a minimum floor area of 25 square metres, two windows for cross ventilation and a door entrance with a suitable lock.

(d) The building shall be suitable for all weather use. It shall be equipped with an electric heater and air conditioner so that the room temperature can be maintained between either 16-18^{o}C or 24-25 ^{o}C.

(e) The building shall be adequately lighted with fluorescent fixtures and have a minimum of three wall outlets.

(f) The building shall be furnished with two desks, two drafting tables, table 3m X 1.2m, one stool, one four drawer legal size filing cabinet, and a minimum of 12 chairs.

(g) A portable toilet shall be located near the field office building. The toilet shall have a locking door and be for the exclusive use of the Contract Administrator and other personnel from the City.

(h) The field office building and the portable toilet shall be cleaned on a weekly basis immediately prior to each Site meeting. The Contract Administrator may request additional cleaning when he deems it necessary.

E2.2 The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the office facilities.

E2.3 The office facilities will be provided from the date of the Commencement of the Work until Total Performance.

E3. GEOTECHNICAL INFORMATION

E3.1 Further to GC:3.1, of the General Conditions, geotechnical test holes have been drilled in the vicinity of the proposed Works to determine the character of the subsurface soil to facilitate the design of the Work. The information is considered accurate at the locations indicated and at the time of the investigation. However, considerable variations in the soil conditions may exist between test holes and fluctuations in ground water levels can be expected seasonally. Test hole logs are included.

E3.2 Bidders are responsible for any interpretation they place on the supplied information and are expected to make such additional investigation of the soil as they feel necessary to satisfy themselves.

E3.3 Any test borings made by the Bidder shall be done in accordance with the requirements of the appropriate authority of the City of Winnipeg. Bidders shall notify the Contract Administrator prior to starting any soil boring operation.

E4. DANGEROUS WORK CONDITIONS

E4.1 Further to clause GC 6.26 of the General Conditions, the Contractor shall be aware that underground chambers, manholes, and sewers are considered a confined space and shall follow the "Guidelines for confined Entry Work" as published by the Manitoba Workplace Safety and Health Division.

E4.2 The Contractor shall be aware of the potential hazards that can be encountered in gate chambers, manholes and sewers such as explosive gases, toxic gases and oxygen deficiency.

E4.3 The air in a confined space must be tested before entry and continuously during the time that personnel are inside the space. Equipment for continuous monitoring of gases must be explosion-proof and equipped with a visible and audible alarm. The principal tests are for oxygen deficiency, explosion range and toxic gases. Testing equipment must be calibrated in accordance with manufacturer's specifications.

E4.4 The Contractor shall ventilate all confined spaces including underground chambers, tunnels, pipes and shafts as required and approved by the Manitoba Workplace Safety and Health Act (the “Act”). If no ventilation is supplied, a Worker must wear a respirator or supplied air to enter the confined space.

E4.5 Workers must wear a respirator or supplied air at all times when entering a chamber, manhole or sewer where live sewage is present.

E4.6 The Contractor shall provide a photoionization detector (PID) on Site at all times to monitor potential hydrocarbon vapours in the confined spaces. The gas detector and safety equipment conforming to the Act shall be made available to the Contract Administrator for his use during inspections. In addition, the Contract Administrator shall collect discrete air samples for laboratory analysis.

E4.7 The Contract Administrator may issue a Stop Work order to the Contractor if the above guidelines are not being followed. The Contractor shall not resume his operations until the Contract Administrator is satisfied the Contractor is following the appropriate procedures. The Contractor shall have no claim for extra time or costs due to the Stop Work order for not following these safety guidelines.

E5. MOBILIZATION AND DEMOBILIZATION

E5.1 Mobilization and demobilization will include but not be limited to start-up costs, equipment setup and removal, field office and storage facilities set-up and removal and Site cleanup.

E5.2 Mobilization and demobilization will be measured on a unit basis and paid for at the Contract Unit Price for “Mobilization and Demobilization” in accordance with this specification, accepted and measured by the Contract Administrator.

E5.3 50% of the Mobilization and Demobilization unit price will be paid on the first progress payment.

E5.4 The remaining 50% of the Mobilization and Demobilization unit price will be paid subsequent to the completion of the Work and restoration and clean up of the Site.

E6. PROTECTION OF EXISTING TREES

E6.1 Do not remove existing trees and take the following precautionary steps to avoid damage from construction activities to existing trees within the limits of the construction area.

E6.1.1 Do not stockpile materials and soil or park vehicles and equipment within 2 metres of trees.

E6.1.2 Strap mature tree trunks with 25 x 150 x 2400 wood planks. Smaller trees shall be similarly protected using appropriately sized wood planks.

E6.1.3 Excavations shall be carried out in a manner to minimize damage to existing root systems. Where roots must be cut to facilitate an excavation they shall be neatly pruned at the face of the excavation.

E6.1.4 Work on Site shall be carried out in a manner to minimize damage to existing tree branches. Where damage to tree branches does occur, the Contractor shall neatly prune the damaged branch.

E6.1.5 American elm trees shall not be pruned between April 1st and August 1st and Siberian elm trees between April 1st and July 1st of any year under provisions of The Dutch Elm Disease Act.

E6.2 All damage to existing trees due to construction activities shall be repaired to the equirements and satisfaction of the City of Winnipeg, Public Works Department, Forestry Branch at the Contractor's expense.

E6.3 Costs for protection of trees will be included in gate chamber construction.

E7. WATERWAY BY-LAW AND PERMITS

E7.1 The Contractor shall note that all Works fall within 107 metres (350 feet) of the regulated summer water level of the Red River and are therefore within the jurisdiction of the Waterway By-law. The Contract Administrator will apply and pay for the required Waterway Permits for the permanent Work. The Contractor shall adhere to restrictions imposed by the permit.

E7.2 The Contractor shall be responsible to apply and pay for a Waterway Permit for all temporary Works including construction access ramps as outlined in E10.3.

E7.3 Under no circumstances will stockpiling of any material be permitted within 107 metres of the regulated summer water level of the Red River.

E7.4 The Contractor Administrator will apply and pay for the building permit and the conditional use permit.

E8. SHOP DRAWINGS

E8.1 Description

(a) This Specification shall revise, amend and supplement the requirements of CW 1100.

(i) The term 'shop drawings' means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, including Site erection drawings which are to be provided by the Contractor to illustrate details of a portion of the Work.

(ii) The Contractor shall submit specified shop drawings to the Contract Administrator for review. All submissions must be in metric units. Where data is in imperial units, the correct metric equivalent shall also be show on all submissions for Engineering review.

(b) Shop Drawings

(i) Original drawings are to be prepared by Contractor, SubContractor, Supplier, Distributor, or Manufacturer, which illustrate appropriate portion of Work; showing fabrication, layout, setting or erection details as specified in appropriate sections.

(ii) Shop drawings for the following structural components shall bear the seal of a registered Contract Administrator of Manitoba.

(a) Shoring.
(b) Reinforcing steel.
(c) Metal Fabrications.

(c) Contractor's Responsibilities

(i) Review shop drawings, product data and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.

(ii) Verify:

(a) Field Measurements
(b) Field Construction Criteria
(c) Catalogue numbers and similar data

(iii) Coordinate each submission with requirements of Work and Contract Documents. Individual shop drawings will not be reviewed until all related drawings are available.

(iv) Notify Contract Administrator, in writing at time of submission, of deviations from requirements of Contract Documents.

(v) Responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator's review of submission, unless Contract Administrator gives written acceptance of specified deviations.

(vi) Responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.

(vii) The Contractor shall make any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.

(viii) After Contract Administrator's review and return of copies, distribute copies to subtrades as appropriate.

(ix) Maintain one (1) complete set of reviewed shop drawings, filed by Specification Section Number, at the Site of the Work for use and reference of the Contract Administrator and SubContractors.

(d) Submission Requirements

(i) Schedule submissions at least 14 Calendar Days before dates reviewed submissions will be needed, and allow for a 14 Calendar Day period for review by the Contract Administrator of each individual submission and re-submission, unless noted otherwise in the Contract Documents.

(ii) Submit five (5) paper prints of shop drawings. The Contractor is advised that the Contract Administrator will retain three (3) copies of all submittals and return two (2) copies to the Contractor.

(iii) Accompany submissions with transmittal letter, containing:
(a) Date
(b) Project title and Bid Opportunity number
(c) Contractor's name and address
(d) Number of each shop drawing, product data and sample submitted
(e) Specification Section, Title, Number and Clause
(f) Drawing Number and Detail/Section Number
(g) Other pertinent data

(iv) Submissions shall include:
(a) Date and revision dates.
(b) Project title and Bid Opportunity number.
(c) Name of:
(a) Contractor
(b) SubContractor
(c) Supplier
(d) Manufacturer
(e) Separate detailer when pertinent
(d) Identification of product of material.
(e) Relation to adjacent structure or materials.
(f) Field dimensions, clearly identified as such.

(g) Specification section name, number and clause number or drawing number and detail/section number.
(h) Applicable standards, such as CSA or CGSB numbers.
(i) Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.

(e) Other Considerations

(i) Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.

(ii) Material and equipment delivered to the Site of the Works will not be paid for at least until pertinent shop drawings have been submitted and reviewed.

(iii) Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.

(iv) No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions and review of shop drawings.

E9. FLOW CONTROL

E9.1 During winter months land drainage and storm relief sewers can receive flow of an undetermined amount from groundwater infiltration, watermain breaks, snow melt and other unforeseen sources.

E9.2 Provide flow control measures to contend with and maintain flow in the land drainage and storm relief sewers that are directed to the location where gate chambers are being modified. Flow control measures shall include but not be limited to diversions, flumes and by-pass pumping. A temporary bulkhead across the new slide gate opening will be required during construction until the new slide gate is installed.

E9.3 Discharge hoses for by-pass pumping shall not be laid across vehicle or pedestrian traffic areas and must be protected from freezing during winter months. Pumping equipment if used, shall be set-up in a location and in such a way to not be a noise problem for nearby residences

E9.4 Provide a flow control plan to the Contract Administrator for review before removing any existing sewer pipe or gate chamber concrete.

E9.5 Costs for flow control will be included in gate chamber concrete construction.

E9.6 In the event the river level becomes higher than the gate chamber activation level and flow in the sewer system is expected to exceed the sewer capacity due to spring runoff, the Contract Administrator may suspend Work activities that require temporary by-pass pumping and temporary shutdown of the Site. Suspension of these activities will continue until the river level drops below flood pumping activation level and the high flow diminishes in the sewer.

E9.7 If in the opinion of the Contract Administrator suspension of Work activities that require temporary by-pass pumping and temporary shutdown of the Site may cause a delay in completion of the Work through no fault of the Contractor, the completion date of the Work will be adjusted accordingly.

E9.8 The Contractor shall ensure that the existing slide gate remains accessible and operational during construction. The Contractor shall not operate the existing slide gate unless approved by the Contract Adminstrator.

E10. SITE DEVELOPMENT AND RESTORATION

E10.1 Description

This Specification shall cover all aspects of the Site Development and restoration Work, including erection, maintenance and removal of safety fencing, sediment control Works, snow clearing, general access development, access maintenance and removal, and Site restoration.

E10.2 Materials

E10.2.1 Equipment

All equipment, implements, tools and facilities used shall be of a size and type as required to complete the Work in a reasonable time, approved by the Contract Administrator. The Contractor shall keep all equipment in good Working order, and have sufficient standby equipment available at all times, as required.

E10.3 Construction Methods

E10.3.1 Site and Construction Access

The Contractor shall be responsible to develop suitable Site access. This includes but is not limited to, temporary bridging over structures, temporary removal and reinstallation of safety fencing, any landscaping and grading repairs, restoration of vegetation, etc. necessary to restore any Site and construction access areas to their pre-existing condition.

All construction access ramps from the top bank area down to the edge of the river shall be constructed by excavating to the necessary ramp grade and disposing of the material off Site. Under no circumstances will the excavated material or any additional materials be placed as fill in the ramp area. Detailed construction access ramp drawings are to be submitted to the Contract Administrator for approval a minimum seven (7) days prior to any construction activity on Site.

The Contractor is responsible for obtaining and paying for all required permits and permissions that are necessary for Site access, including a Waterways Permit, if required by the City of Winnipeg. Contact Don Kingerski, P.Eng., Riverbank Management Contract Administrator at 986-5159 for information regarding Waterways Permits.

The locations of the Contractor's construction access ramps shall be restored to the same condition or better than it was prior to the initiation of any Work.

E10.3.2 Existing Patio at 1180 Kildonan Drive

The Contractor shall remove and reconstruct the existing patio at 1180 Kildonan Drive to a condition substantially which existed prior to construction. The existing condition of the Patio is shown on the photos included. All materials used for the reconstruction shall be new materials of a consistent size, type, and geometry as the existing patio. This shall include, but not limited to the timber retaining wall, concrete paving stone, limestone blocks, granular base, topsoil and sod.

E10.3.3 Existing Chain Link Fence

The existing chain link fence along the right-of-way shall be removed to permit construction of the permanent Works and reconstructed. New fence materials including wire mesh, posts, rails, fasteners, and any other required items shall be used for the reconstruction and shall be consistent with the existing fence.

E10.3.4 Frozen Waterways Permit

The Contractor is responsible for obtaining a Frozen Water Permit for permission to Work on the river ice. Contact the City of Winnipeg Police Service.

E10.3.5 Vegetation Removal

Some vegetation (small trees and sod) removal will be permitted in order to facilitate Site access. Existing vegetation shall not be removed without prior approval from the Contract Administrator. The Contractor shall load and haul any removed vegetation, and dispose of the material off Site immediately upon collection. Stockpiling shall not be permitted.

E10.3.6 Snow and Ice Removal

Snow cover shall be cleared from the riverbank and hauled off-site prior to placement of the rockfill riprap. The methodology to clear the snow shall be subject to the approval of the Contract Administrator.

Ice at the shoreline of the River shall be broken and cleared before the placement of riprap below ice level. Care shall be taken to ensure that the ice is removed, and does not become trapped below rockfill riprap placement.

E10.3.7 Safety Fence

The Contractor shall erect and maintain for the duration of the project, a safety fence acceptable to the Contract Administrator to restrict access to the Site. The fencing shall enclose the entire Site with appropriate gates or openings that are closed at the end of each Work day. Appropriate signs shall be erected to warn all recreational users of the river that an open water hazard exists. This shall include but not be limited to snowmobilers and skiers. The installed fencing shall consist of Dupont Number L70 orange plastic safety fence or approved equal, with a mesh spacing of 45 mm and a minimum height of 1.2 meters supported by steel posts driven into the ice surface. If ice conditions will not support the posts, temporary supports shall be provided. The steel posts shall be sized and capable of maintaining the snow fence material upright, regardless of conditions. Upon completion of the Work, the fence shall be removed and disposed of off Site.

E10.3.8 Environmental Regulations

(b) The Contractor shall adhere to all relevant Federal and Provincial environmental regulations.

(c) The Contractor shall plan to Work in accordance with the current environmental regulations of “Manitoba Stream Crossing Guidelines for Protection of Fish and Fish Habitat”, Fisheries and Oceans, and Manitoba Natural Resources.

(d) The Contractor shall supply, in writing, prior to commencement of Work on-site, a detailed plan for sediment control on this project.

(e) The Contractor shall ensure that a sufficient supply of suitable spill kits are on-site to cleanup minor spills, should they occur. The Contractor shall supply the name, address and phone number of a local supplier, where additional kits are available on short notice.

E10.3.9 General Site Cleanup and Restoration

All areas of the construction Site shall be restored to a condition at least equivalent to its original condition prior to initiation of Work. This may include, but is not necessarily limited to the Contractor’s lay down area, the removal of the Contract Administrator Site trailer, and removal of all temporary fencing.

E10.3.10 Topsoil and Sod

All topsoil and sodding Work within the limits of the right of way and rock column area shall be in accordance with E19. All other existing grassed areas disturbed by the Contractor during construction, which are not designated for construction of items to be permanently incorporated into the Work, shall be restored by the Contractor to existing condition or better using topsoil and sod at his own cost.

E10.4 Method of Measurement and Payment

Site Development and Restoration

The Site development and restoration will be measured and paid for at the Contract Lump Sum Price for "Site Development and Restoration", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E11. AUTHORIZED WORK ON PRIVATE PROPERTY

E11.1 Portions of the permanent Work must be performed on private property. The Contract Administrator will obtain permission for any permanent Work that must be performed at 1178 and 1180 Kildonan Drive.

E11.2 Further to GC 6.28, the Contractor shall confine his Works to the right-of-way or easements. Where Work is required to be done on private property other than specified in E11.1 the Contract Administrator will authorize such Work in writing after the Contractor has provided in writing to the Contract Administrator the permission of the affected property owner.

E12. OUTFALL SEWER REPAIRS

E12.1 Description

This Specification shall amend and supplement Standard Specifications CW 2130, CW 2160, and CW 3610.

The Work to be done by the Contract under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work hereinafter specified.

E12.2 Materials

E12.2.1 Handling and Storage of Materials

All materials shall be handled and stored in a careful and Workman-like manner, to the satisfaction of the Contract Administrator.

E12.2.2 Testing and Approval

All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the City for any materials supplied for testing purposes.

E12.2.3 Slip Joint

Shop drawings shall be submitted for all slip joints. The slip joint shall be installed as shown on the drawings. Galvanizing shall be hot-dip conforming to the requirements of CSA

G164-N1981, to a minimum net retention of 600g/m2. All bolts and nuts shall be galvanized steel conforming to ASTM A-325. All welding shall be fully approved by the Canadian Welding Bureau in conformance with CSA Standard W.47.1. Welding splatter and other fabricator burrs, where exposed, shall be ground off and/or field smooth, and left ready for subsequent operations. All miscellaneous metal, after fabrication, shall be hot-dip galvanized.

E12.2.4 Galvanized Primer

Galvanized primer for repair of damaged coating shall be zinc rich, ready mix to CGSB-1-GP-181M.

E12.2.5 Bedding and Backfill Material

Sand bedding and Modified Class 2 backfill material as per CW 2030, modified to have 0.6 m of compacted excavated Site select material as opposed to the detailed 0.3 m of compacted excavated material.

E12.2.6 CSP Outfall Pipe

Shall be the wall thickness as shown on the construction drawings, CSP as per Clause 5.3 of CW 3610.

E12.2.7 CSP Couplers, CSP Saddles and Concrete Transition Coupler

(a) Material for CSP to CSP connections shall conform to CSA Specification CAN3-G401. Standard or dimpled with bolt and angle attachments.

(b) Material for CSP saddle connections shall conform to CSA Specification CAN3-G401. Galvanized primer for repair of damaged coating shall be zinc rich, ready mix to CGSB-1-GP-181M.

(c) Material for concrete transition collars shall be in accordance with CW 2160 Type B concrete.

E12.2.8 Debris Grating

Shop drawings shall be submitted for the debris gratings and shall be installed as shown on the drawings. Galvanizing shall be hot-dip conforming to requirements of CSA G164-N1981 to a minimum net retention of 600g/m2. All bolts and nuts shall be typical steel, conforming to ASTM A-320 Grade B8M. All welding shall be fully approved by the Canadian Welding Bureau in conformance with CSA Standard W47.1. Welding shall be done by currently licensed welders only. Welding splatter and other fabricator burrs, where exposed, shall be ground off and/or filed smooth, and left ready for subsequent operations. All miscellaneous metal, after fabrication, shall be hot-dip galvanized. No separate measurement will be made for hot-dip galvanizing.

E12.2.9 Handrails and Pipe Sleeve

Shop drawings shall be submitted for the three-rail handrail and pipe sleeve and shall be installed as shown on the drawings. Galvanizing shall be hot-dip conforming to requirements of CSA G164-N1981 to a minimum net retention of 600g/m2. All bolts and nuts shall be type 316 stainless steel conforming to ASTM A-320 Grade B8M. All welding shall be fully approved by the Canadian Welding Bureau in conformance with CSA Standard W47.1. Currently licensed welders shall do the welding. Welding splatter and other fabricator burrs where exposed, shall be ground off and/or filed smooth, and left ready for subsequent operations. All miscellaneous metal, after fabrication, shall be hot-dip galvanized. No separate measurement will be made for hot-dip galvanizing.

E12.2.10 Equipment

All equipment, implements, tools and facilities used shall be of a size and type as required to complete the Work in a reasonable time, approved by the Contract Administrator. The Contractor shall keep all equipment in good Working order, and have sufficient standby equipment available at all times, as required.

E12.3 Construction Methods

E12.3.1 Bedding

Ensure bedding is thoroughly tamped and that the pipe is uniformly supported throughout and completed in accordance with CW 2030, unless otherwise indicated by the Contract Administrator.

E12.3.2 Backfill

Backfill around the pipe, in maximum 300-mm lifts, alternating from side to side. At no time should the difference in backfill elevation on either side of the pipe be greater than 450 mm. Work must be completed in accordance with CW 2030, unless otherwise indicated by the Contract Administrator.

Backfilling above the pipe shall be in accordance with CW 2030 for Modified Class 2 backfill. The top 600-mm of backfill is to be Site select excavated material, as approved on Site by the Contract Administrator, not the standard 300 mm excavated material. The Contractor shall ensure the compaction equipment utilized, is consistent with degree of compactive effort required to achieve the specified densities, and adequately protects against overloading the pipe.

E12.3.3 Excavation

Where construction operations are restricted by existing trees and structures, the minimum required trench width shall be dug and maintained using a wood or steel shoring, designed and sealed by a Structural Professional Engineer who is a member of the Association of Professional Engineers and Geoscientists of the Province of Manitoba (APEGM). The Contractor shall provide shop drawings to the Contract Administrator, for review, prior to the start of excavation. Design and construction of the trench structure shall be considered incidental to the cost of the pipe installation and no payment will be made for this Work. Work must be completed in accordance with CW 2030, unless otherwise indicated by the Contract Administrator.

The Contractor shall take precautionary steps to prevent damage from construction activities to adjacent private property. All damage to adjacent private property caused by the Contractor’s activities shall be repaired to, equal or better condition than prior to construction, as approved by the Contract Administrator. No separate measurement or payment will be made for the protection of adjacent private property.

E12.3.4 Diversion of Flows

Flows such as snowmelt, rainfall, a watermain break, or any other flow travelling through the outfall shall be diverted during construction. The cost of the flow diversion is considered incidental to the installation of the pipe.

E12.3.5 Temporary Shoring

Any temporary shoring installed during the construction operations must be removed upon completion of construction and is considered incidental to the installation of the pipe.

E12.3.6 Removal and Installation of CSP

CSP field cuts shall be straight circumferential cuts. Clean all ends free of burrs etc., and touch up all areas affected by Work with galvanized primer.

The Contractor shall excavate and dispose of the existing outfall piping and debris grate in accordance with the Standard Construction Specifications.

All outfall pipes shall be installed as shown on the drawings and in accordance with CW 3610.

All pipes shall be laid to the established line and grade.

E12.3.7 Connections

Where the drawings indicate connection to an existing pipe, the Contractor shall carefully expose the end of the existing pipe.

Where the existing pipe has a damaged end, sufficient length of the damaged pipe shall be removed to provide a straight end in acceptable condition. The cut end of the CSP pipe shall be coated with a galvanizing compound approved by the Contract Administrator.

Where a concrete transition collar is required connect the new pipe to the existing pipe using the concrete transition collar as shown on the drawings.

Slip joints are to be internal unless noted otherwise on the drawings. The receiving pipes are to be cleaned of all surface debris, including but not limited to frozen backfill, ice and internal sediment.

The slip joints are to be installed in locations as shown on the drawings and as directed by the Contract Administrator. Angle brackets are to be located at the 9:00 and 3:00 o'clock position unless approved otherwise by the Contract Administrator. Bolts are to be tightened evenly throughout the coupler.

E12.3.8 Installation of Debris Grate

Debris Grates shall be installed in the location as shown on the drawings.

E12.3.9 Shop Drawings

Submit prepared shop drawings for the: slip joint, debris grate, handrail, and plate sleeve details in accordance with Clause 1.5 of CW 1110.

E12.4 Method of Measurement and Payment

E12.4.1 Removal and Installation of CSP

The removal and installation of the CSP shall be measured on a linear basis. The length to be paid for shall be the total number of linear meters of CSP, measured from the tie-in point to the tip of the manufactured bevelled end section, horizontally above the center of the pipe installed in accordance with this Specification and acceptable to the Contract Administrator. The bevelled end section, and removal of both the existing CSP and existing debris grate shall be considered incidental to the installation of the CSP and no separate payment will be made.

Removal and installation of CSP will be paid for at the Contract Unit Price for "Removal and Installation of CSP", measured specified herein, which price shall be payment in full for performing all operations described and all other items incidental to the Work included in this Specification.

E12.4.2 Supply and Installation of Slip Joints

The supply and installation of Slip Joints shall be measured on a unit basis. The Contractor shall be paid for the total number of slip joints installed in accordance with this Specification, as measured by the Contract Administrator.

E12.4.3 Supply and Installation of Debris Grates

The supply and installation of the Debris Grate shall be measured on a unit basis. The units to be paid for shall be the total number of Debris Grates installed in accordance with this Specification and acceptable to the Contract Administrator as computed from measurements made by the Contract Administrator.

Supply and installation of Debris Grate will be paid for at the Contract Unit Price for "Supply and Installation of Debris Grate", measured specified herein, which price shall be payment in full for performing all operations described and all other items incidental to the Work included in this Specification.

E12.4.4 Supply and Installation of Handrails and Pipe Sleeves

The supply and installation of the Handrails and Pipe Sleeves including all required accessories will be measured on a unit basis. The units to be paid for shall be the total number of handrails constructed in accordance with this Specification and accepted by the Contract Administrator as computed from measurements made by the Contract Administrator.

Supply and installation of Handrails and Pipe Sleeves will be paid for at the Contract Unit Price for "Supply and Installation of Handrails and Pipe Sleeves", measured specified herein, which price shall be payment in full for performing all operations described and all other items incidental to the Work included in this Specification.

E12.4.5 Supply and Installation of Concrete Transition Collar

The supply and installation of concrete transition collars will be measured on a unit basis and paid for at the Contract Unit Price for "Concrete Transition Collar". The number of units to be paid for will be the total number of concrete transition collars constructed in accordance with this specification, accepted and measured by the Contract Administrator.

E13. HIGH DENSITY POLYETHYLENE SPIRAL WOUND PIPE

E13.1 Description

E13.1.1 This Specification shall cover the requirements for the supply and installation of the 1675 mm (66 inch) diameter HDPE spiral wound pipe.

E13.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E13.2 Submittal

E13.2.1 The Contractor shall submit at least one (1) week prior to the commencement of Work, the HDPE spiral wound liner pipe design, including calculations for loads, wall thickness, and other design considerations according to the manufacturer's recommendations.

E13.2.2 The Contractor shall submit at least one (1) week prior to the commencement of Work, the installation procedure for the HDPE spiral wound liner pipe including joining, heat shrink

sleeve installation, anticipated pushing force and pushing apparatus, lubrication, setup locations, and end treatments.

E13.2.3 The Contractor shall submit at least one (1) week prior to the commencement of Work, a proposed material and/or product which is to be used as the casing spacers.

E13.2.4 The Contractor shall submit at least one (1) week prior to the commencement of Work, a proposed method for the installation of the casing spacers.

E13.2.5 The fusing of the pipe liner must be performed by qualified personnel with a minimum of three (3) years of experience in HDPE pipe fusing. The Bidder shall submit proof of experience, in writing, within 3 days of request by the Contract Administrator. The Contractor shall submit the installation procedure at least one (1) week prior to the commencement of the Work..

E13.3 Equipment

E13.3.1 All equipment, implements, tools and facilities used shall be of a size and type as required to complete the Work in a reasonable time as approved by the Contract Administrator. The Contractor shall keep all equipment in good Working order, and have sufficient standby equipment available at all times, as required.

E13.4 Liner Pipe Raw Material Requirements

E13.4.1 The liner pipe shall be manufactured from a high density polyethylene material which meets or exceeds the minimum cell classification 345444C when classified in accordance with ASTM D3350.

E13.4.2 The raw material used to produce the liner pipe shall be a polyethylene compound qualified as Type II, Category 5, Class C, Grade P34 in accordance with ASTM D1248.

E13.4.3 The polyethylene raw material shall contain a minimum of 2% well dispersed finely divided carbon black for UV stabilization. Additives, which can be conclusively proven not to be detrimental to the liner pipe, may also be used provided that the pipe produced meets or exceeds all of the requirements of this specification.

E13.4.4 The liner pipe shall contain no recycled compound except that generated in the manufacturers own plant from resin of the same specification and from the same raw material supplier.

E13.4.5 The liner pipe manufacturer's Quality System shall be certified by an appropriate independent body to meet the requirements of the ISO 9002 Quality Management Program.

E13.4.6 Compliance with the requirements of Clause 13.4.4 of this specification shall be certified, in writing, by the pipe supplier, upon request.

E13.5 Liner Pipe Design

E13.5.1 The liner pipe shall be manufactured with dimensions and tolerances in accordance with ASTM F714, ASTM F894 or CSA B182.6.

E13.5.2 The required liner pipe structural characteristics shall be selected based on considerations of both the installation process and the anticipated traffic or service loads and other location specific conditions. These conditions normally include an evaluation of:

(i) minimum anticipated clearance between the liner and the existing CSP culvert being; rehabilitated (including allowances for joint offsets and separations and deflections);

(ii) flow capacity of the rehabilitated culvert;

(iii) external loads (earth and traffic);

(iv) construction or installation loads (push/pull forces external grouting pressure); and

(v) structural support of the culvert developed by grouting.

E13.5.3 The liner pipe should have sufficient wall stiffness to safely resist external hydrostatic pressures generated by ground water levels above the top of the pipe and/or by grouting, pressures if appropriate. When grouted, the liner pipe will react as though it was buried in soil; thus flexible pipe/soil backfill design equations apply.

E13.6 Liner Pipe Products

E13.6.1 Acceptable Lining Pipe Product.
1675 mm (66 inch) Diameter High Density Polyethylene (HDPE) Spiral Wound Pipe
Trade name: **KWH Weholite**
Manufacturer: KWH Pipe (Canada) Ltd.

E13.6.2 The Contractor may elect to use an alternative product upon review and approval by the Contract Administrator. The Contractor shall request the Manufacturer to directly submit written information on the preparation, materials, design, performance, references, and use of proposed products.

E13.6.3 Lubricant shall be non-toxic, vegetable based, lubricating gel.

E13.7 Casing Spacer Products

E13.7.1 Acceptable casing spacer materials include wood, styrofoam, HDPE casing spacers, or an approved equivalent.

E13.8 Inspection

E13.8.1 The Contractor shall perform an inspection of the existing steel conduit with the Contract Administrator prior to attempting to install the liner pipe. The purpose of this inspection is to ensure that there are no locations within the deteriorated culvert that are so badly misaligned or deflected that the liner pipe cannot be pulled or pushed past.

E13.9 Installation of Casing Spacers

E13.9.1 The casing spacers may either be installed on the liner pipe or installed on the host pipe to ensure that the liner pipe is aligned within the host pipe as shown in the drawings.

E13.10 Installation of The Liner Pipe

E13.10.1 The Contractor must ensure that all obstructions and joint offsets are removed or corrected as required to facilitate the installation of the HDPE liner pipe. The Contractor will be responsible for the cleaning of all pipes as required prior to the installation of the liner pipe. The cost for cleaning shall be incidental to the cost of the installation of the HDPE pipe. The Contractor must confirm, with the HDPE pipe manufacturer, the allowable bending tolerances of the HDPE liner pipe prior to installation to ensure that pipe deflections in the existing pipe do not interfere with or prevent the installation of the liner pipe. (also refer to Guide–1/95; Guideline document from “The Society of the Plastics Inc.)

E13.10.2 The maximum push force for the installation of the HDPE pipe liner shall be 230 kN (51,600 lbs). The Contractor shall submit a proposed pushing apparatus and anticipated force as per Clause 13.2. All pulling apparatus shall have a means of monitoring the pull force exerted on the pipe.

E13.10.3 Application of the lubricant shall be as approved by the Contract Administrator.

E13.11 Fusing of Liner Pipe

E13.11.1 Wherever possible, the HDPE pipe should be joined by the method of thermal butt fusion, as outlined in ASTM D 2657, Heat Joining Polyolefin Pipe and fittings. Butt fusion joining of the pipe and fittings shall be performed in accordance with the procedures recommended by the manufacturer. The temperature of the heater plate shall not exceed 425 degrees Fahrenheit (+/- 25 degrees Fahrenheit). The joining interfacial pressure should not exceed 25 pounds per square inch of projected end area for European design fusion machines or 75 pounds per square inch of projected end area for American design fusion machines.

E13.12 Sealing the Cut Ends of the Liner Pipe

E13.12.1 All cut ends and cut-out sections of the HDPE spiral wound pipe shall be sealed by a method to be determined by the pipe supplier and approved by the Contract Administrator.

E13.13 Method of Measurement

E13.13.1 Installation of HDPE Spiral Wound Pipe

Supply and installation of HDPE Spiral Wound Pipe shall be measured on a linear measure basis. The length to paid for shall be the total number of linear metres acceptably supplied and installed complete with welded joints, grouting, construction of transitions and necessary hardware, measured horizontally, at grade, above the centre line of the pipe, as computed by measurement made by the Contract Administrator.

E13.14 Basis of Payment

E13.14.1 Installation of HDPE Spiral Wound Pipe

Supply and Installation of HDPE Spiral Wound Pipe will be paid for at the Contract Unit Price per linear metre for "Supply and Installation of HDPE Spiral Wound Pipe", measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and as shown on the Drawings and Details and all other items incidental to the Work included in this Specification.

E14. GROUTING

E14.1 Description

E14.1.1 This Specification shall cover the requirements for the cementitious grouting. The items specified herein include the injection grouting of conventional or cellular foam cementitious grout and general repair grout.

E14.1.2 This section also covers the requirements for furnishing, handling, transporting, storing, mixing and injecting the grouting materials, waste water and waste grout disposal; clean-up of Work areas upon completion of the Work and all such other operations as are incidental to the grouting.

E14.1.3 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E14.2 General Requirements

E14.2.1 All grouts shall be installed in accordance with the supplier's instruction and as indicated on the Contract Drawings.

E14.2.2 Grout shall be prepared according to the grout manufacturer's written instructions for placement of grout by pumping or tremie placement.

E14.2.3 The Contractor shall supply Workmen with appropriate safety equipment for performing pressure grout, and associated tasks. Supply safety devices, confined space entry equipment, drop sheets and other items to protect the Site, other contents and other personnel from contact with the Contractor's materials or equipment.

E14.3 Quality Assurance

E14.3.1 The applicator shall have a minimum of 3 years of experience performing similar Work and be authorized by the supplier's for performing injection of the nature specified, using the product specified or approved.

E14.3.2 The specialized batching, mixing, and placing equipment shall be automated with bulk handling equipment approved by the manufacturer. Transit mixes are not acceptable for this application

E14.3.3 During all phases of grouting, the Contractor must supply and maintain a backup system, repair parts, or reserve equipment to maintain grouting operations in the event of an equipment failure, or during a time of critical operation.

E14.4 Submittals

E14.4.1 The Contractor shall submit with the Tender Submission a statement of qualifications of the applicator of the grout. The statement must identify the years of experience of the individuals responsible for the mix design, grout preparation and installation. Proof must be given that the applicator has experience with Work of similar nature and scope.

E14.4.2 The Contractor shall submit a grout mix design a minimum of one (1) week prior to proceeding with the Work. The mix design shall meet the specifications herein, and shall detail all components of the grout mixture. The submission shall include all written recommendations of product manufacturer for each product to be used in the mix. The submission shall also include the anticipated 28 day compressive strength.

E14.4.3 The Contractor must submit a detailed procedure for grouting a minimum of one (1) week prior to proceeding with the operation. It shall include the names of supervisory staff, equipment lists, and a list of material expected to be used during the grouting. If requested by the Contract Administrator, the Contractor shall also list the date, start, and completion times of the grouting procedure. The detailed procedure must also include the following:

(i) Grout port types and dimensions, configuration along the axis of the liner pipe, and longitudinal spacing.

(ii) Grouting application rates and anticipated hydrostatic pressure on the liner pipe.

(iii) Method for repairing grout ports.

(iv) Type, material specification, configuration and location of bulkheads.

E14.5 Records

E14.5.1 The Contractor will keep records of all grouting operations, such as the time of each change of grouting operation, pressure, rate of pumping, proportioning of grout constituents, amount of cement for each change in water/cement ratio, and other data as deemed by the Contract Administrator to be necessary. The Contractor shall furnish all necessary assistance and cooperation to this end. A copy of all records shall be submitted to the Contract Administrator at the end of each Workday.

E14.6 Protection To Work And Cleanup

E14.6.1 The Contractor will be required to furnish such pumps as may be necessary to care for wastewater and grout from his operations. The Contractor shall, upon completion of his operations, clean up all waste resulting from his operations that is unsightly or would interfere with the efficient operation of the project as anticipated by the original design.

E14.7 Supervision of Grouting Operations

E14.7.1 All pressure grouting operations shall be performed in the presence of the Contract Administrator, and shall be in accordance with the following general procedures.

E14.8 Equipment

E14.8.1 All equipment, implements, tools and facilities used shall be of a size and type as required to complete the Work in a reasonable time as approved by the Contract Administrator. The Contractor shall keep all equipment in good Working order, and have sufficient standby equipment available at all times, as required.

E14.9 Products

E14.9.1 All products shall be new, free of defects, and supplied in their original factory containers.

E14.9.2 Written recommendations from the product supplier(s) for application and preparation shall be available for the Contract Administrator upon request.

E14.9.3 All products shall be handled, stored, and prepared in accordance with the written recommendations of the product manufacturer.

E14.10 Cementitious Grout Products

E14.10.1 Grout for the annular space and void filling shall be a mix of compounds consisting of non-metallic aggregate, Portland cement, chemical concrete additives, which may include water reducing, plasticizing and aqueous foam agents. Pozzolans and other cementitious materials may not be used.

(i) Compressive strength: 5-10 MPa (745 - 1450 psi) at 28 days.

(ii) Net expansion at 28 days: maximum 0.4%.

(iii) Net shrinkage at 28 days: shrinkage not permitted.

E14.10.2 All cementitious grout materials shall be supplied in original manufacturer's packaging, clearly identifying the product and preparation instructions.

E14.10.3 Grout for general repair, host pipe/liner pipe transition and other areas shall be multi-purpose Specialty Polymers Inc. (SPI) rapid repair grout, or approved equal.

E14.11 Other Requirements

E14.11.1 Sand

(i) Sand for grout shall be clean and consist of hard, tough, durable, uncoated particles. The shape of the particles shall be generally rounded or cubical. The sand shall be generally well graded from fine to coarse in accordance with ASTM C 136 with 100 percent passing the No. 8 sieve.

(ii) The percentage of surface moisture in terms of the saturated surface-dried sand will be determined in accordance with ASTM C 70, or other method giving comparable results.

(iii) Sand shall be stored in such a manner as to avoid the inclusion of any foreign materials in the grout. All sand shall remain in free draining storage for at least 72 hours prior to use.

E14.11.2 Water shall be potable water, which shall be imported to the Site.

E14.11.3 All materials shall be delivered to the Site in undamaged, unopened containers bearing the supplier's original labels.

E14.11.4 WHMIS labels on all containers shall confirm with Canadian regulations, including English and French risk phrases, proper chemical name, shipping class, packing group and UN number.

E14.11.5 MSDS for all materials shall conform with Canadian regulations.

E14.11.6 No materials shall be used which are manufactured from or contain toluene diisocyanate (TDI), toluene, acetone or methyl ethyl ketone.

E14.11.7 No materials shall be used which are flammable or which display shipping Class 3 red warning labels.

E14.11.8 The Contractor shall keep all materials from freezing as per the Manufacturer's specifications.

E14.12 Execution

E14.12.1 Contractor shall evaluate, select and submit for review and approval the injection grouting material, method, and pertinent data to the Contract Administrator for each condition and type of joint, or void identified and deemed by the Contractor as requiring treatment at least two (2) weeks prior to the commencement of injection grouting.

E14.12.2 The Contractor shall arrange a meeting with the Contract Administrator no less then 48 hours prior to any grouting operations to review and discuss the grouting Work plan, schedule, materials and methodology for the Work to be performed.

E14.12.3 All drilling and grouting equipment used shall be of a type, capacity and mechanical condition suitable for performing the Work, as approved by the Contract Administrator. The power and equipment and the layout thereof shall meet all applicable requirements of municipal, provincial, and federal regulations and codes for both safety and otherwise.

E14.13 Cementitious Grout Injection Preparation and Installation

E14.13.1 Grouting shall be performed in conjunction with E27 Cold Weather Requirements.

E14.13.2 All joints and areas to be grouted shall be cleaned of any dirt, grease, marine growth, or other substances that could interfere with penetration of grout, or its bond. Potable water shall initially be used, and if deemed unsuccessful by the Contract Administrator, the Contractor shall propose other materials.

E14.13.3 All cleaning, flushing, or other agents shall be approved by the Contract Administrator and shall be sufficiently flushed or neutralized to allow proper installation and application of grout. Flushing or neutralizing shall be performed in accordance with manufacturer's written recommendations.

E14.13.4 Injection ports shall be installed in holes drilled through the liner. The Contract Administrator shall approve the spacing between ports. The Contractor shall submit a plan for the injection port distribution which shall include the configuration and distribution of injection ports, the port size, the number of ports per location, and the number of locations at least two (2) weeks prior to the commencement of injection grouting. All injection ports shall be flushed clean prior to grouting, and repaired to the satisfaction of the Contract Administrator once grouting operations are complete

E14.13.5 Grout shall be placed from the bottom of the cavity to the top of the cavity in a uniform and continuous procedure. During grouting, adjacent ungrouted ports shall be left open to permit the flow or escape of air, water, or flushed-out grout. When required, cap or seal adjacent ports or vent holes once clean; consistent grout is observed flowing from vent or port. At all times, a minimum of one vent hole or port shall be maintained open and monitored for grout level. The Contractor shall submit the proposed grouting procedure at least two (2) weeks prior to the commencement of injection grouting.

E14.13.6 A fine screen or filter shall be used to remove lumps and other foreign matter from the slurry prior to pumping or tremie placement of the grout. The Contractor must make every effort to maintain proper placement and flow of grout.

E14.13.7 As grouting proceeds, cap and move grout injection hose from port to port following the flow of clean grout flowing from vents or ports. In general, grouting should move from port to port in a regular and steady manner.

E14.13.8 Grouting pressures shall be monitored and adjusted by the Contractor to suit local conditions encountered to permit full and complete penetration of the grout, while preventing leakage of grout or displacement of structural elements. The Contractor shall review changes in grouting pressure or rate with the Contract Administrator as Work proceeds. Grout pressure shall not exceed 33.8 kPa (4.9 psi) without the written approval of the Contract Administrator.

E14.13.9 If the Contractor elects to perform simultaneous grouting operations, the Contractor must maintain sufficient reserve equipment and labour to accommodate and complete grouting of one cavity in the event of difficulty or equipment failure during grouting of the another cavity.

E14.13.10 The batching and preparation of grout shall be performed in accordance with the written recommendations of the grout supplier, and the supplier's technical representative.

E14.13.11 No Work shall be done adjacent to grouted areas for twenty-four (24) hours after the completion of grouting.

E14.13.12 All excess surface sealing material, grout, seepage, and ports shall be removed from the surface of the liner pipe upon the final curing or set of the grout. Any voids encountered during removal shall be repaired as directed by the Contract Administrator.

E14.13.13 The preparation of grouting mixes and pumping pressures shall be monitored by the Contract Administrator during all operations, and adjustments may be required to suit local conditions.

E14.13.14 Construct grouted transition between existing SPCSP and new HDPE Spiral Wound Pipe as shown on the drawings.

E14.13.15 Upon completion of the Work, remove all injection-related materials from the Work area, and remove all debris from the Site.

E14.14 Method of Measurement

E14.14.1 Grouting of annular space at RR-98 shall be considered incidental to the installation of the HDPE Spiral Wound Pipe.

E14.15 Basis of Payment

E14.15.1 No payment shall be made for the Grouting of annular space at AS-81 as it is considered incidental to the installation of the HDPE Spiral Wound Pipe.

E15. GEOTEXTILE

E15.1 Description

E15.1.1 This Specification shall cover the supply and placement of the geotextile fabric below the rockfill riprap.

E15.2 Materials

E15.2.1 Each geotextile roll to be used shall be tagged to provide product identification for inventory and quality control purposes.

E15.2.2 Geotextile rolls shall be furnished with suitable wrapping for protection against moisture and extended exposure from the sun, and contamination from dirt, dust, and any other deleterious materials. The geotextile shall remain wrapped in a protective covering until it is used.

E15.2.3 Non-woven geotextile fabric shall meet or exceed the following requirements:

Parameter	Test Method	Minimum Criteria
Grab Tensile Strength	ASTM D4632	900 N
Mullen Burst	ASTM D3786	2600 kPa
Puncture	ASTM D4833	550 N
Trapezoidal Tear	ASTM D4533	350 N
Apparent Opening Size	ASTM D4751	1.2 mm
Permittivity	ASTM D4491	1.2 sec^{-1}
Flow Rate	ASTM D4491	60 $L/sec/m^2$

E15.2.4 Suitable products shall be Amoco 4553, Layfield LP 8, Emco R080, Geotex 801, Terrafix 600R, Armtec 250, Mirafi 180 N, Trevira 011/250, or approved equivalent.

E15.3 Construction Methods

E15.3.1 Geotextiles shall consist of non-woven fabric.

E15.3.2 All Work related to the geotextile storage, handling, and installation shall comply with the procedures and recommendations of the manufacturers, and as accepted by the Contract Administrator.

E15.3.3 Snow and ice shall be cleared from the riverbank in accordance with E10.3.6 prior to placement of geotextile.

E15.3.4 The fabric shall be loosely laid in order to allow conformity to the bedding surface. Folds and wrinkles in the fabric shall be avoided. Pins, nails or weights shall be installed to hold the fabric in place such that placement of fill material will not excessively stretch or tear the fabric and seam overlaps will be maintained.

E15.3.5 The fabric shall be overlapped in a downstream direction (upstream panel overtop of downstream panel) at all joints a minimum of 600 mm. The overlap shall be pinned or secured as approved by the Contract Administrator.

E15.3.6 A minimum of 300 mm of material shall be placed over the fabric prior to equipment passage.

E15.3.7 Riprap shall be placed on the geotextile in such a manner that the geotextile is not damaged, torn, excessively stretched, or punctured.

E15.3.8 Any damaged geotextile, as identified by the Contract Administrator, shall be repaired immediately at the Contractors own cost. All fill material shall be cleared a minimum of 1 m around the damaged area. The damaged area shall be covered with a geotextile patch that shall be large enough to be sewn or overlapped a minimum of 600 mm onto the undamaged geotextile.

E15.4 Measurement and Payment

E15.4.1 The supply and placement of geotextile, and related Work specified herein will be measured on an area basis and paid for at the Contract Unit Price for "Geotextile". The area to be paid for shall be the total number of square metres of ground covered by geotextile, placed in accordance with this Specification, accepted and measured by the Contract Administrator.

E15.4.2 Overlap at all joints shall be considered a single layer of geotextile for measure and payment purposes.

E15.4.3 Geotextile used for repairs will be excluded from the quantity paid.

E16. ROCKFILL RIPRAP

E16.1 Description

E16.1.1 This Specification shall cover the supply and placement of rockfill riprap.

E16.2 Materials

E16.2.1 The rockfill material for use as riprap shall consist of a clean free draining, sound, dense, durable, crushed rock. The material shall be free from organics, roots, silts, sand, clay, snow, ice or any other material that would detract from the strength and drainage characteristics of clean rockfill.

E16.2.2 Individual particles shall be shaped such that no dimension is greater than two times the smallest dimension. Flat, elongated, or platy particle shapes will not be accepted.

E16.2.3 Should the Contractor choose to use limestone, it shall be durable white crystalline limestone. Softer buff to yellow dolomite or dolostone will not be accepted.

E16.2.4 The rockfill material shall meet the following requirements:

Parameter	Test Method	Specified Limit
Bulk Specific Gravity	ASTM C127	2.6 minimum
Absorption	ASTM C127	2.5 % maximum
LA Abrasion Loss	ASTM C131	32% maximum
Soundness	ASTM C88	13% maximum
Gradation	ASTM D5519	See below

E16.2.5 Rockfill riprap shall be well graded having a full range and even distribution of sizes and shall conform to the following gradation:

Canadian Metric Sieve Size (millimeters)	Percent of Total Dry Weight Passing Each Sieve
450	100%
300	50-70%
200	25-40%
100	10-20%
50	0-5%

E16.3 Submittals

E16.3.1 The Contractor shall submit the proposed supplier(s) and location of quarry Sites for supply of riprap.

E16.3.2 Representative samples of the rockfill riprap submitted for material testing purposes shall be completed as specified herein.

E16.4 Quarry Sites

E16.4.1 Contractors supplying rockfill riprap shall be responsible for demonstrating that the material is of adequate quality and volume to meet the material specifications contained herein.

E16.5 Testing and Approval

E16.5.1 All materials set forth in this Specification shall be subject to inspection and testing by the Contract Administrator or by the testing laboratory designated by the Contract Administrator. There shall be no charge for any materials taken by the Contract Administrator for testing purposes.

E16.5.2 The Contract Administrator will visit proposed quarry Sites for inspection of the proposed rockfill material and quarry faces a minimum of fourteen (14) days prior to supply and placement of riprap.

E16.5.3 No supply and placement of riprap will be permitted prior to the Contract Administrator reviewing the source.

E16.5.4 The procedures for preparation of all rockfill samples for use in material inspection and testing shall be subject to review and acceptance by the Contract Administrator for individual tests. The samples may be obtained from crushed and processed material at the sizing necessary for specific tests if the material is deemed to be representative of the riprap that will be used, subject to the acceptance of the Contract Administrator.

E16.5.5 The testing frequency necessary to confirm the material quality will be specified at the discretion of the Contract Administrator.

E16.6 Construction Methods

E16.6.1 Subcutting of the existing subgrade shall be performed in accordance with E.22

E16.6.2 Place geotextile as shown on the Drawings and in accordance with E.15. Snow and ice shall be cleared from the bank in accordance with E10.3.6.

E16.6.3 Rockfill shall be pushed or rolled into place in such a manner that the larger rocks are uniformly distributed and the smaller rocks serve to fill the places between the larger rocks such that excessive segregation of the various particle sizes does not occur.

E16.6.4 Sufficient levelling shall be done to produce a neat and uniform surface, conforming to the shape and dimensions shown on the Drawings.

E16.6.5 The allowable fill tolerances shall be within ± 50 mm of the grades and thickness shown on the Drawings, provided positive downslope grading is achieved.

E16.6.6 Provide a smooth uniform surface from the existing grade and new riprap when placing outside edges or transitions, as accepted by the Contract Administrator.

E16.6.7 Temporary stockpiling of riprap along the riverbank shall not be permitted. Material shall be placed to the required lines and grade shown the Drawing immediately upon delivery to the Site.

E16.7 Measurement and Payment

E16.7.1 The supply and placement of rockfill shall be measured on a weight basis and paid for at the Contract Unit Price for "Rockfill Riprap". The weight to be paid for shall be the total number of metric tonnes of rockfill supplied and placed in accordance with this Specification, as measured by a certified weigh scale and accepted by the Contract Administrator.

E16.7.2 The Contractor shall provide the weigh tickets to the Contract Administrator for the material supplied to the Site at the time of delivery. No payment will be made for any weigh tickets which are not supplied at the time of delivery, or which are lost.

E17. ROCKFILL COLUMNS

E17.1 Description

E17.1.1 This Specification shall cover the installation of the rockfill columns, including the auger drilling, sleeving, cuttings removal, supply and placement of rockfill and clay cap backfill, and provisions for handling groundwater infiltration.

E17.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for an incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E17.2 Materials

E17.2.1 General

(a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.

E17.2.2 Rockfill Backfill

(a) The rockfill material for use as backfill shall consist of a clean free draining, sound, dense, durable, crushed rock. The material shall be free from organics, roots, silts, sand, clay, snow, ice or any other material that would detract from the strength and drainage characteristics of clean rockfill.

(b) Individual particles shall be shaped such that no dimension is greater than two times the smallest dimension. Flat, elongated, or platy particle shapes will not be accepted.

(c) Should the Contractor choose to use limestone, it shall be durable white crystalline limestone. Softer buff to yellow dolomite or dolostone will not be accepted.

(d) The rockfill material shall meet the following requirements:

Parameter	Test Method	Specified Limit
Bulk Specific Gravity	ASTM C127	2.6 minimum
Absorption	ASTM C127	2.5 % maximum
LA Abrasion Loss	ASTM C131	32% maximum
Soundness	ASTM C88	13% maximum
Gradation	ASTM D5519	See below

(e) Rockfill riprap shall be well graded having a full range and even distribution of sizes and shall conform to the following gradation:

Canadian Metric Sieve Size (millimeters)	Percent of Total Dry Weight Passing Each Sieve
150	100%
75	40-70%
25	0-5%

E17.2.3 Clay Cap

The impervious clay cap at the top of the rockfill columns shall consist of a high plasticity clay material, with a liquid limit in excess of 50%. The clay shall be free of deleterious material such as roots, organic material, ice, snow or other unsuitable materials, and may be salvaged from the on-site excavation, as approved by the Contract Administrator. Frozen material will not be accepted.

E17.2.4 Rockfill Column Sleeves

(a) During augering of the rockfill columns, it may be necessary to use steel sleeves to prevent the sidewalls of the columns from caving. The sleeves shall be of a length suitable to extend from ground surface down to a minimum of 0.6 metres into the underlying till material.

(b) The Contract Administrator will make no payment for excess rockfill material that is used because the Contractor used a sleeve with a diameter larger than 2.1 m.

E17.3 Submittals

E17.3.1 The Contractor shall submit the proposed supplier(s) and location of quarry Sites for supply of rockfill backfill.

E17.4 Quarry Sites

E17.4.1 Contractors supplying rockfill riprap shall be responsible for demonstrating that the material is of adequate quality and volume to meet the material specifications contained herein.

E17.5 Testing and Approval

E17.5.1 All materials set forth in this Specification shall be subject to inspection and testing by the Contract Administrator or by the testing laboratory designated by the Contract Administrator. There shall be no charge for any materials taken by the Contract Administrator for testing purposes.

E17.5.2 The Contract Administrator will visit proposed quarry Sites for inspection of the proposed rockfill material and quarry faces a minimum of fourteen (14) days prior to supply and placement of riprap.

E17.5.3 No supply and placement of riprap will be permitted prior to the Contract Administrator reviewing the source.

E17.5.4 The procedures for preparation of all rockfill samples for use in material inspection and testing shall be subject to review and acceptance by the Contract Administrator for individual tests. The samples may be obtained from crushed and processed material at the sizing necessary for specific tests if the material is deemed to be representative of the riprap that will be used, subject to the acceptance of the Contract Administrator.

E17.5.5 The testing frequency necessary to confirm the material quality will be specified at the discretion of the Contract Administrator.

E17.6 Construction Methods

E17.6.1 General

The excavation shall be supervised at all times, and open shafts shall be adequately guarded or covered for safety.

E17.6.2 Excavation

(a) The rock column shafts shall be excavated by drill rig augers to the depth as shown on the Drawings. Note that the glacial till and/or bedrock contact elevation may vary and the depth of excavation may differ from that shown on the Drawings.

(b) Drilling shall not commence until the rockfill is on Site to backfill the shaft.

(c) Any deleterious or sloughed material shall be removed from the rock column shaft prior to backfilling.

(d) Discharge of water contained within the auger hole from displacement of the rockfill during backfill will be acceptable. The Contractor shall be responsible to contain and direct any displaced water such that it will not affect other construction Work or cause excessive erosion of the native riverbank soils. The control of the water shall be considered incidental to the Work.

(e) The construction of the rock columns shall be a continuous operation with backfilling immediately following excavation.

(f) The Contractor must complete backfilling of each rock column before commencing to excavate adjacent rock columns.

(g) Excavated material shall be removed from the riverbank area immediately upon excavation and disposed of offsite. Stockpiling of excavated material on the riverbank area will not be permitted.

E17.6.3 Sleeving Rock Column Shafts

(a) The Contractor shall install steel sleeving as required to control sloughing and caving of the shafts.

(b) Shafts shall only be sleeved where it is not possible to advance and maintain an open hole during the excavating, backfilling and compacting procedures, and the Contractor shall only be paid for sleeving approved by the Contract Administrator. If the Contractor uses sleeves that do not extend from ground surface to the bottom of the hole, a pro-rated payment for the sleeve will be made based upon the actual length of the sleeve used.

E17.6.4 Backfilling and Compaction

(a) Excavated rock column shafts shall be backfilled immediately upon excavation. The rockfill shall be placed in maximum 1.5 m lifts, with each lift compacted using reverse auger methods with the drill weight of the auger. No hole shall remain without backfill overnight, or for a period beyond four (4) hours.

(b) After placement of the rockfill to the required dimensions shown on the Drawings, the impervious clay cap shall be placed in layers not exceeding 200 millimetres, and compacted to a minimum of 95% of the Standard Proctor Maximum Dry Density. The clay cap shall be located within undisturbed native material surrounding the caisson. Care shall be taken to ensure that an effective seal results between the wall of the shaft excavation and the clay material placed, to protect against water infiltration into the shaft, as approved by the Contract Administrator.

E17.6.5 Supply of Rockfill

The Contractor shall monitor the supply rate of the rockfill material to ensure that the backfilling operations are not delayed.

E17.6.6 Stockpiling of Rockfill Material

Stockpiling of rockfill material will not be permitted on the riverbank except at locations where existing rockfill columns or rockfill shear keys are in place, subject to the approval of the Contract Administrator.

E17.6.7 Contaminated Rockfill Material

Where crushed limestone has become contaminated with silt, clay, snow, ice or other deleterious material due to the Contractor's method of operation, negligence, failure to backfill in a timely manner, etc. the material shall be classified as rejected backfill and shall be weighed prior to disposal for deduction from the total weight of crushed limestone measured for payment.

E17.7 Measurement and Payment

E17.7.1 Shaft Drilling

The drilling of shafts for the rockfill columns will be measured on a length basis and paid for at the Contract Unit Price for "Shaft Drilling". The length to be paid for shall be the total number of vertical metres of shaft drilled, measured from the ground surface at the time of the rockfill column installation carried out in accordance with this Specification, acceptanced and measured by the Contract Administrator.

E17.7.2 Rockfill

The supply and placement of the rockfill for the rockfill columns will be measured on a weight basis and paid for at the Contract Unit Price for "Rockfill". The weight to be paid for shall be the total number of metric tonnes of rockfill material supplied and placed in accordance with this Specification as measured by a certified weigh scale and accepted by the Contract Administrator. The Contractor shall provide the weigh tickets to the Contract Administrator for the material supplied to the Site at the time of delivery. No payment will be made for any weigh tickets which are not supplied at the time of delivery, or which are lost.

The supply and placement of the clay caps shall be incidental to the rockfill. No separate payment will be made for the clay caps.

E17.7.3 Sleeving

Sleeving of the rockfill caissons will be measured on a unit basis and paid for at the Contract Unit Price for "Sleeving". The Contractor shall be paid for the total number of sleeves used in accordance with this specification, as measured by the Contract

Administrator. Only the holes directed by the Contract Administrator to be sleeved will be paid for.

E18. CHANNEL PROTECTION

The ice surface and riverbank channel shall be cleared of construction materials prior to ice break-up. The Contractor shall clean up all materials, including but not limited to: soil, snow fence, construction debris, etc. from this construction activity. All items that will have an adverse impact on the channel shall be removed. Channel Protection shall be considered incidental to the Works of this Contract and no measurement or payment will be made for this item.

E19. TOPSOIL AND SODDING

The riverbank area within the limits of the Hawthorne Flood Pumping Station Right of Way and limits of rockfill columns shall be re-vegetated with topsoil and sod. Work shall be in accordance with, and shall be measured and paid in accordance with CW 3510.

E20. SILT FENCE

E20.1 Description

E20.1.1 This specification covers the erection of temporary silt fencing, which shall be installed and maintained at the locations shown on the drawings to control runoff and minimize the release of detrimental silt loading to watercourses.

E20.1.2 The scope Work included in this specification is as follows:

(a) Supply and Install temporary silt fencing at locations as indicated, in accordance with the detailed drawing provided, prior to undertaking any other activities on the Site where silt fencing is required.

(b) Maintain the silt fencing in serviceable condition throughout the entire duration of activities at the Site where silt fencing is required, including final restoration and cleanup of the construction Site.

(c) Remove the silt fencing and restore the area where the fencing was installed, without further disturbing the area and without releasing any deleterious substances to the adjacent watercourse.

E20.2 Materials

E20.2.1 Fences Posts

(a) Fence posts shall be 100 mm diameter untreated wood posts or 50 mm diameter steel.

E20.2.2 Filter Fabric

(a) Filter Fabric Shall be a woven geotextile material specifically designed for a silt fence applications, meeting the following minimum requirements:

Property	**Test Method**	**Value**
Grab Tensile Strength	ASTM D 4632	0.55 kN
Grab Tensile Elongation	ASTM D 4632	15%
Mullen Burst	ASTM D 4786	2060 kPa
Puncture	ASTM D 4833	0.285 kN
Trapezoid Tear	ASTM D 4533	0.285 kN

UV Resistance	ASTM D 435	5 80 % @ 500 hrs
Apparent Opening Size (AOS)	ASTM D 4751	0.60 mm
Flow Rate	ASTM D 4491	405 l/min/m2

Acceptable Product: “Amoco 2130 Silt Fence Fabric” or approved equal.

E20.2.3 Wire Mesh

(a) Wire mesh shall be galvanized or plain metal with wire gauge = 3.0 mm, wire spacing @ 150 mm o/c.

E20.2.4 Fencing Material Fasteners

(a) Staples or wire ties of sufficient strength and spacing to withstand 500 N (100 lbf) pull test at any point on the wire mesh.

E20.3 Construction Methods

E20.3.1 Ensure that no deleterious substances are discharged into the adjacent watercourse at any time during construction activities.

E20.3.2 Silt Fence Installation

(a) Excavate 150 x 150 anchor trench along alignment of silt fence as indicated.

(b) Install fence posts as indicated. Ensure that fence posts are firmly driven into undisturbed soil, or are completely and firmly backfilled if installed via auger methods. Attach wire mesh as support backing for silt fence filter fabric with fasteners as specified in E20.2.4. Attach silt fence filter fabric on top of wire mesh in similar fashion. Overlap any fence seams (wire mesh or filter fabric) by 450 mm minimum. Ensure that wire mesh and filter fabric are installed on the upslope side of the post and are fully laid in anchor trench as shown.

(c) Install and compact impermeable excavated materials into anchor trench and slope as indicated. Compact to 95% of maximum dry density (ASTM D-698).

E20.3.3 Silt Fence Maintenance

(a) Inspect silt fence daily, prior to staring any other construction activities. If fence posts are found loose or not upright, repair in accordance with installation procedure as specified in E20.3.2. If silt fence is found to be loose or torn, repair or replace as necessary to comply with E20.3.2.

(b) If silt deposition at the fence is 300 mm or more in depth, carefully remove and dispose of silt offsite without disturbing silt fence.

E20.3.4 Silt Fence Removal

(a) The silt fence shall remain in place until new vegetation growth has established on the bank, as determined by the Contract Administrator.

(b) Upon authorization of the Contract Administrator, remove all fence posts, wire mesh, fabric, and fasteners from Site.

(c) Restore areas disturbed in accordance with E10, without releasing any deleterious substances to the adjacent watercourse.

E20.4 Measurement and Payment

E20.4.1 The supply, placement, and removal of silt fence shall be measured on a length basis and paid for at the Contract Unit Price per lineal metre for “Silt Fence”. The length to be paid for shall be the total number of metres supplied and placed in accordance with this Specification, accepted and measured by the Contract Administrator. Payment of silt fence shall be in accordance with the following payment schedule:

(a) Sixty percent (60%) of the Contract Unit Price per lineal metre for “Silt Fence” shall be paid following supply and installation.

(b) Forty percent (40%) of the Contract Unit Price per lineal metre for “Silt Fence” shall be paid following final removal.

E20.4.2 Removal of accumulated sediment from the silt fence is considered incidental to the Work and no separate measurement or payment will be made.

E21. TREE REMOVAL

E21.1 Description

E21.1.1 This specification shall cover the removal of existing trees.

E21.1.2 The Work to be done by the Contractor under this specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E21.2 Materials

E21.2.1 Existing Trees to be Removed

The existing trees to be removed include, but not limited to ash, elm, cottonwood, oak, pine, maple, spruce, etc., all of which may be cut with standard chain saw equipment. The existing trees range from 50 mm to 1,000 mm diameter.

E21.3 Construction Methods

E21.3.1 Prior to commencement of the Work the Contract Administrator shall identify all trees for removal. The Contractor shall cut down only trees designated to be removed, and grub out all stumps and roots greater than 100 mm diameter. In general, the Contractor shall start at the top of the tree and remove branches or trunks not longer than 2 m. Trees are to be felled so as to land within the limits of the Works. The Contractor shall load and haul all trees, stumps, roots, logs, brush, rubbish and all other surface litter from the Site and dispose of these materials at an approved disposal Site, acceptable to the Contract Administrator.

E21.3.2 The Contractor shall take all precautions to prevent damage to structures, adjacent property and to trees and shrubs. In the event of damage, the Contractor will be held liable, and shall be required to provide appropriate restoration at his cost, to the satisfaction of the Contract Administrator.

E21.3.3 Any trees damaged during construction activities shall be examined by a bonded tree care professional and pruned as required. Damaged trees which are not viable shall be replaced by the Contractor at his own cost.

E21.4 Measurement and Payment

E21.4.1 The removal of existing trees shall be measured on a per tree basis and paid for at the Contract Unit Price per unit for “Tree Removal”, “50 mm to 250 mm diameter”, “greater than 250 mm to 500 mm diameter”, “greater than 500 mm diameter”. The amount to be paid shall be the total number of trees removed in accordance with this specification, accepted and measured by the Contract Administrator.

E21.4.2 The removal of trees and brush less than 50 mm diameter is considered incidental to the Work and no separate measurement or payment will be made.

E22. RIVERBANK REGRADING

E22.1 Description

E22.1.1 This Specification shall cover excavation and regrading of the riverbank.

E22.1.2 The Work to be done under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E22.1.3 This Specification shall supplement and amend standard City of Winnipeg Specification CW3170-R3.

E22.2 Materials

E22.2.1 Excavation

The materials covered in this Specification consist of the in-situ overburden soils and may include but not necessarily limited to organic topsoil, clay, silt , sand, gravel, fill, rubble, trees, tree roots, shrubs, etc., all of which may be excavated with standard hydraulic excavation equipment.

E22.2.2 Clay Fill

The clay backfill for the slope regrading shall consist of a high plasticity material with a liquid limit in excess of 50%. The clay shall be free of deleterious material such as roots, organics, ice, snow or other unsuitable materials, and may be salvaged from the rockfill column excavation as approved by the Contract Administrator. Placement of frozen material will not be acceptable.

E22.3 Construction Methods

E22.3.1 Stripping and Topsoil Excavation

All existing vegetation and topsoil within the limits of the riverbank regrading shall be stripped in accordance with clauses 9.2(a) and (b) of CW3170-R3 and disposed of off Site.

E22.3.2 Common Excavation

All material encountered within the limits of the riverbank regrading following stripping shall be excavated to the lines and grades shown on the Drawings. All excavation shall proceed from the top of slope down to minimize the potential for slope instability. All materials shall be removed off Site immediately upon excavation. The allowable excavation tolerances shall be with 50 mm of the grade shown on the Drawings, provided positive drainage is achieved.

E22.3.3 Clay Fill

Clay fill shall be placed along the bank to the lines, grades, and elevations shown on the Drawings. The clay shall be spread and placed in layers not exceeding 150 mm thick and compacted to 95% SPMDD.

E22.4 Measurement and Payment

E22.4.1 Stripping, Topsoil and Common Excavation

(a) Stripping, Topsoil and Common Excavation shall be measured on a volume basis and paid for at the Contract Unit Price for “Riverbank Regrading”. The volume to be paid for shall be the total number of cubic metres of material excavated in accordance with this Specification, as measured by the Contract Administrator. Excavated volumes will be computed by the average end area method.

(b) Excavation required for outfall pipe repairs, construction of the new FPS, or any other structures is not part of this Specification. These items are to be completed in accordance with Specification E12 and E26.

E22.4.2 Clay Fill

Placement of clay fill is considered incidental to the regrading Work and no separate measurement or payment will be made.

E23. STRAW MULCH

E23.1 Description

E23.1.1 This Specification shall cover the supply and placement of straw mulch on all areas of the riverbank to provide temporary erosion protection where existing vegetation has been removed.

E23.2 Materials

E23.2.1 The material shall consist of wheat or barley straw, or other plants approved by the Contract Administrator. The straw mulch shall be air dried, reasonably light in colour, and shall not be musty, mouldy, caked or otherwise of low quality. The mulch shall be free of coarse (chaff) material and free of noxious weeds and/or seeds to prevent the introduction of weeds into previously seeded and planted areas. Dry mulching material that breaks down and does not bend will not be acceptable. The power mulching process shall produce a minimum of 75% of the straw being between 150 mm and 200 mm in length.

E23.3 Construction Methods

E23.3.1 General

(a) The Contractor shall supply and place straw mulch material immediately after final grading is completed and prior to March 31 of any year.

(b) Straw mulch shall be placed ensuring that there is a minimum of 90% ground coverage by area, as measured and accepted by the Contract Administrator.

(c) Mulched areas shall be inspected periodically and after runoff producing storm events. Damaged areas shall be repaired immediately as determined by the Contract Administrator. Areas requiring remulching as directed by the Contract Administrator will be re-measured and additionally paid for at the Contract Unit Price for the Work item.

E23.3.2 Spreading of Straw Mulch Material

(a) The straw mulch material shall be spread at a rate of 0.45 kg/m2, to a layer 25 to 50 mm in thickness. Mulch that remains clumped or bunched after application shall be separated and respread.

E23.3.3 Removal of Straw Mulch

(a) Immediately prior to placement of topsoil and sod and/or topsoil and seed all straw mulch shall be removed and disposed of off Site.

E23.4 Measurement and Payment

E23.4.1 Supply placement and removal of straw mulch will be measured on an area basis and paid for at the Contract Unit Price for “Straw Mulch”. The area to be paid for shall be the total number of square metres of ground covered by straw mulch, supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

E24. TREE AND SHRUB PLANTING

E24.1 Description

E24.1.1 This Specification shall cover the supply and planting of new trees and shrubs.

E24.1.2 The Contractor shall supply all labour, material, equipment and services necessary to complete the Work specified herein.

E24.2 Materials

E24.2.1 The Contractor shall supply and install the size and species as shown below.

TREES	**SIZE**
Green Ash	75 mm calliper
Manitoba Maple	75 mm calliper
Cottonwood (male)	75 mm calliper

SHRUBS	**SIZE**
Dogwood	1 gallon pot

E24.2.2 Trees shall be measured when the branches are in their normal position. Height dimensions specified are to refer to the main body of the tree and not from branch tip to root base. Where trees have been specified by calliper or diameter, reference is to be made to the diameter of the trunk measure 15 cm above the ground as the tree stands in the nursery prior to lifting.

E24.2.3 Water is to be potable and free of minerals which may be detrimental to plant growth.

E24.2.4 Planting soil shall consist of black topsoil, a fertile friable natural loam containing by volume not less than 4% and no more than 25% of organic matter for clay loams, and not less than 2% and no more than 25% for sandy loams, with an acidity value ranging from pH 6.0 to 7.5 capable of sustaining vigorous plant growth.

E24.2.5 Root ball burlap shall be 150 g Hessian burlap, biodegradable.

E24.2.6 Anti-desiccant shall be a wax-like emulsion to provide film over tree leaf surfaces reducing evaporation but permeable enough to permit transpiration.

E24.2.7 Wound dress shall be a horticulturally accepted non-toxic, non-hardening emulsion.

E24.2.8 Wire baskets shall be a horticulturally accepted product designed to carry the weight and burlap-covered root ball. Minimum diameter basket size to conform to the same maximum diameter of the tree root ball for the respective minimum tree calliper.

E24.2.9 Mulch shall be a clean bark or wood chip mulch with chips not less than 15 mm nor larger than 75 mm is size and not more than 20 mm thick. Mulch is to be free of leaves, branches, and other extraneous matter.

E24.2.10 Fertilizer shall be a slow release formulation of low nitrogen and high phosphorous e.g. 10-50-12. Apply quantities at rates stated by the product manufacturer.

E24.2.11 Quality and source of trees and shrubs shall comply with Guide Specification for Nursery Stock, 1985 Edition of Canadian Nursery Trades Association referring to size and development of the plant and root ball. Nomenclature of specified trees shall conform to the International Code for Nomenclature of Cultivated Plants.

E24.2.12 All trees and plants shall be clearly labelled as to species, size, and nursery origin until such time as they have been set in place on Site, and approved by the Contract Administrator. After approval the Contractor shall remove all tags and labels.

E24.2.13 Trees are to have been root pruned regularly, but not later than one growing season prior to arrival on Site. The Contractor may be required to provide the Contract Administrator with documentation outlining his root-pruning program.

E24.2.14 Trees are to characteristically developed for their species and structurally sound, well branched, healthy and vigorous and densely foliated when in leaf. The tree is to have a healthy, well developed, fibrous root system which may be verified through a testing procedure that destructively samples one or more randomly selected root balls.

E24.2.15 Trees are to have only one, sturdy, reasonably straight and vertical trunk, and a well balanced crown with fully developed leader.

E24.2.16 Trees shall be free from disease, insect infestation, rodent damage, sun scald, frost cracks, abrasions, unhealed scars, scars exceeding 5 cm in diameter, major forks or crooks in the trunk, broken branches, or angled leaders.

E24.2.17 Trees exhibiting suppressed, weakly developed branches due to competition from other closely spaced tress in the nursery will not be accepted. Trees exhibiting dead branches will not be accepted.

E24.2.18 Balled and burlapped trees in excess of 3 m height must have been dug with large firm balls. Roots in balls must be comprised of 75% fibrous and feeder root systems.

E24.2.19 Tree spade dug trees are to be dug with mechanized digging equipment with hydraulic spade. Root balls are to satisfy C.N.T.A. standards.

E24.2.20 Use of collected and native trees is not permitted.

E24.3 Construction Methods

E24.3.1 Trees and shrubs shall be planted during unfrozen ground conditions and suitable weather conditions for plant growth. Trees are to be planted within forty-eight (48) hours of excavation from the nursery. The location of plantings will be staked out or painted on Site by the Contract Administrator.

E24.3.2 Excavate planting pits as indicated by the stakes or paint marks. Excavated soil shall be removed off Site. Remove any water that enters excavations prior to planting. Loosen bottom of planting hole to depth of 100-150 mm, cover the bottom of each excavation with minimum 150 mm topsoil mixture and incorporate with the subgrade. Plant trees vertically and orient to give the best appearance in relation to structure, roads, and sidewalks. With balled and burlapped root balls and root balls in wire baskets, loosed burlap and cut away to top 1/3 without disturbing root ball. Do not pull burlap or rope form under root ball. Non-biodegradable wrapping must be removed.

E24.3.3 Tamp planting soil around root system in layers of 150 mm eliminating air voids. When 2/3 of planting soil has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling. Each plant shall have an earth saucer at its base having a diameter as large as the excavation with a 10 cm lip formed at the perimeter of the saucer to retain water. When planting is completed, give surface of planting saucer dressing of fertilizer. Mix fertilizer thoroughly with top layer of planting soil and water in well.

E24.3.4 Trees shall be individually staked within seven (7) calendar days following planting with two 2.4 m metal T-bars located on the northwest and southeast side of the tree, and connected to the trunk with rubber hose or an industry accepted substitute. Prune nursery stock after planting to compensate for loss of roots suffered during transplanting.

E24.3.5 Trees and shrubs shall be watered during the planting procedure and once a week thereafter, or more frequently if required, during the growing season.

E24.4 Maintenance

E24.4.1 The Contractor shall provide a one year maintenance of trees and shrubs from the date of Total Performance. Maintenance Work shall include:

E24.4.2 Fertilizing – Spread Fertilizer consisting of synthetic slow release with maximum 35% nitrogen evenly at a frequency, ratio and rates recommended by the Manufacturer.

E24.4.3 Watering –Apply 40 litres of water per tree twice a month or more if drought conditions prevail.

E24.4.4 Tree Supports and Tie Adjustments – Maintain tree supports and ties in proper repair. Remove supports as directed by Contract Administrator. Strengthen any tree which is leaning.

E24.4.5 Replace trees and shrubs that die within the one-year maintenance period.

E24.5 Measurement and Payment

E24.5.1 The supply, planting and maintenance of trees and shrubs will be measured on a unit basis and paid for at the Contract Unit Price of “Tree and Shrub Planting”. The amount to be paid for will be the total number of trees and shrubs supplied, planted, and maintained in accordance with this specification, accepted and measured by the Contract Administrator.

E25. DEMOLITION OF STRUCTURES

E25.1 Description of Work

E25.1.1 The Work required under this section shall include, but is not limited to, the following:

(a) Demolition of gate chamber concrete to specified limits

(b) Removal and disposal of construction debris

E25.1.2 The Work required under this section shall include, but is not limited to, the following: Removal of existing concrete, performing saw cutting, demolition, protection of services to be maintained, demolition and disposal of existing concrete, and clean up of Work Site in anticipation of new Work for those demolition areas indicated on the drawings.

E25.1.3 The Work to be done by the Contractor under this Section shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as described hereinafter.

E25.2 References

E25.2.1 CSA S350-M1980, Code of Practice for Safety in Demolition of Structures.

E25.2.2 Manitoba Workplace Safety and Health Act, and all applicable National, Provincial, and Municipal regulations.

E25.3 Protection

E25.3.1 Prevent movement, settlement or damage of adjacent structures, services, walks, parts of existing structures to remain. Provide bracing, shoring as required. Make good damage caused by demolition.

E25.3.2 Take precautions to support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, cease operations and notify the Contract Administrator.

E25.4 Execution

E25.4.1 Inspection

(a) Inspect Site with Contract Administrator and verify extent and location of items designated for removal, disposal, salvage and items to remain.

(b) Locate and protect utilities.

(c) Notify and obtain approval of Contract Administrator before starting demolition.

E25.4.2 Preparation

(a) Disconnect and re-route electrical and telephone service in accordance with authorities having jurisdiction. Post warning signs on electrical lines and equipment which must remain energized during period of demolition.

(b) Disconnect and reroute mechanical services, as necessary, in accordance with authorities having jurisdiction.

(c) Do not disrupt active or energized utilities.

E25.4.3 Safety Code and Requirements

(a) Unless otherwise specified, carry out demolition Work in accordance with the City of Winnipeg Safety Directives and Guidelines.

(b) Blasting operations shall not be permitted during demolition unless reviewed and approved by the Contract Administrator.

E25.4.4 Demolition

(a) Demolish structures to permit construction of new Work as indicated.

(b) Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as Work progresses.

(c) At end of each day's Work, leave Work in safe condition so that no part is in danger of toppling or falling.

(d) Remove structural framing.

(e) Do not sell or burn materials on Site.

(f) Fracturing of concrete that is to remain shall be minimized. Concrete immediately adjacent to concrete which is to remain shall be demolished using hand-held breakers or jack hammers (maximum 10 kgs/20 lbs.). Other methods of performing concrete demolition may be submitted for review and approval to the Contract Administrator. The Contractor shall take measures to ensure that the concrete beyond the limits of demolition is not fractured or shattered. The Contractor shall remove using acceptable methods and replace any concrete which is deemed to be fractured as a result of demolition methods employed by the Contractor. This repair Work shall be performed at no additional cost to the City of Winnipeg.

E25.4.5 Demolition Tolerances

(a) All demolition shall be done using equipment and procedures to prevent over-breakage of the existing structure.

(b) Final demolition surfaces must remain locally within (25 mm) of the demolition lines, alignments, or limits shown on the drawings. Demolition beyond the limits shown shall

be reviewed by the Contract Administrator. The Contractor shall repair excess demolition to the satisfaction of the Contract Administrator, and at no cost to the City where required.

(c) All protrusions into the defined limits of demolition shall be removed if they interfere with the placement and alignment of embedded components or reinforcing steel.

E25.4.6 Abrasive Wiresaw and Sawcutting

(a) Areas of demolition shall be delineated from existing concrete that is to remain using either abrasive disc sawcutting, or abrasive wiresawing.

(b) All sawcuts shall be performed straight and normal to the surface being cut, following the locations shown on the drawings, or as directed by the Contract Administrator.

(c) Overruns at the junctions of sawcuts, and mis-starts shall be cleaned and filled with dry patching mortar of matching colour, as directed by the Contract Administrator.

(d) Minimum depths of sawcuts shall be 2" (50 mm) unless otherwise shown on drawings.

E25.4.7 Disposal of Demolished Material

(a) The Contractor shall be responsible for removal of debris and waste from the Work area to the location to an appropriate solid waste disposal area approved by the contract administrator.

(b) Metal debris, which may include structural steel, miscellaneous inserts, and reinforcing steel, shall be removed from Site and disposed of by the Contractor.

E25.5 Measurement and Payment

E25.5.1 Concrete Demolition:

Demolition of gate chamber concrete will be measured on a unit basis and paid for at the Contract Unit Price for “Concrete Demolition”.

No payment shall be made for demolition beyond the limits specified, or those otherwise approved by the Contract Administrator. The separation, as necessary of embedded and structural steel shall be considered incidental to the Work. The installation of temporary supports, shoring or hangers shall also be considered incidental to the Work. Sawcutting of concrete and removal of construction debris shall be considered incidental to the Work.

E26. CAST-IN-PLACE CONCRETE CONSTRUCTION

E26.1 Description

E26.1.1 This specification shall cover construction of cast-in-place concrete and shall supplement, revise and amend CW 2160.

E26.2 Materials

(a) Concrete Mix Design

(i) Concrete mix design shall be as indicated in the Construction Notes on the Drawings.

(b) Lean-Mix Concrete Design

(i) Proportioning of fine aggregate, coarse aggregate, cement, and water for lean mix concrete shall be as follows:

- Cement: Type 50
- Minimum Compressive Strength @ 28 days: 15 MPa
- Slump: 80 mm
- Air Content: nil

- Minimum Cement Content = 240 kg/m3
- Maximum Water/Cement Ratio = 0.49

(c) Grout

(i) Grout shall be Sika Grout 212 or approved equal.

(d) Reinforcing Steel

(i) Bar accessories:

- To be made from a non-corroding material.
- Shall not stain, blemish or spall the concrete surface for the life of the concrete.
- Shall be approved by the Contract Administrator.
- Bar chairs shall be PVC.

(e) Bonding Agent shall be ACRYL-STIX or approved equal.

(f) Cast Iron Slide Gates, wall thimbles, mechanical lift operator, stems and accessories shall be in accordance with E28 of this specification.

(g) Cast Iron Flap Gates and wall thimbles shall be in accordance with E29 of this specification.

(h) Miscellaneous Metals and Accessories in accordance with E30 of this specification and as shown on the Drawings.

(i) Shop Drawings

(i) Provide shop drawings in accordance with E8 of this specification.

(ii) Submit shop drawings for reinforcing steel a minimum of two (2) weeks prior to the fabrication of any reinforcing steel.

(j) Backfill

(i) In accordance with CW 2030. Class of backfill to be as shown on the Drawings.

E26.3 Construction Methods

E26.3.1 Construction Method Submission

(a) No Work shall commence on construction of cast-in-place concrete until after the Contract Administrator's review of the Contractor's Construction Method submission.

(b) Excavation for the construction of subsurface concrete shall be by the shored excavation method.

(c) The Contractor shall prepare for the Contract Administrator's review a Construction Method submission detailing:

(i) Construction sequence to be followed including all methods to be employed to ensure no damage occurs to existing structures or adjacent properties within or adjacent to an excavation.

(ii) Shoring system to be used.

(iii) Proposed method of chamber construction.

(iv) Specialized equipment to be used.

(v) Any design revisions proposed to accommodate the Contractor's proposed construction method.

(vi) Water control considerations including details on the Contractor's proposed method of groundwater and surface runoff control.

(d) The Contractor shall respond to any concerns that may be raised by the Contract Administrator after review of Construction Method submission.

E26.3.2 Excavation

(a) Remove excavated material from the Site immediately. Excavated material shall not be stockpiled on-site unless it will be used as backfill the same day it is excavated.

(b) Place a minimum 75 millimetre thick lean mix concrete slab in the bottom of the excavation to provide a clean Working base upon completion of the excavation to the required limits.

(c) Lean mix concrete shall be well-tamped and screed to give a level Working platform for setting up forms and placing reinforcing steel. Allow the concrete to set for twenty-four (24) hours before setting up forms or placing reinforcing steel.

(d) Supply and place lean mix concrete, as directed by the Contract Administrator, as backfill for any portions of the excavation, carried beyond the required limits of excavation. The limits of excavation shall be considered to be the inside face of the shoring system and the underside of the Working base slab.

(e) All Working areas below grade shall be kept adequately and securely supported during and after excavation until the shoring and bracing is in place to prevent loss of ground or injury to any person from falling material.

E26.3.3 Excavation Security Fence

(a) Further to Clause 3.1 of CW 1130, completely cover the excavation and provide a security fence to completely surround the excavation when unattended generally in accordance with the following.

(b) Security fence shall be chain link fence or approved equal, a minimum 1.80 metres high with metal support posts embedded far enough into the ground and spaced close enough together so the fence will not sag or collapse.

(c) Attach fencing securely to posts.

(d) Secure the gate or end of the fencing to a post with chain and a padlock.

(e) Provide alternate security fence proposal to Contract Administrator for approval.

E26.3.4 Shoring

(a) The type, strength, and amount of shoring and bracing shall be such as the nature of the ground and attendance conditions may require, taking into account property lines, existing slopes, utilities and roadways.

(b) Shoring and bracing shall be so spaced and dimensioned as to prevent caving, loss of ground, surface settlement, or squeezing of the soil beyond the neat lines of excavation. It shall be free from defects that might impair its strength or suitability for the Work. Sheeting/shoring and bracing shall conform to the latest revisions of the “Construction Safety Act” of the Department of Labour of the Government of Manitoba.

(c) Supporting design calculations as required to facilitate review of the submission for conformance with the Contract Documents.

(d) Submit Shop Drawings and design calculations for the shoring/excavation system designed and sealed by a Professional Engineer registered or licensed to practice in the Province of Manitoba and experienced in the structural design of shoring systems. The designer of the shoring system shall inspect the system during construction and certify, in writing to the Contract Administrator, that construction is in conformance with the approved design.

(e) Shoring and bracing shall be installed such that the structure size and wall thickness shown on the drawings can be obtained subsequent to installation of the shoring system.

(f) Shoring and bracing shall remain in place until concrete has attained 75% of the design strength.

E26.3.5 Cast in place Concrete Chamber Construction

(a) Construct cast in place concrete chambers in accordance with CW 2160, except as supplemented, revised or amended in this specification and as indicated in the construction notes on the Drawings.

(b) Adjust the location of reinforcing steel adjacent to openings to frame those openings in accordance with good practice, and maintain the bar spacing intent.

(c) Do not use welded splices for reinforcing steel.

(d) Order all wall reinforcing steel in lengths to best suit the spacing of walers so that reinforcing bars will not be bent or misformed in order to remove the walers.

(e) Install foundation waterproofing in accordance with E30 of this Specification.

E26.3.6 Backfill

(a) Place and compact backfill material as indicated on the Drawings in accordance with CW 2030.

(b) Do not place backfill material in a frozen state.

(c) Supply heating and hoarding in accordance with CW 2160 if required to ensure material does not freeze before compaction is complete.

(d) Notify the Contract Administrator at least one (1) full Working Day in advance of any backfilling operation. No Backfill shall be placed against concrete until approved by the Contract Administrator and in no case before field cured test cylinders show the concrete strength to be 75% of that specified.

E26.3.7 Grout

(a) Mix and apply grout in accordance with the manufacturer's instructions. Consistency to be suitable for the intended application.

E26.3.8 Slide Gate Installation

(a) Install slide gate, wall thimble, mechanical lift operator, stem and accessories as shown on the Drawings and in accordance with E28 of this specification.

(b) Slide gates shall be left in the open position at all times except when on Site Working on the gate.

E26.3.9 Flap Gate Installation

(a) Install flap gate, wall thimble and lifting cable as shown on the Drawings and in accordance with E29 of this specification.

E26.3.10 Miscellaneous Metal Fabrications

(a) Install miscellaneous metal fabrications as shown on the Drawings and in accordance with E30 of this specification.

E26.3.11 Bollards

(a) Install removable bollards at the locations shown and as detailed on the Drawings.

E26.4 Measurement and Payment

E26.4.1 Construction of cast-in-place concrete will be measured on a unit basis and paid for at the Contract Unit Price for "Cast-in-place Concrete". Said price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the Work included in this specification except installation of control gates

supply and installation of miscellaneous metal and rehabilitation of existing slide gate which shall be paid for separately.

E27. COLD WEATHER REQUIREMENTS

E27.1 Description

(a) Should any concrete Work be required to be carried out when the mean daily temperature is below 5°C or anticipated to be below 5°C within the next 24 hours, cold weather requirements will be specified herein.

(b) All freshly placed concrete shall be protected from the elements and from defacements due to construction operations.

E27.2 Construction Methods

(a) The following are minimum requirements for protecting concrete during and after placement during freezing weather, but mere adherence to these requirements will not relieve the Contractor of the necessity for producing concrete which has not been weakened or injured by frost of freezing, or replacing such damaged Work at no additional expense to the City;

(i) Before any concrete is placed, all ice, snow, and frost shall be completely removed from all formWork, and other surfaces against which concrete temperatures of such surfaces raised above 7°C for twenty-four (24) hours minimum prior to concreting. Where concrete Work is to come in contact with the earth, the surface of the earth shall be completely free of frost when concrete is placed thereon.

(ii) Concrete aggregates and water shall be heated to not over 80°C. Concrete shall be not less than 20°C or more than 30°C in temperature when deposited. Concrete when placed during freezing weather, or if freezing is anticipated during curing period, shall be fully enclosed and the temperature of same maintained at not less than 20°C for five (5) days nor less than 5°C for an additional five (5) days.

(iii) Heating enclosures shall be strong and wind-proof, well ventilated with heating units so located as to prevent local overheating or drying of the concrete or damage from combustion gases. Only indirect fired heaters will be accepted. Units must be vented outside the enclosure. No direct fired units will be accepted.

(iv) The Contractor shall inform the Contract Administrator well in advance as to the methods of enclosure and frost protection he proposes to employ.

E27.3 Measurement and Payment

E27.3.1 Cold weather requirements shall be considered incidental to the the construction of cast-in-place concrete and no measurement or payment will be made for this item.

E28. CAST IRON SLIDE GATES

E28.1 Description

(a) This Specification shall cover the installation and testing of cast iron slide gates, wall thimbles, mechanical lift operator, stems, wall brackets, and accessories.

E28.2 Construction Methods

E28.2.1 Installation

(a) Install cast iron slide gates, wall thimbles, mechanical lift operator, stems, wall brackets and accessories as shown on the drawings and in accordance with the manufacturer’s recommendations.

(b) Make arrangements to have a qualified field representative of the slide gate supplier/manufacturer inspect the installation during and after completion and provide a Certificate of Satisfactory Installation to the Contract Administrator.

E28.2.2 Field Testing

(a) Perform leakage tests in the Contract Administrator's presence once slide gates have been installed to ensure compliance with the allowable leakage rate indicated in AWWA C560-00.

(b) Arrange for a qualified field representative of the slide gate supplier/manufacturer to be present during field testing.

(c) The test for seating head will be performed by closing the existing slide gate, installing a temporary bulkhead at the sewer pipe inlet, filling the chamber with water to the specified head and measuring the leakage rate through the gate.

(d) The Contractor will be responsible to pump river water or supply water from a hydrant into the chamber for testing purposes.

(e) If a gate fails the field leakage test, the Contractor shall undertake adjustments, replacements or other modifications recommended by the slide gate supplier/manufacturer's field representative and repeat the test. The sequence shall be repeated until the gate passes the allowable leakage rate.

E28.3 Measurement and Payment

E28.3.1 Installation and testing of cast iron slide gates, wall thimbles, mechanical lift operator, stems, wall brackets and accessories will be paid for at the Contract Unit Price for "Installation and Field Testing of Control Gates, Thimbles and Operator".

E29. CAST IRON FLAP GATES

E29.1 Description

(a) This Specification shall cover the installation and testing of cast iron flap gates and wall thimbles.

E29.2 Construction Methods

E29.2.1 Installation

(a) Install cast iron flap gates and wall thimbles as shown on the drawings and in accordance with the manufacturer's recommendations.

(b) Make arrangements to have a qualified field representative of the flap gate supplier/manufacturer inspect the installation during and after completion and provide a Certificate of Satisfactory Installation to the Contract Administrator

E29.2.2 Field Testing

(a) Perform leakage tests in the Contract Administrator's presence once flap gates have been installed to ensure compliance with the allowable leakage rate of 1.24L/min per metre of seated perimeter at any head.

(b) Arrange for a qualified field representative of the flap gate supplier/manufacturer to be present during field testing.

(c) The test for seating head will be performed by closing the flap gate and existing slide gate, filling the chamber between the gates with water to the specified head and measuring the leakage rate through the gates.

(d) The Contractor will be responsible to pump river water or supply water from a hydrant into the chamber for testing purposes.

(e) If a gate fails the field leakage test, the Contractor shall undertake adjustments, replacements or other modifications recommended by the flap gate supplier/manufacturer's field representative and repeat the test. The sequence shall be repeated until the gate passes the allowable leakage rate.

E29.3 Measurement and Payment

E29.3.1 Installation and testing of cast iron flap gates and wall thimbles will be paid for at the Contract Unit Price for "Installation and Field Testing of Control Gates, Thimbles and Operator".

E30. METAL FABRICATIONS

E30.1 Description

E30.1.1 General

(a) This Specification shall cover the supply, fabrication, transportation, handling, delivery and placement of metal fabrications.

E30.2 Materials

E30.2.1 All materials shall be of a type acceptable to the Contract Administrator, and shall be subject to inspection and testing by the Contractor Administrator.

E30.2.2 Material intended for use in the various assemblies shall be new, straight, clean, with sharply defined profiles.

E30.2.3 Steel Sections and Plates:to CAN/CSA G40.20/G40.21, Grade 300 W, except W, HP and HSS sections, which shall be Grade 350 W.

E30.2.4 Steel Pipe: to ASTM A53/A53M, seamless, galvanized, as specified by item.

E30.2.5 Welding materials: to CSA W59.

E30.2.6 Hot dipped galvanized steel repair material: Galvalloy and Gal-Viz

E30.2.7 Stud Anchors: to ASTM A108, Grade 1020.

E30.2.8 Aluminum: to CAN/CSA S157 and the Aluminum Association 'Specifications for Aluminum Structures'. Aluminum for plates shall be Type 6061-T651. Aluminium plate shall have an approved raised oval or multi-grip pattern.

E30.2.9 Isolating sleeves shall be "Nylite" – headed sleeve as manufactured by SPAE-Naur of Kitchener, Ontario, or approved equal.

E30.2.10 Anchor bolts and fasteners: ASTM A276, Type 316 stainless steel, of ample section to safely withstand the forces created by operation of the equipment or the load to which they will be subjected.

E30.3 Construction Methods

E30.3.1 Submittals

(a) The Contractor shall submit the qualifications of the fabricator and welders to the Contractor Administrator for acceptance. Submit shop drawings in accordance with E8 clearly indicating materials, core thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and, accessories. Indicate field measurements on shop drawings.

E30.3.2 Fabrication

(a) Fabricate Work square, true, straight and accurate to required size, with joints closely fitted and properly secured. Assemble Work in such a way that no disfigurements will show in the finished Work, or impair the strength.

(b) Confirm measurements for all fabrications before fabricating.

(c) Cut aluminium plate with edges straight and true, and as far as practical, maintain continuity of the pattern at abutting edges.

(d) Pieces shall be of the sizes indicated on the Drawings and shall not be built up from scrap pieces. Confirm sizes with field measurements.

(e) Where possible, fit Work and shop assemble, ready for erection.

(f) Angle frames shall be of the same material as the cover plate (except for existing frames designated on the drawings for re-use), and cover plates shall be hinged and be supplied with lifting handles, as shown on the Drawings. Exterior covers shall be supplied with a hasp for a padlock.

(g) Remove and grind smooth burrs, filings, sharp protrusions, and projections from metal fabrications to prevent possible injury. Correct any dangerous or potentially harmful installations as directed by Contract Administrator.

(h) All steel welding shall conform to CSA Standard W.59. Fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with CSA Standard W.47.1. Welding shall be done by currently licensed welders only.

(i) All aluminum welding shall be in accordance with the requirements of CSA W59.2. The fabricator shall be fully certified in conformance with CSA Standard W47.2. All welding shall be done in a licensed welding shop, and no field welding will be permitted unless approved in writing, in advance, by the Contract Administrator.

(j) Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

(k) All steel shall be hot-dip galvanizing after fabrication, in accordance with CAN/CSAG164, to a minimum net retention of 600 gm/m^2.

(l) Seal exterior steel fabrications to provide corrosion protection in accordance with CAN3-S16.1.

(m) Use self-tapping shake-proof flat-headed screws on items requiring assembly by screws.

E30.3.3 Erection

(a) Do steel welding Work in accordance with CSA W59 and aluminum welding Work in accordance with CSA W59.2

(b) Erect metal Work in accordance with reviewed shop drawings, square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

(c) Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles where not specifically indicated on the Drawings.

(d) Provide components for building in accordance with shop drawings and schedule.

(e) Make field connections with bolts to CAN/CSA-S16, or weld.

(f) Touch-up rivets, bolts and burnt or scratched surfaces that are to receive paint finish, with zinc primer after completion of erection.

(g) Repair damaged galvanized surfaces and field welds with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780, Repair of

Damaged Hot Dip Galvanizing Coatings. The general procedure shall be to allow a small amount of the repair alloy to flow then spread by brushing briskly with a wire brush. Brushing shall be sufficient to obtain a bright finish. Repeat process three times to ensure a proper thickness is achieved. Temperatures shall be kept below 177ºC (350ºF) at all times. All heating of structural steel. Work shall be done in the presence of the Contract Administrator.

(h) Install access hatch frames square and level at the locations show on the Drawings. Embed anchors in concrete as shown on the Drawings. Install covers and adjust hardware to proper function.

(i) All aluminum surfaces in contact with concrete shall be isolated using alkali resistant bituminous paint meeting the requirements of CGSB 31-GP-3M.

(j) Install electrochemical isolation gaskets and sleeves to electrically isolate dissimilar metals.

E30.4 Measurement and Payment

E30.4.1 Supply, fabrication, transportation, handling, delivery and placement of metal fabrications will be paid for at the Contract Unit Price for “Supply and Installation of Miscellaneous Metals”.

E31. DFO LETTER OF ADVISE

E31.1 The Contractor is advised that the Federal Department of Fisheries and Oceans has issued a letter of advice for the project. A copy of the letter is included. All of the conditions and recommendations in that letter shall apply to the Work.

E32. TOPSOIL AND SEEDING

E32.1 Description

Topsoil and seeding shall be completed in accordance with CW 3520-R6 except as noted herein.

E32.2 Materials

Grass seed shall consist of a Canada common native seed mix as follows:
20% Slender Wheatgrass
20% Switchgrass
20% Big Bluestem
20% Canada Wildrye
10% Fringed Brome
10% Canada Milkvetch

Grass species that may be substituted in varying percentages (no greater than 20%) as alternatives to those listed above include;

Prairie Cordgrass
Streambank Wheatgrass
Western Wheatgrass
Northern Wheatgrass

Oats shall be Canada No. 1 Grade.

E32.3 Submittals

The Contractor shall submit the proposed seed mix for review by the Contract Administrator prior to initiating seeding operations.

E32.4 Construction Methods

Grass seed shall be sown at a rate of 0.22 kg per 100 square metres.

Oats shall be sown at a rate of 0.38 kg per 100 square metres.

Oats and grass seed may be mixed and sown together or they may be sown separately.

E32.5 Maintenance of Seeded Area

Areas seeded with native grasses shall be mowed during the first growing season to control pioneering weeds and other competition. For the purposes of this project a weed is defined as any plant not included in the seed mix. Mowing should be done before the general height is 150 to 250 mm, or when the weedy foliar cover reaches 50 percent of the seeded area, or when the weed species begin to flower. The first mowing shall be set at a height of 75 mm with the following mowings to be set at a height of 100 to 200 mm. Rotary, flail, or sickle bar type mowing equipment is acceptable.

All other maintenance of seeded area shall be in accordance with CW 3520-R6.

E33. ENVIRONMENTAL PROTECTION PLAN

E33.1 The Contractor shall plan and implement the Work of this Contract strictly in accordance with the requirements of the Environmental Protection Plan as herein specified, Fisheries Authorization & CEAA Screening report.

E33.2 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work and are available for viewing at the office of the Contract Administrator.

A. Federal

1. Canadian Environmental Assessment Act (CEAA) c.37
2. Transportation of Dangerous Goods Act and Regulations c.34
3. The Fisheries Act
4. Navigable Waters Protection Act

B. Provincial

1. The Dangerous Goods Handling and Transportation Act D12
2. The Endangered Species Act E111
3. The Environment Act c.E125
4. The Fire Prevention Act F80
5. The Manitoba Heritage Resources Act H39.1
6. The Manitoba Noxious Weeds Act N110
7. The Manitoba Nuisance Act N120
8. The Public Health Act c.P210
9. The Workplace Safety and Health Act W210
10. And current applicable associated regulations.
    (Note: Provincial regulations updated as of September 1999)

C. Municipal

1. The City of Winnipeg By-law No. 2480/79 and all amendments up to and including 7969/2000
2. The City of Winnipeg By-law No. 1573/77 and all amendments up to and including 7670/2000
3. And any other applicable Acts, Regulations, and By-Laws.

E33.3 The Contractor is advised that the following environmental protection measures apply to the Work.

A. Materials Handling and Storage

1. Construction materials shall not be deposited or stored on riverbanks or river shorelines unless written acceptance from the Contract Administrator is received in advance.

2. Construction materials and debris shall be prevented from entering the Assiniboine River. In the event that materials and/or debris inadvertently enter the watercourse, the Contract shall be required to remove the material and restore the watercourse to its original condition.

B. Fuel Handling and Storage

1. The Contractor shall obtain all necessary permits from Manitoba Conservation for the handling and storage of fuel products and shall provide copies to the Contract Administrator.

2. All fuel handling and storage facilities shall comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.

3. Fuels, lubricants, and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act shall be stored and handled within the approved storage areas.

4. In accordance with Section 2.5 (Construction: General Guidelines) of the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat, (DFO and DNR, 1996), the Contractor shall ensure that any temporary fuel storage areas established for construction of the project are contained by an impermeable dike and are located a minimum distance of 100 metres away from the high water line of the Assiniboine River. Dikes shall be designed, constructed, and maintained to retain not less than 100% of the capacity of the total number of containers or 110% of the largest container, whichever is greatest. The dikes shall be constructed of clay or similar impervious material. If this type of material is not available, the dike shall be constructed of locally available material and lined with high density polyethylene (HDPE). Furthermore, the fuel storage area(s) shall be secured by a barrier such as a high fence and gate to prevent vandalism.

5. The Contractor shall ensure that all fuel storage containers are inspected daily for leaks and spillage.

6. Products transferred from the fuel storage area(s) to specific Work Sites shall not exceed the daily usage requirement.

7. When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size shall be spread on the ground to catch the fluid in the event of a leak or spill.

8. Refuelling of mobile equipment and vehicles shall take place at least 100 metres from a watercourse.

9. The area around storage Sites and fuel lines shall be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.

10. A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills shall be stored nearby on-site. The Contractor shall ensure that additional material can be made available on short notice.

C. Waste Handling and Disposal

1. The construction area shall be kept clean and orderly at all times during and at completion of construction.

2. At no time during construction shall personal or construction waste be permitted to accumulate for more than one day at any location on the construction Site, other than at a dedicated storage area as may be approved by the Contract Administrator.

3. All resulting debris shall be deposited at a Waste Disposal Ground operating under the authority of Manitoba Regulation #150/91. Exceptions are liquid industrial and hazardous wastes which may require special disposal methods (see SC:21.4 D).

4. Indiscriminate dumping, littering, or abandonment shall not take place.

5. No on-site burning of waste is permitted.

6. Waste storage areas shall not be located so as to block natural drainage.

7. Run-off from a waste storage area shall not be allowed to cause siltation of a watercourse.

8. Waste storage areas shall be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.

9. Equipment shall not be cleaned near watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.

D. Dangerous Goods/Hazardous Waste Handling and Disposal

1. Dangerous goods/hazardous wastes are identified by, and shall be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.

2. The Contractor shall be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.

3. The Contractor shall have on-site staff that is trained and certified in the handling of the dangerous/hazardous goods, when said dangerous/hazardous goods are being utilized on-site for the performance of the Work.

4. Different waste streams shall not be mixed.

5. Disposal of dangerous goods/hazardous wastes shall be at approved hazardous waste facilities.

6. Liquid hydrocarbons shall not be stored or disposed of in earthen pits on-site.

7. Used oils shall be stored in appropriate drums, or tankage until shipment to waste oil recycling centres, incinerators, or secure disposal facilities approved for such wastes.

8. Used oil filters shall be drained, placed in suitable storage containers, and buried or incinerated at approved hazardous waste treatment and disposal facilities.

9. Dangerous goods/hazardous waste storage areas shall be located at least 100 metres away from the high water line and be dyked.

10. Dangerous goods/hazardous waste storage areas shall not be located so as to block natural drainage.

11. Run-off from a dangerous goods/hazardous waste storage area shall not be allowed to cause siltation of a watercourse.

12. Dangerous goods/hazardous waste storage areas shall be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.

E. Emergency Response

1. The Contractor shall ensure that due care and caution is taken to prevent spills.

2. The Contractor shall report all major spills of petroleum products or other hazardous substances with significant impact on the environment and threat to human health and safety (as defined in Table 1 below) to Manitoba Conservation, immediately after occurrence of the environmental accident, by calling the 24-hour emergency phone number (204) 945-4888. The Contract Administrator shall also be notified.

3. The Contractor shall designate a qualified supervisor as the on-site emergency response co-ordinator for the project. The emergency response co-ordinator shall have the authority to redirect manpower in order to respond in the event of a spill.

4. The following actions shall be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on-site emergency response co-ordinator:
    1. Notify emergency-response co-ordinator of the accident:
        - identify exact location and time of accident
        - indicate injuries, if any
        - request assistance as required by magnitude of accident (Manitoba Conservation 24-hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup)

    - Attend to public safety:
        - stop traffic, roadblock/cordon off the immediate danger area
        - eliminate ignition sources
        - initiate evacuation procedures if necessary

    - Assess situation and gather information on the status of the situation, noting:
        - personnel on-site
        - cause and effect of spill
        - estimated extent of damage
        - amount and type of material involved
        - proximity to waterways, sewers, and manholes

- If safe to do so, try to stop the dispersion or flow of spill material:
  - approach from upwind
  - stop or reduce leak if safe to do so
  - dike spill material with dry, inert sorbet material or dry clay soil or sand
  - prevent spill material from entering waterways and utilities by diking
  - prevent spill material from entering manholes and other openings by covering with rubber spill mats or diking

- Resume any effective action to contain, clean up, or stop the flow of the spilled product.

5. The emergency response co-ordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to Manitoba Conservation according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.

6. When dangerous goods are used on-site, materials for containment and cleanup of spill material (e.g. absorbent materials, plastic oil booms, and oversized recovery drums) shall be available on-site.

7. Minor spills of such substances that may be contained on land with no significant impact on the environment may be responded to with in-house resources without formal notification to Manitoba Environment.

8. City emergency response, 9-1-1, shall be used if other means are not available.

9. The on-site emergency response coordinator shall contact The Canadian Coast Guard, Selkirk (204) 785-6030, if the spill material reaches and is on or in the Red or Assiniboine Rivers.

Table 1 Spills that must be reported to the Manitoba Conservation as Environmental Accidents

Classification		Hazard	Reportable Quantity/Level
1		Explosives	All
2.1		Compressed Gas (flammable)	100 L*
2.2		Compressed Gas	100 L*
2.3		Compressed Gas (toxic)	All
2.4		Compressed Gas (corrosive)	All
3		Flammable Liquids	100 L
4		Flammable Solids	1 kg
5.1	PG** I & II	Oxidizer	1 kg or 1 L
	PG III	Oxidizer	50 kg or 50 L
5.2		Organic Peroxide	1 kg or 1 L
6.1	PG I	Acute Toxic	1 kg or 1 L
	PG II & III	Acute Toxic	5 kg or 5 L
6.2		Infectious	All
7		Radioactive	Any discharge or radiation level exceeding 10 mSv/h at the package surface and 200 uSv/h at 1 m from the package surface
8		Corrosive	5 kg or 5 L
9.1		Miscellaneous	50 kg

		(except PCB mixtures)
9.1	PCB Mixtures	500 g
9.2	Aquatic Toxic	1 kg or 1 L
9.3	Wastes (Chronic Toxic)	5 kg or 5 L

* Container capacity (refers to container water capacity)
** PG = Packing Group(s)

F. Vegetation

1. Vegetation shall not be distributed without written permission of the Contract Administrator. The Contractor shall protect plants or trees which may be at risk of accidental damage. Such measures may include protective fencing or signage and shall be approved in advance by the Contractor Administrator.

2. Trees damaged during construction activities shall be examined by bonded tree care professionals; viable trees damaged during construction activities shall be pruned according to good practise by bonded tree care professionals. Damaged trees which are not viable shall be replaced at the expense of the Contractor.

3. Trees identified to be at risk by the Contract Administrator are to be strapped with 25 x 100 x 2400 millimetre wood planks, or suitably protected as approved by the Contract Administrator.

4. Herbicides and pesticides shall not be used adjacent to any surface watercourses.

5. All landowners adjacent to the area of application of herbicides or pesticides shall be notified prior to the Work.
6. Trees or shrubs shall not be felled into watercourses.

7. Areas where vegetation is removed during clearing, construction, and decommissioning activities, shall be revegetated as soon as possible in accordance with the landscaping plans forming part of the contract, or as directed by the Contract Administrator.

G. Landscaping

1. Restoration of boulevards requiring topsoil and sod.

H. Red and Assiniboine Rivers Navigation Protection

Dangerous Goods/Hazardous Waste Handling and Disposal

(a) The Red and Assiniboine Rivers are open to navigation from approximately mid April to mid November, annually. During this period, it will be the responsibility of the Contractor to fully ensure the safety of river users.

(b) The Contractor shall provide, install, and maintain adequate warning signs and lighting on any structure beyond the water's edge to notify boats and other craft navigating on the Assiniboine River that construction is underway. These warnings shall meet the requirements of the Winnipeg Rivers and Streams Authority Number One and of the Canadian Coast Guard.

(c) Prior to commencing any applicable operations over the Red River, the Contractor shall provide to the Contract Administrator a copy of all necessary approvals received by the Contractor.

E34. CONCRETE SURFACE REPAIRS

E34.1 Description

This Specification shall cover all operations related to the repair of delaminated spalled and deteriorated areas of the existing gate chamber concrete.

E34.2 Materials

(a) Substructure Concrete

The substructure concrete requirements are:

- 20 mm nominal size of course aggregate
- minimum cementitious content shall be 360 kg/m^3
- 0.40 maximum water/cementitious
- 30 MPa minimum compressive strength at 28 days

(b) Reinforcing Steel

The reinforcing steel shall meet the requirements of CAN/CSA-G30.18-M92, Grade 400W. The Contractor shall supply the reinforcing steel.

E34.3 Construction Methods

(a) Concrete Repair

The size and location of the substructure concrete repair areas as shown on the Plans are approximate. The Contractor shall repair the spalled and deteriorated concrete in the general area as identified and as otherwise directed by the Contract Administrator in the field. The Contractor shall provide safe access to the substructure concrete areas for the Contract Administrator to inspect the substructure concrete and to mark out the repair areas in the field.

All areas requiring repair shall be saw cut around their perimeter to a depth of 25 mm. All concrete in the repair area shall be removed to a depth of unsound, spalled and deteriorated concrete. When corroded reinforcing steel is exposed additional concrete shall be removed to provide at least 20 mm clearance around the entire surface of the corroded reinforcing steel. All resulting concrete and steel surfaces shall be thoroughly cleaned by rotary powered steel brush. All rust and scale shall be thoroughly removed from exposed reinforcing steel. The repair surfaces shall be pre-soaked prior to placement of concrete.

Repaired areas shall receive a trowelled finish to match the existing substructure concrete surface.

E34.4 Measurement and Payment

Substructure concrete repairs will be measured on an area basis. The area to be paid for will be the total number of square metres of substructure concrete repaired in accordance with this Special Provision as computed from measurements made by the Contract Administrator.

Substructure concrete repairs will be paid for at the Contract Unit Price per square metre for "Surface Repairs to Existing Gate Chamber Concrete" measured as specified herein, which price will be payment in full for performing all operations herein described.

Division 4 – Masonry

Division 6 – Wood & Plastics

Division 7 – Thermal & Masture Protection

Division 8 – Doors & Windows

Division 9 – Finishes

Division 15 – Mechanical

Division 16 – Electrical

Division 17 - Instrumentation

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA)
.1 CSA A179 Mortar and Grout for Unit Masonry.
.2 CSA A371 Masonry Construction for Buildings.

1.2 Delivery, Storage and Handling

.1 Deliver materials to job site in dry condition. Keep materials dry until use, except where wetting of bricks is specified.

.2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.3 Environmental Requirements

.1 Hot Weather Requirements: 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 flashing or other permanent construction.
.3 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
.4 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

PART 2 - PRODUCTS

2.1 Materials

.1 As specified in related section in Division 4 – Masonry.
.2 Use same brands of materials and source of aggregate for entire project.

PART 3 - EXECUTION

3.1 Installation

.1 Do masonry work in accordance with CSA A371 except where indicated otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

.4 Make masonry courses uniform in height with both vertical and horizontal joints of equal and uniform thickness.

.5 Keep air space in cavities and weep holes free of mortar droppings and other debris to allow free air movement and positive moisture drainage to exterior.

.6 Lay masonry units in full mortar bed. Do not shift or tap units after mortar has taken initial set. Where adjustments must be made, remove mortar and replace with fresh supply.

.7 Bed joints evenly and fill solidly with mortar. Rock masonry into place at closures with head joints thrown against adjacent masonry units.

.8 Where new masonry abuts set masonry, clean existing surfaces and dampen if necessary to obtain bond.

3.2 Construction

.1 Clean unglazed clay masonry as work progresses.

.2 Exposed masonry:
- .1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

.3 Jointing:
- .1 Allow joints to set just enough to remove excess water, then tool with jointer to provide smooth, compressed, uniform joints.
- .2 Use round jointer to provide concave joints where concave joints are indicated.
- .3 Strike flush all joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.

.4 Cutting:
- .1 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.
- .2 Make cuts straight, clean, and free from uneven edges.
- .3 Use masonry saw where necessary.

.5 Building in:
- .1 Build in items required to be built into masonry.
- .2 Prevent displacement of built-in items during construction. Check plumb, locationand alignment frequently, as work progresses.
- .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.6 Wetting of Bricks
- .1 Except in cold weather, wet clay bricks having an initial rate of absorption exceeding 1 g/min/1000 mm^2: wet to uniform degree of saturation, 3 to 24 h before laying, and do not lay until surface dry.
- .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.

.7 Support of loads:
- .1 Use 20 MPa concrete where concrete fill is used in lieu of solid units.
- .2 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.

.8 Provision for movement:
- .1 Built masonry to tie in with stabilizers, with provision for vertical movement.

.9 Provisions for other trades:
- .1 Provide openings in masonry walls where required or indicated. Accurately locate chases and openings and neatly finish to the required sizes.
- .2 Where masonry encloses conduit or piping, bring to proper level indicated and as directed.
- .3 Do not cover pipe or conduit chases or enclosures until advised that work has been inspected and tested.

.10 Loose steel lintels:
- .1 Install loose steel lintels. Centre over opening width.

.11 Control joints:
- .1 Construct continuous control joints as indicated.
- .2 Provide continuous vertical control joints in exterior masonry veneer as indicated, but at no more than 6 m on centre maximum spacing.
- .3 Fill control joints with expansion joint filler and joint sealants as specified in related section in Division 4 – Masonry.

3.3 Site Tolerances

.1 Tolerances in notes to Clause 5.3 of CSA A371 apply.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

The masonry will be measured and paid for at the Contract Lump Sum Price for “Masonry”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

.1 CSA A179 Mortar and Grout For Unit Masonry.

PART 2 - PRODUCTS

2.1 Materials

.1 Mortar: CSA A179, Type S for loadbearing masonry, Type N for non-loadbearing masonry, based on Property specifications.

PART 3 - EXECUTION

3.1 Construction

.1 Do masonry mortar work in accordance with CSA A179.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Mortar and Masonry

Mortar and Masonry shall be considered incidental to the Contract Lump Sum Price for "Masonry".

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

.1 CSA A179 Mortar and Grout For Unit Masonry.

PART 2 - PRODUCTS

2.1 Materials

.1 Mortar: CSA A179, Type S for loadbearing masonry, Type N for non-loadbearing masonry, based on Property specifications.

PART 3 - EXECUTION

3.1 Construction

.1 Do masonry mortar work in accordance with CSA A179.

.2 Tie masonry veneer to backing in accordance with NBC, CSA S304, CSA A371 and as indicated.

3.3 Reinforced Lintels and Bond Beams

.1 Reinforce masonry lintels and bond beams as indicated. Place and grout reinforcement in accordance with CSA S304, CSA-A371, and CSA-A179.

3.4 Grouting

.1 Grout masonry in accordance with CSA S304, CSA-A371, and CSA-A179 and as indicated.

3.5 Anchors

.1 Supply and install metal anchors as indicated.

3.6 Lateral Support and Anchorage

.1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated.

3.7 Field Bending

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Contract Administrator.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars and connectors that develop cracks or splits.

3.8 Field Touch-up

.1 Touch up damaged and cut ends of galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Masonry Reinforcement and Connectors

Masonry Reinforcement and Connectors shall be considered incidental to the Contract Lump Sum Price for “Masonry”.

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM)
  .1 ASTM A 653/ A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association (CSA)
  .1 CSA A371, Masonry Construction for Buildings.

PART 2 - PRODUCTS

2.1 Materials

.1 Control joint fillers and joint sealants: as specified in Section 07900 - Joint Sealants.

.2 Masonry flashing: self-adhesive modified bitumen sheet membrane: minimum 1.0 mm thick. Use primers recommended by manufacturer. Acceptable products: Bakelite Blueskin SA, WR Grace Perm-A-Barrier, Soprema Colphene 1500.

.3 Metal drip edge: brake formed of 0.6 mm galvanized sheet steel commercial quality to ASTM A653 with Z275 designation zinc coating. Prefinished with Stelcolor 8000 Series coil coating. Colour selected by Contract Administrator. Form drip edge to extend 100 mm under base course, with 6 - 9 mm formed drip at front edge.

PART 3 – EXECUTION

3.1 Installation

.1 Install continuous control joint fillers in control joints at locations indicated.

.2 Install weep hole vents in vertical joints immediately over flashings in masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre. Leave out the bottom 50 mm of mortar from vertical joints. Keep weep holes free from mortar droppings and debris to allow free air movement and positive drainage of moisture.

3.2 Construction

.1 Building flashings in masonry in accordance with CSA A371 and as follows.
  .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, angle lintels over openings and elsewhere indicated. Install flashings under weep hole courses.
  .2 In cavity walls and veneered walls carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, bond to backup wall and seal top edge water tight.
  .3 Lap joints 150 mm and seal.

.2 In addition to masonry flashing provide metal drip edge at angle lintels over openings. Align drip edge straight and even. Overlap joints minimum 20 mm.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Masonry Accessories

Masonry Accessories shall be considered incidental to the Contract Lump Sum Price for "Masonry".

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

.1 CAN3-A165 Series (CAN3-A165.1) (CAN3-A165.3) (CAN3-A165.4) CSA Standards on Concrete Masonry Units.

PART 2 - PRODUCTS

2.1 Materials

.1 Standard concrete masonry units: to CSA A165 Series (CSA A165.1).

.1 Classification: H/15/A /M.

.2 Size: modular

.3 Special shapes: provide square units for exposed corners. Provide purpose made shapes for lintels and bond beams. Provide additional special shapes as indicated.

PART 3 – EXECUTION

3.1 Installation

.1 Concrete block units.

.1 Bond: running stretcher.

.2 Coursing height: 200 mm for one block and one joint.

.3 Jointing: concave where exposed or where paint or other finish coating is specified.

.2 Concrete block lintels.

.1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.2 End bearing: not less than 200 mm.

3.2 Cleaning

.1 Standard block: allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Concrete Masonry Units

Concrete Masonry Units shall be considered incidental to the Contract Lump Sum Price for “Masonry”.

PART 1 - GENERAL

1.1 Related Work

.1 Section 04050 – Masonry Procedures
.2 Section 04060 – Mortar and Grout
.3 Section 04090 – Masonry Accessories

1.2 Work Included

.1 Work under this section shall include all labour, materials, equipment and services necessary to the completion of all single course split face limestone work as shown on the drawings or hereinafter specified.

1.3 Storage and Handling

.1 Check all stone on arrival for damage and report to carrier, noting damage on delivery slip or bill of lading. Handle stone carefully with competent workmen and proper equipment. Avoid chipping edges or corners. Store stone off ground and prtect from dirt and damage.

1.4 Job Conditions

.1 Existing Conditions: Inspect and arrange for correction of defects or dimension errors in concrete or steel structural surfaces which would affect stone work.

1.5 Shop Drawings

.1 Submit shop drawings in accordance with E8.

PART 2 - PRODUCTS

2.1 Materials Properties

.1 Stone: shall be: Manitoba Tyndall limestone as quarried and supplied by Gillis Quarries Ltd.
.2 Colour: shall be: buff
.3 Grade: shall be Standard Grade

2.2 Mixes

.1 Mortar:
One (1) part non – staining cement (“Medusa” or equal)
One (1) part lime
Six (6) parts sand

2.3 Fabrication and Manufacture

Stone shall be supplied in random lengths (to be further jointed on the job by the setting contractor as required) and shall be supplied in heights and depths as follows:

.1 Course heights shall be 133 mm
.2 Wall thickness shall be ± 90 mm
.3 Top beds shall be: “Sawn”, note special sizes on drawings
.4 Ends: Majority of ends shall be: “Sawn”
.5 Face finish shall be: Pitched - Face

PART 3 - EXECUTION

3.1 Installation

.1 Patterns and Joints: Stone strips shall be laid up in full beds of mortar in a series of continuous single rises or coursings, taking care to build best split – face to outside. Stagger vertical joints for balanced appearance, no vertical joint to fall directly over another. All vertical joints to be sawn for best appearance. All joints to be 10 mm in width. Mortar in all vertical joints shall be packed flush with split – stone face. Mortar in all horizontal joints to be tooled slightly. Abnormally protruding stone edges to be chipped off on the job by the setting contractor to achieve more monolithic appearance of finished wall.

.2 Anchoring: Stone to be anchored to back-up wall with metal wall ties spaced not more than 400 mm apart vertically and 600 mm apart horizontally. All anchors to be corrosion resistant metal, and to be supplied by setting contractor.

3.2 Field Quality Control

.1 After setting, protect projecting areas, corners etc. with boards. Keep stone – work dry covering walls at night and during rains.

3.3 Adjust and Clean

.1 Each day brush clean with fibre bristle brushes, preferably dry, or with a minimum amount of clean water. Do not use wire brushes, acids, or acidic or alkaline cleaning compounds.

.2 Water repellent: When exterior stone work is thoroughly dry, apply one floodcoat of a water solution of sodium methyl siliconate. (Union Carbide R-20," or equal). Use brush or low pressure spray.

PART 4 – MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Quarried Stone

Quarried Stone shall be considered incidental to the Contract Lump Sum Price for "Masonry".

PART 1 – GENERAL

1.1 References

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-11.3, Hardboard.
.2 Canadian Standards Association (CSA)
  .1 CSA B111 - Wire Nails, Spikes and Staples.
  .2 CSA O80 - Wood Preservation.
  .3 CAN/CSA O141 - Softwood Lumber.
  .4 CSA O151 - Canadian Softwood Plywood.
.3 National Lumber Grades Authority (NLGA)
  .1 Standard Grading Rules for Canadian Lumber.

1.2 Quality Assurance

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

PART 2 - PRODUCTS

2.1 Materials

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with CAN/CSA-O141, Spruce, Pine or Fir NLGA No. 2 or better grade. Glued end-jointed (finger-jointed) lumber is not acceptable
.2 Canadian softwood plywood (CSP): to CSA 0151, standard construction, square edge. Standard sheathing grade.
.3 Hardboard paneling: to CAN/CGSB-11.3, smooth, tempered, 1219 x 2438 x 3 mm thick panels.
.4 Nails, spikes and staples: to CSA B111 and NBC requirements. Galvanized.
.5 Bolts: steel, of sizes required, complete with nuts and washers. Galvanized.
.6 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead plugs, recommended for purpose by manufacturer.
.7 Surface-applied wood preservative: copper napthenate or pentachlorophenol base water repellent preservative. Use clear for materials exposed in final assembly, coloured elsewhere.

2.2 Pressure Preservative Treated Wood

.1 Provide lumber materials pressure preservative treated for:
  .1 Rough bucks at openings.
  .2 Wood strapping.
  .3 Lumber used on exterior of building, above or below grade.
.2 Treat material to CAN/CSA-O80 using Type-C (copper chromate arsenate) preservative to obtain a minimum net retention level of 6.4 kg/m3) of wood.
.3 Materials shall be dried after treatment to a moisture content of 19% or less.
.4 Each piece of treated material shall be identified with a tag or ink mark bearing the Canadian Wood Preservers' Bureau quality mark.
.5 Apply surface applied wood preservative to heartwood exposed from ripping, end cutting or boring.

PART 3 - EXECUTION

3.1 Installation

.1 Comply with requirements of NBC, Part 9 supplemented by following paragraphs.
.2 Install members true to line, levels and elevations. Space uniformly.
.3 Construct continuous members from pieces of longest practical length.
.4 Install spanning members with "crown-edge" up.
.5 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
.6 Countersink bolts where necessary to provide clearance for other work.
.7 Use fastenings of following types, except where specific type is indicated or specified:
  .1 To hollow masonry, plaster and panel surfaces use toggle bolt.
  .2 To solid masonry and concrete use expansion shield with lag screw, lead plug with wood screw.
  .3 To structural steel use bolts through drilled hole, or welded stud-bolts or power driven self-drilling screws, or welded stud-bolts or explosive actuated stud-bolts.
.8 Install furring and blocking as required to space-out and support surface wall and ceiling finishes, facings, fascia, soffit, siding and other work as indicated. Align and plumb faces of furring and blocking to tolerance of 1:600.
.9 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work. Except where indicated otherwise, use material at least 38 mm thick.
.10 Install fascia backing, nailers and other wood supports as required and secure using galvanized fasteners.
.11 Install hardboard paneling with finishing nails.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Rough Carpentry

Rough Carpentry will be measured and paid for at the Contract Lump Sum Price for “Roof Framing and Roof Cladding”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this specification.

PART 1 - GENERAL

1.1 References

.1 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702 - Standard for Mineral Fibre Thermal Insulation for Building.

PART 2 - PRODUCTS

2.1 Materials

.1 Batt and blanket mineral fibre insulation: to CAN/ULC-S702, Type 1 – no membrane. Thickness indicated.

PART 3 - EXECUTION

3.1 Installation

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Fill all voids completely. Cut and trim insulation neatly to fill voids; leave no gaps.

.4 Do not compress insulation to fit into spaces.

.5 Do not enclose insulation until installation has been reviewed by Contract Administrator.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Batt and Blanket Insulation

The supply and installation of batt and blanket insulation will be measured and paid for at the Contract Lump Sum Price for “Thermal and Moisture Protection”.

PART 1 - GENERAL

1.1 Quality Assurance

.1 Coordinate installation of air barrier materials with work of other trades to minimize exposure of membrane to elements or damage, and to

.2 Overlap and seal air barrier with air and vapour barrier membranes installed by other trades to ensure continuity of building air/vapour barrier system over entire building.

1.2 Environmental Conditions

.1 Apply primers and membranes in dry weather and only when air and surface temperature are within manufacturer's recommended limits.

.2 For applications below recommended temperature consult manufacturer and do not proceed until approved by manufacturer or his representative.

PART 2 - PRODUCTS

2.1 Materials

.1 Self-adhesive air barrier membrane: modified bitumen on high-density polyethylene film, with silicone release paper on adhesive side, minimum 1.0 mm thick.

.1 Acceptable material – exterior walls: Soprema Sopraseal Stick 1100, Bakor Blueskin SA, WR Grace Perm-A-Barrier, IKO Aquabarrier AVB.

.2 Acceptable material – roof deck: IKO Armour Gard Ice and Water Protector, W.R. Grace Ice and Water Shield; Domtar Eaveshield; Nordshield Water Stopper; Bakor Eave Guard; BPCO ProGard; EMCO Gripgard.

.2 Primers: as recommended by manufacturer and suitable for substrate.

.3 Mastics and sealants: as recommended by manufacturer, suitable for substrate.

.4 Flashing and stripping membranes: as recommended by air barrier membrane manufacturer.

PART 3 - EXECUTION

3.1 Examination

.1 Verify that surfaces and conditions are cured, dry and acceptable for installation of air barrier membranes.

.2 Notify Contract Administrator in writing of unsuitable surfaces or working conditions and await remedial measures. Commencement of work shall imply acceptance of surfaces and working conditions.

3.2 Preparation

.1 Clean substrates of all snow, ice, loose particles, oil, grease, dirt, curing compounds, or other foreign matter detrimental to installation and bonding of air barrier membrane.

.2 Repair defects in concrete and masonry surfaces such as mortar droppings spalled or poorly consolidated areas, honeycombing. Patch rough areas with a well-adhered parge coat to provide smooth surface. Allow to fully cure and dry.

.3 Remove sharp protrusions, form lines and rough edges.

3.3 Priming

.1 Prime all surfaces and substrates to receive self-adhesive air barrier membranes.

.2 Apply primers in accordance with manufacturer's instructions, at recommended rate of application.

.3 Do not apply to frozen or damp surfaces. Apply in dry weather when air and surface temperatures are within manufacturer's recommended limits.

.4 Avoid pooling of primer and allow to cure until tack-free.

.5 Prime only an area that can be covered in a working day. Re-prime areas which over dry or become soiled or dusty.

3.4 Workmanship

.1 Install materials in accordance with manufacturer's instructions using only materials approved for use with their products.

.2 Apply with good construction practice to maintain continuity of air barrier membrane over building elements.

.3 Do not commence work until all other work penetrating substrates has been completed, and reviewed by Contract Administrator.

.4 Use largest lengths possible to minimize joints. Overlap side and end laps minimum 50 mm. Stagger end laps minimum 300 mm in adjacent rows.

.5 Locate end joints minimum 300 mm from internal and external corners.

.6 Masonry cavity walls:

.1 Install sheets horizontally between masonry ties penetrating membrane.

.2 Overlap horizontal joints minimum 50 mm. Slit membrane at each tie and seal making air tight.

.7 Roof deck:

.1 Install sheets starting at low point parallel to roof eave. Overlap succeeding sheets minimum 50 mm to shed water.

.8 Place membrane in position without stretching, taking care to avoid trapped air, creases or fishmouths. As installation progresses roll membrane with hand roller to ensure full contact and bond to substrates.

.9 Flash and seal around all penetrations and protrusions such as pipes, conduits, steel angle supports, masonry ties, anchors. Cut and fit membrane neatly and snug fitting, leave no gaps. Seal and make airtight.

.10 Seal with mastic all difficult detail areas that do not allow easy installation of membrane. Make airtight.

.11 At rough openings cut air barrier membrane to form opening. Return membrane into opening and seal to rough bucks. Reinforce corners with additional piece of membrane cut and formed to seal corners.

.12 Overlap and seal air barrier membrane to air and vapour barriers installed by other trades. Maintain continuity of building air/vapour barrier system over entire building.

3.5 Installation Self-Adhesive Air Barrier

.1 Apply membrane in accordance with manufacturer's instructions.

.2 Roll out sheets and press firmly to substrate. As installation progresses roll with hand roller to ensure positive bond.

.3 At all internal corners, both vertical and horizontal, provide a fillet strip formed of liquid mastic. Do not use fibre or wood cants.

.4 Flash and seal around all penetrations and protrusions such as pipes, conduits, steel angle supports, masonry ties and anchors. Cut and fit membrane neatly and snug fitting, leave no gaps. Seal around all protrusions with mastic sealant. Make airtight.

3.6 Patching and Repairing

.1 Inspect membrane for defects and poor workmanship before covering and make corrections immediately.

.2 Ensure full contact and bond to substrates. Patch and repair loose or poorly bonded areas.

.3 Patch and repair misaligned or inadequately lapped seams, tears, punctures or fishmouths to the satisfaction of the Contract Administrator.

.4 Patch cuts, tears, and punctures by bonding an additional layer of air barrier membrane over damaged area. Patch shall extending minimum 150 mm in all directions from fault. Seal and make airtight.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Air Barriers

The supply and installation of air barriers will be considered incidental to the Contract Lump Sum Price for “Thermal and Moisture Protection”.

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM)
  .1 ASTM A 653/A 653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  .2 ASTM A 792/A 792M, Standard Specification for Steel Sheet, 55% Aluminum- Zinc Alloy-Coated by the Hot-Dip Process.
  .3 ASTM C 1177, Specification for Glass Mat Gypsum Substrate Used as Sheathing.
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type.
.3 Underwriters Laboratory Canada (ULC).
  .1 CAN/ULC-S701, Thermal Insulation, Polystrene, Boards and Pipe Coverings.
.4 National Building Code (NBC)

1.2 Design Criteria

.1 Design metal panel roof and wall systems to provide for thermal movement of component materials caused by ambient temperature range of -35°C to 75°C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
.2 Include expansion joints to accommodate movement in panel systems and between panel systems and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
.3 Design members to withstand dead load, snow loads and build-up, wind loads including uplift, calculated in accordance with NBC and applicable local regulations, to maximum allowable deflection of 1/180th of span.
.4 Provide for positive drainage of condensation occurring behind panels and water entering at joints, to exterior face of panels.

1.3 Shop Drawings

.1 Submit six copies of shop drawings to Contract Administrator.
.2 Indicate sizes and dimensions of components, panel types, materials and finish, subframing components, anchor details, compliance with design criteria and requirements of related work. Indicate details and flashings at wall and roof openings.

1.4 Samples

.1 Submit colour samples of prefinished steel sheet on actual base metal in specified finishes and colours to Contract Administrator.

PART 2 - PRODUCTS

2.1 Materials

.1 Z275 galvanized sheet steel conforming to ASTM A653 m Grade 230.
.2 Sheathing paper: to CAN/CGSB-51.32, spunbound olefin type. Tyvek Commercial Wrap.
.3 Fasteners:
  .1 Deck covering to steel deck: No. 10 flat head, self tapping, Type A or AB, zinc plated screws to CSA B35.3. Drywall screws not acceptable.
  .2 Sub-girts to steel deck, sub-girt to sub-girt, and roof clips to roof deck: type, size and spacing as recommended by roof system manufacturer, self-drilling, corrosion-resistant fasteners.
  .3 Roof system components: stainless steel exposed fasteners, designed to accommodate full thermal expansion and contraction of materials, and as recommended by panel system manufacturer, complete with neoprene washer under head of fastener. Head colour to match materials being fastened.
.4 Sealants: as specified in Section 07900 – Joint Sealants.

.5 Closures and gaskets: closed cell polyurethane foam, adhesive on two sides, release paper protected.
.6 Touch-up paint: as recommended by panel manufacturer.
.7 Isolation coating: alkali resistant, bituminous paint or epoxy resin solution.

2.2 Components

.1 Roof Panels:
  .1 Factory preformed of galvanized sheet steel.
  .2 Base metal thickness: 0.79 mm (22 gauge).
  .3 Finish: prefinished.
  .4 Acceptable material: Vicwest Marquis 450 (Slate Blue) with interlocking batten ribs.
.2 Exposed joint (perpendicular to profile): ends of siding sheet shop cut clean and square, backed with tight fitting filler lapping back of joint, exposed components colour matched to siding.
.3 Cap flashings, drip flashings, internal corner flashings, copings and closures for head, jamb, sill and corners, of same material, base metal thickness and finish as adjacent panels, brake formed to shape.
.4 Sub-girts and alignment bars: galvanized steel sheet to ASTM A 653/A 653M with Z275 zinc coating, profile to accept preformed panels with structural attachment to building frame. Base metal thickness as recommended by manufacturer to meet design requirements.

PART 3 - EXECUTION

3.1 Installation

.1 Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.
.2 Mechanically fasten deck covering to steel deck with screws spaced 400 mm on centre each way. Place with long axis of each sheet transverse to steel deck ribs, with end joints staggered and fully supported on ribs.
.3 Install sheathing paper between roof deck and roof panels. Overlap sheets to shed water. Overlap ends.
.4 Install roof and wall panel support systems and components using fasteners of type and size recommended by manufacturer to resist uplift forces and thermal expansion and contraction. Exposed fasteners head colour to match panels.
.5 Install components true to line and plane, free of dents.
.6 Provide alignment bars, brackets, clips, inserts, shims as required to securely and permanently fasten wall and roof systems to building structure.
.7 Install head, jamb and sill flashings, closures, and trims pieces as required for complete installation.
.8 Install wall panels over sill flashings, install cap flashings and ensure completed installation is continuously sealed at perimeter.
.9 Provide formed top closures, and flashing sealed against weather penetration, at ridges, changes in pitch, and vertical walls.
.10 Flash roof penetrations with material matching roof panels, and make watertight.
.11 Form seams in direction of water-flow and make watertight.
.12 Clean exposed exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Metal Roof

The supply and installation of metal roofing will be measured and paid for at the Contract Lump Sum Price for “Roof Framing and Roof Cladding”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

PART 1 - GENERAL

1.1 References

.1 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-19.13, Sealing Compound, One-component, Elastomeric, Chemical Curing.

1.2 Environmental and Safety Requirements

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of material safety data sheets acceptable to Labour Canada.
.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

PART 2 - PRODUCTS

2.1 Sealant Materials

.1 Urethanes, One Part, Self-Leveling.
.1 To CAN/CGSB-19.13, Type 1.
.2 Acceptable material: Sikaflex 1cSL, Bostik Chem-Calk 950.
.2 Urethanes, One Part, Non-Sag.
.1 To CAN/CGSB-19.13, Type 2.
.2 Acceptable products: Sikaflex 1a, Tremco DyMonic, Bostik Chem-Calk 900.
.3 Sealant colours: selected by Consultant from manufacturer’s standard colour selection.
.4 Foam backer rods: extruded polyethylene foam, compressible, oversized 30 to 50%.
.1 Acceptable material: Tremco Tundra Foam.
.5 Bond breaker tape: polyethylene bond breaker tape that will not bond to sealants.
.6 Expanding foam sealant: high-density open cell polyurethane foam, pre-compressed, impregnated with water-based, stablilized acrylic, self-adhesive. Secondary seal requiring primary seal of wet sealant.
.1 Acceptable material: Emseal Greyflex.
.7 Adhesives: type recommended by expanding foam sealant manufacturer.
.8 Primers: type recommended by sealant manufacturer, for appropriate sealant and corresponding substrate.
.9 Joint cleaner: non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

2.2 Sealant Selection

.1 Perimeters of exterior openings where frames meet exterior facade of building: Urethanes One Part, Non-Sag.
.2 Expansion and control joints in exterior surfaces of precast, architectural wall panels: Urethanes One Part, Non-Sag.
.3 Expansion and control joints in exterior surfaces of unit masonry walls: Urethanes One Part, Non-Sag.
.4 Coping joints and coping-to-facade joints: Sealant type: Urethanes One Part, Non-Sag.
.5 Cornice and wash (or horizontal surface joints): Sealant type: Urethanes One Part, Selfleveling.
.6 Exterior joints in horizontal wearing surfaces (as itemized): Sealant type: Urethanes One Part, Self-leveling.
.7 Perimeters of interior frames where frames meet interior finishes: Urethanes One Part, Non-Sag.

.8 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant type: Urethanes One Part, Non-Sag.
.9 Under thresholds at exterior doors. Sealant type: Urethanes, One Part, Non-Sag.
.10 As itemized in other sections.

PART 3 - EXECUTION

3.1 Protection

.1 Protect installed work of other trades from staining or contamination.

3.2 Preparation of Joint Surfaces

.1 Before commencing application of sealants test materials for indications of staining or poor adhesion.
.2 Ascertain that sealers and coatings applied to sealant substrates are compatible with sealant used and that full bond between the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and bond, if necessary.
.3 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
.4 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair work.
.5 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
.6 Ensure joint surfaces are dry and frost free.
.7 Prepare surfaces in accordance with manufacturer's directions.

3.3 Priming

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 Backup Material

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install foam backer rod to achieve correct joint depth and shape, with approximately 30% compression.

3.5 Expanding Foam Sealants

.1 Install expanding foam sealants in accordance with manufacturer’s instructions.
.2 Coordinate installation with work of other trades to ensure foam sealants are installed before building joints are covered.
.3 For expansion and control joints above grade in exterior walls install as secondary seal with wet caulking as primary seal.
.4 Where used as a secondary seal together with field applied wet caulking provide bond breaker tape or backer rod between foam sealant and caulking.
.5 Size preformed foam sealant to suit joint depth and width allowing for proper compression of the material.
.6 Use adhesives recommended by manufacturer, suitable for substrate and application.
.7 Install in longest possible lengths. Keep number of joints to a minimum. Join individual strips by means of scarfe joint, cut at approximately 30°.

3.6 Application

.1 Sealant:
- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:
- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup:
- .1 Clean adjacent surfaces immediately and leave work neat and clean.
- .2 Remove excess and droppings, using recommended cleaners as work progresses.
- .3 Remove masking tape after initial set of sealant.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Joint Sealers

The supply and installation of joint sealers shall be considered incidental to the Contract Lump Sum Price for “Doors and Finishes”.

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM).
  .1 ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-1 .181 - Ready-Mixed Organic Zin c-Rich Coating.
  .2 CGSB 41-GP-19 - Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA).
  .1 CSA W59 - Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA):
  .1 CSDFMA Specifications for Commercial Steel Doors and Frames.
  .2 CSDFMA Recommended Selection and Usage Guide for Commercial Steel Doors.

1.2 Shop Drawings

.1 Submit six copies of shop drawings to Contract Administrator. Indicate each type of door and frame, materials, core thickness, mortises, reinforcements, arrangement of hardware, location and methods of anchors, exposed fastenings and reinforcing, and finishes. Indicate details of jamb and head, frame types.

1.3 Delivery, Storage and Handling

.1 Store frames in dry location, above ground to prevent corrosion. Protect by suitable means until installation. Brace and stack to prevent wracking, bending, twisting and other damage. Replace or make good materials that become damaged or defective as directed by Contract Administrator.

PART 2 - PRODUCTS

2.1 Materials

.1 Hot dipped galvanized steel sheet: to ASTM A 653 coating designation Z275 (G90).

.2 Minimum base steel thicknesses for components in accordance with CSDFMA Table 1, except as follows:
  .1 Doors: 1.2 mm (18 gauge).
  .2 Frames: 1.6 mm (16 gauge).

.3 Door core materials: polyurethane core bonded to face sheets with heat resistant, epoxy resin based, low viscosity, contact cement.

.4 Primer: to CAN/CGSB -1.181.

.5 Door silencers: single stud rubber/neoprene type.

.6 Top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19M

.7 Sealant (caulking): as specified in Section 07900 – Joint Sealants.

.8 Foam sealant: spray-applied polyurethane foam sealant, CFC and urea formaldehyde free, non-shrinking after cure. Ener-Foam, Insta-Seal or equal.

.9 Metallic paste filler: to manufacturer's standard.

2.2 Door Hardware

.1 Hardware Items

.1 Hinges	CB1960 114 x 102 NRP	630	Stanley
.2 Passage Set		626	Schlage
.3 Weatherstrip	W50		Crowder
.4 Sweep seals	W13S		Crowder
.5 Threshold	CT10		Crowder
.6 Door stop/holder	100H Series	630	Glynn Johnson

.2 Provide deadbolt and exit device with Medeco cylinder keyed to City of Winnipeg requirements. Owner will provide lock number before keying.
.3 Provide keys in triplicate for each lock.

2.3 Frames Fabrication

.1 Fabricate frames in accordance with CSDFMA specifications, welded, thermally broken type construction.
.2 Blank, mortise, reinforce, drill and tap frames and reinforcements to receive hardware using templates provided by door hardware supplier. Reinforce internally for surface mounted hardware.
.3 Weld in top hinge reinforcement with 20 mm leg to hinge reinforcement, 25 mm leg to frame. Reinforce head of frames wider than 1200 mm.
.4 Protect mortised cutouts with steel guard boxes for frames installed in masonry and concrete walls.
.5 Prepare frame for door silencers.
.6 Welding in accordance with CSA W59. Accurately mitre or mechanically joint frame product and securely weld on inside of profile. Spot welding not acceptable.
.7 Grind welded joints and corners to a flat plane, fill with metallic paste and sane to uniform smooth finish.
.8 Securely attach floor anchors to inside of each jamb profile.
.9 Weld in two temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.4 Frame Anchorage

.1 Provide appropriate anchorage to floor and wall construction.
.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
.3 Provide two anchors for rebate opening heights up to 1520 mm and one additional anchor for each additional 760 mm of height or fraction thereof.

2.5 Door Fabrication

.1 Doors: swing type, flush, steel stiffened, insulated core construction.
.2 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
.3 Blank, reinforce, drill doors and tap for mortised, templated hardware. Reinforce doors for surface mounted hardware.
.4 Reinforce doors with vertical stiffeners, securely laminated to each face sheet at 150 mm on centre maximum. Fill voids between stiffeners with polyurethane core.

2.6 Shop Priming

.1 Provide touch-up primer at areas where zinc coating has been removed during fabrication or installation.
.2 Apply in factory one coat of zinc-rich primer CAN/CGSB-1.181 to all exposed surfaces. Properly pre-treat and prepare surfaces before application of primer to ensure good primer adhesion.

PART 3 - EXECUTION

3.1 Installation

.1 Install doors and frames to CSDFMA Installation Guide.
.2 Set frames plumb, square, level and at correct elevation. Secure anchorages and connections to adjacent construction.
.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support

at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Install doors and hardware in accordance with hardware templates and manufacturer's instructions. Adjust operable parts for correct function.

.6 Touch up with primer finishes damaged during installation.

3.2 Caulking and Sealing

.1 Fill head and jamb frame sections with spray foam sealant. Fill shim space around perimeter of frames with spray foam sealant.

.2 Seal joint between frames and adjacent construction with sealant (caulking). Apply sealant around full perimeter of frames, on both sides of opening. Provide foam backer rod or bond breaker tape behind sealant. Apply sealants in accordance with Section 07900 – Joint Sealants.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Steel Door and Frames

The supply and installation of steel doors and frame will be measured and paid for at the Contract Lump Sum Price for “Doors and Finishes”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

PART 1 - GENERAL

1.1 Design Criteria

.1 Design and install linear metal soffit to resist wind up-lift forces.

1.2 Shop Drawings

.1 Submit six copies of shop drawings to Contract Administrator. Indicate manufacturer, profiles, accessories, materials and finishes.

1.3 Samples

.1 Submit colour samples to Contract Administrator of manufacturer's complete colour range for colour selection by Contract Administrator.

PART 2 - PRODUCTS

.1 Basic materials:
  .1 Aluminum sheet, Aluminum Association Alloy AA1100.

.2 Linear strips: 30 mm deep channel shaped strips of minimum 0.056 mm thick, aluminum sheet, to suit 100 mm module. Edge square.
  .1 Snapped on, and securely retained on carriers without separate fasteners.
  .2 Face plain.
  .3 Space between strips to be closed with recessed matching coloured inserts perforated with 1 mm diameter holes over approximately 20% of surface area.
  .4 Finish: baked enamel.

.3 Carrier: manufacturer's standard exterior carrier with integral clips for snap-on installation of linear strips to 100 mm module, fabricated from aluminum with black baked enamel finish.

.4 Edge trim and seal: manufacturer's standard wall moulding colour to match strips.

.5 Accessories: clips, end closers, side closers as recommended by system manufacturer, colour to match strips.

2.2 Finishes

.1 Baked enamel: manufacturer's standard 2 coat matte finish in standard colours as later selected.

PART 3 - EXECUTION

3.1 Erection

.1 Do not erect soffit until work above soffit is complete.

.2 Secure hangers to overhead structure using attachment methods recommended by manufacturer.

.3 Suspend hangers from building structural members plumb and free from contact with insulation or other objects.

.4 Secure hangers in manner to prevent deterioration or failure due to age, corrosion or elevated temperatures.

.5 Maximum spacing of hangers or supports: 1200 mm on centre along carrier and 300 mm from ends. Maximum spacing of carriers: 900 mm on centre and 150 mm from ends of linear strips. Support each strip on at least 3 carriers. Stagger end joints.

.6 Lay out linear strips perpendicular to exterior walls.

.7 Scribe and cut metal panel units for accurate fit at borders and other penetrations.

.8 Provide hanger at each corner of openings of fixtures.

.9 Terminate strip ends 25 mm from walls and other vertical surfaces. Use factory made closed end units where ends are exposed to view.
.10 Install edge trim at perimeter, and penetrations.
.11 Use manufacturer's field cut-off device for 90° and 45° end cuts.
.12 Install inserts between linear strips.

3.2 Cleaning and Touch Up

.1 Clean any dirty of discoloured surfaces of linear metal units in accordance with manufacturer's written recommendations.
.2 Ensure units are free from defects.
.3 Remove and replace any damaged or improperly installed units.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Linear Metal Soffit

The supply and installation of linear metal soffit will be considered incidental to the Contract Lump Sum Price for “Doors and Finishes”.

PART 1 - GENERAL

1.1 Related Work

.1 Plywood paneling, Section 06100.
.2 Steel doors and frames, Section 08100.
.3 Graffiti resistant coatings, Section 09965

1.2 References

.1 Master Painters Institute (MPI)
  .1 Architectural Painting Specifications Manual.
.2 Society for Protective Coatings (SSPC)
  .1 Systems and Specifications Manual, SSPC Painting Manual, Volume Two.
.3 National Fire Code of Canada

1.3 Quality Assurance

.1 Conform to latest MPI requirements for painting work including preparation and priming.

1.4 Delivery, Handling and Storage

.1 Deliver, store materials in original containers with labels intact. Observe manufacturer's recommendations for storage and handling.
.2 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

1.5 Site Requirements

.1 Unless specifically pre-approved by product manufacturer, perform no painting work when:
  .1 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
  .2 Rain or snow is forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
  .3 The maximum moisture content of the substrate exceeds MPI or paint manufacturer’s prescribed limits
.2 Apply paint finish only:
  .1 In areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
  .3 Apply paint only when previous coat of paint is dry or adequately cured.

PART 2 - PRODUCTS

2.1 Materials

.1 Only paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
.2 Paint materials for paint systems shall be products of a single manufacturer.
.3 Contract Administrator will select colours and determine total number of colours to be used on project and their locations.

2.2 Gloss/Sheen Ratings

.1 Paint gloss shall be as defined in MPI Architectural Painting Specifications Manual.
.2 Gloss level ratings of painted surfaces shall be as specified herein.

2.3 Painting Systems

.1 Shop primed steel:
  .1 EXT 5.1D - Alkyd semi-gloss finish premium grade.
.2 Galvanized metal:
  .1 EXT 5.3B - Alkyd semi-gloss finish premium grade.
.3 Plywood paneling:
  .1 EXT 6.4B - Alkyd semi-gloss finish premium grade.

PART 3 - EXECUTION

3.1 General

.1 Perform preparation and operations for painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
.2 Do repainting of previously painted surfaces in accordance with MPI Maintenance Repainting Manual, except where specified otherwise.
.3 Apply paint materials in accordance with paint manufacturers' written application instructions.
.4 Paint all new work, except prefinished items or where indicated otherwise.
.5 Do not paint structural steel and roof decking, mechanical and electrical equipment.

3.2 Existing Conditions

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report damages, defects, unsatisfactory or unfavourable conditions to Contract Administrator before proceeding with work.
.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter and report findings to Contract Administrator. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 Protection

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Contract Administrator.
.2 Protect items that are permanently attached such as Fire Labels on doors and frames.
.3 Protect factory finished products and equipment.
.4 Protect passing pedestrians and general public in and about the building.
.5 Remove electrical cover plates, light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking any painting operations. Store securely store items and re-installed after painting is completed.

3.4 Cleaning and Preparation

.1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements.
.2 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
.3 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.
.4 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
.5 Lift gate mechanism:
  .1 Degrease lift gate mechanism by steam cleaning or pressure washing and solvent cleaning to remove oil and grease soiling from gear mechanism.
  .2 Remove flaked paint and rust by wire brushing and power tool cleaning.

3.5 Application

.1 Apply paint by brush, roller, airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.3 Painting coats specified are intended to cover surface completely. If necessary apply additional coats until satisfactory coverage is obtained. Provide additional coats at not additional cost to Contract.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

.6 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.7 Do not paint door and miscellaneous hardware, unless indicated otherwise.

.8 Do not paint nameplates, signage, fire labels, or other markers or signs indicated to remain.

.9 Do not paint copper, bronze, chromium plate, nickel, stainless steel, aluminum, lead and other bright metals, unless specified otherwise.

.10 Clean shop applied paint surfaces that become marked. Touch up with primer and paint as required.

3.6 Mechanical/Electrical Equipment

.1 Do not paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment. Leave in original finish.

3.7 Restoration

.1 Clean and re-install all hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Painting

Painting will be considered incidental to the Contract Lump Sum Price for “Doors and Finishes”.

PART 1 - GENERAL

1.1 Product Data

.1 Submit manufacturer's printed product literature, specifications and application instructions to Contract Administrator before commencing application.

1.2 Environmental Conditions

.1 Maintain ambient and structural base temperature at installation area within limits specified by coating manufacturer. Apply coating during dry weather. Do not apply coating to wet or damp surfaces.

1.3 Protection

.1 Protect plants and vegetation that might be damaged by coating. Protect surfaces not intended to have application of 1coatings. Provide adequate ventilation or isolation measures to protect against toxic fumes.

PART 2 - PRODUCTS

2.1 Materials

.1 Graffiti-resistant coating: one component, water based, non-sacrificial, clear penetrating sealer and liquid repellent.

.1 Acceptable products: Fabrikem Fabrishield Paint Repellent PR-60 for precast concrete and PR-61 for clay brick.

PART 3 - EXECUTION

3.1 Preparation

.1 Prepare and clean substrate surfaces in accordance with coating manufacturer's instructions.

.2 Mix and prepare coatings to manufacturer’s instructions.

.3 Take moisture tests on substrates to receive coating to ensure moisture levels are within limits specified by coating manufacturer.

3.2 Application

.1 Apply coating using low pressure spraying apparatus, at recommended coverage rate for product and substrate.

.2 Apply in uniform, even coat to fully wet substrate, without flooding or rundowns.

.3 Allow area to dry completely before applying additional coats.

3.3 Schedule

.1 Apply graffiti-resistant coating to clay brick and architectural precast concrete units.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Graffiti-Resistant Coatings

The supply and installation of graffiti-resistant coatings shall be considered incidental to the Contract Lump Sum Price for “Doors and Finishes”.

TABLE OF CONTENTS

DIVISION 15

1. GENERAL

1.1 Intent

.1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein and in complete accord with applicable codes and ordinances.

.2 In general work in this Division includes:

- Installation of Propeller Pumps supplied by the City.
- Electrical room ventilation system.
- Vent piping

.3 Drawings are diagrammatic. They establish scope, material and installation quality and are not detailed installation instructions.

.4 Follow Manufacturers' recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.5 Division 1 shall apply to work in this system.

.6 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the City of Winnipeg (City). Uncrate equipment, move in place, install complete; start-up and test.

.7 'Provide' shall mean; "supply and install'.

1.2 Co-ordination of Work

.1 Make reference to electrical, mechanical, structural and architectural Drawings when setting out Work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided. Jointly resolve all conflicts on-site before fabricating or installing any materials or equipment.

.2 Where dimensional details are required, coordinate with the applicable architectural and structural Drawings.

1.3 Examination of Site

.1 Before submitting tender, visit and examine the Site and note all characteristics and features affecting the Work. No allowances will be made for any difficulties encountered or any expenses incurred because of any conditions of the Site or item existing thereon, which is visible or known to exist at the time of Tender.

1.4 Quality of Work

.1 All Work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates. Spot checks will be made by the Contract Administrator.

.2 Work which does not conform to standards accepted by the Contract Administrator and the trade may be rejected by the Contract Administrator.

1. GENERAL

1.1 Scope

.1 Install Propeller Pump System supplied by the City.

.2 Cap abandoned 150 mm (6") pipe inside existing lift station.

.3 Provide vent piping as shown.

.4 Section 15010 shall apply to work in this section.

2. PRODUCTS

2.1 Vent Piping

.1 Use Schedule 10, 304 stainless steel pipe with short radius elbows.

.2 Weld 25 mm stainless steel screen across vent opening to the outside, just inside the pipe.

3. EXECUTION

3.1 Propeller Pumps

.1 Pick up propeller pumps from a location in Winnipeg. Handle and transport the pumps according to the manufacturer's recommendations.

.2 Install the pumps according to the manufacturer's recommendations.

.3 Coordinate with Section 16 to ensure the integral pump cable and cable support system are securely installed to avoid movement when the pump is in operation.

.4 Install and secure the pump hoisting cable system as per the pump manufacturer's recommendations and as shown on the drawings.

.5 Assist the pump supplier in carrying out a 3 hour flow test of each propeller pump. This may involve lifting the pumps out of the FPS to permit the supplier to inspect the pump and make any necessary adjustments. Timing of this test will be determined by the Contract Administrator. The Contractor will be responsible for any installation related issues or deficiencies that may arise during this testing program.

3.2 Vent Piping

.1 Install the two vents as shown on the drawings.

3.3 Cap 150 mm Existing Bypass Pipe

.1 In the existing lift station lower level, remove the 150 mm valve from the bypass pipeline. Install a 150 lb steel blind flange with a suitable gasket on the upstream end.

.2 Cut the other end of the pipe running up through the ceiling. Cover the pipe with a steel plate. Then inject grout into the pipe to prevent water leakage back into the builidng.

.3 Coordinate work schedule with the Contract Administrator.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Installation of Propeller Pumps

The installation of these pumps will be measured and paid for at the Contract Lump Sum Price for “Installation of Propeller Pumps”, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

Supply and Installation of Miscellaneous Items

Providing the vent piping and 150 mm bypass pipe cap as specified in Section 15100 will be measured and paid for at the Contract Lump Sum Price for “Provide Miscellaneous Mechanical Items”, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

1. GENERAL

1.1 Scope

.1 Supply and install an electrical room ventilation system as shown on the drawings and as specified.

.2 Section 15010 shall apply to work in this section.

1.2 References

.1 AMCA 210, Laboratory Methods of Testing Fans for Rating Purposes

.2 National Electrical Code (NEC)

.3 National Electrical Manufacturers Association (NEMA) MG1, Motors and Generators

.4 National Fire Protection Association (NFPA) 70, National Fire Protection Code

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), Heating, Ventilation, and Air Conditioning (HVAC) Duct Construction Standards – Metal and Flexible

2. PRODUCTS

2.1 Supply Fan

.1 Fan shall be "Howden Buffalo" baby vent set, size B, 1/3 H.P., 115/1/60, 3450 RPM motor.

2.2 Quality Assurance

.1 Fabricate in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) duct manuals and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) handbooks.

2.3 Material

.1 Sealant: Water resistant, fire resistive, compatible with mating materials.

2.4 Flexible Connections

.1 Fabricate of ULC approved neoprene coated flameproof glass fabric approximately 150 mm (6 in.) wide tightly crimped into metal edging strip and attached to ducting and equipment by screws or bolts at 150 mm (6 in.) intervals. Flexible connection airtight at 500 Pa (2 in wg).

.2 Install on fan inlet connection.

3.0 EXECUTION

3.1 Installation

.1 Rigidly construct metal ducts with joints mechanically, substantially airtight, braced and stiffened so as not to rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled. Seal duct seams watertight with mastic or low velocity duct sealant.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

Electrical Room Ventilation System

The supply and installation of the electrical room ventilation system will be measured and paid for at the Contract Lump Sum Price for “Electrical Room Ventilation System”, which price shall be payment in full for performing all operations herein described and all other items incidental to the work included in this Specification.

PART 1 GENERAL

1.1 General

.1 This Section covers items common to Sections of Division 16 and 17.

1.2 Codes and Standards

.1 Do complete installation in accordance with the current edition of the Canadian Electrical Code (CSA C22.1) except where specified otherwise.

.2 Do overhead and underground systems in accordance with the current edition of CSA C22.3 No.1 except where specified otherwise.

.3 Perform all work in accordance with local codes and bylaws.

1.3 Care, Operation and Start-up

.1 Instruct Contract Administrator and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 Voltage Ratings

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 Permits, Fees and Inspection

.1 Submit to Electrical Safety Authority and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Contract Administrator will provide drawings and specifications required by The City and Supply Authority and all authorities having jurisdiction at no cost.

.4 Notify Contract Administrator of changes required by Authorities prior to making changes.

1.6 Measurement and Payment

.1 The Lump Sum Price for “Electrical” in Form B applies to all work listed within these specifications and on the drawings to provide a complete and operational electrical distribution and control system to meet the operational intent of the facility.

.2 The electrical portion of this contract shall be submitted on Form B as a lump sum. Payment for the work will be based on percentage estimation of progress. The Contract Administrator shall review the percentage of work complete and review the estimated Work with the Contractor prior to submitting the progress payment to the City. Progress estimates shall include time required for training.

1.7 Materials and Equipment

.1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.2 Factory assemble control panels and component assemblies.

1.8 Electric Motors, Equipment and Controls

.1 Provide all power and control wiring and connections including mechanical control wiring as specified on mechanical drawings.

1.9 Finishes

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.10 Equipment Identification

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

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

.2 Utilize nameplate types as required to completely identify unit.

.3 Reduced Voltage Starter Units: Indicate RVS identification number, and fed from identification number “RVS-1/Fed from CDP-1”.

.4 RVS Feeder Units (eg. to motors): Indicate motor identification name and feeder “Pump P-1/Fed from RVS-1”.

.5 Transformer: Indicate feeder circuit identification number, transformer identification number “TR-1/Fed from CDP-1 /Feeds TR-1”.

.6 Lighting Panels, Power Panels, Instrument Power Panels and Feeder Units to Panels: Indicate panel identification name, and where fed from “Panel PP-1/Fed from TR-1”.

.7 Field Operator Stations (eg. start/stop): Indicate station number, title, and where appropriate device controls.

.8 Control devices (eg. remote thermostats): Indicate equipment number of unit being controlled.

.9 Light switches and convenience receptacles: Indicate panel and circuit number.

.10 Co-ordinate names of equipment with Mechanical Division to ensure that identical names are used.

.11 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

.12 Allow for average of twenty-five (25) letters per nameplate.

.13 Identification to be English.

.14 Identify equipment with Size 3 labels engraved with equipment tag.

1.11 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, using Electrovert Type Z cable markers (or equal) on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use number coded wires in control cables, matched throughout system. Identify conductors with permanent indelible identifying markings, numbered on both ends.

.5 Use number coded pairs in instrumentation cables, matched throughout system. Pairs shall be also color coded black and white for polarity indication. Identify conductor pairs with permanent indelible identifying markings, at both ends.

1.12 Wiring Terminations

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.13 Manufacturers and CSA Labels

.1 Visible and legible, after equipment is installed.

1.14 Warning Signs

.1 As specified and to meet requirements of The City and Contract Administrator.

.2 Decal signs, minimum size 175 x 250 mm.

1.15 Single Line Electrical Diagrams

.1 Provide single line electrical diagrams under plexiglass as follows:

.1 Electrical single line: locate in main electrical room.

.2 Drawings: 280 x 460 mm minimum size.

1.16 Location of Outlets

.1 Locate outlets in accordance with Section 16132 – Outlet Boxes, Conduit Boxes and Fittings, and as shown on the drawings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

1.17 Mounting Heights

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 In mechanical rooms: 600 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: 1500 mm.

1.18 Load Balance

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.19 Conduit and Cable Installation

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: pvc, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 Install all cabling in conduit. Conduit shall all be run surface within building.

1.20 Field Quality Control

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province of Manitoba.

.3 Conduct and pay for following tests:

.1 Point to Point wire continuity test for all conductors.

.2 Power distribution system including phasing, voltage, grounding and load balancing.

.3 Circuits originating from branch distribution panels.

.4 Lighting and its control.

.5 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing.

.1 Megger 600 V circuits, feeders and equipment with a 1000 V instrument.

.2 Check resistance to ground before energizing.

.6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Contract Administrator’s review.

1.21 Co-ordination of Protective Devices

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

1.22 Instruction Manuals

.1 The Contractor shall provide the City of Winnipeg with four (4) copies of maintenance and operating manuals showing:

.1 Service Instructions: Including a list of spare parts and replacement parts and the names and addresses of all suppliers.

.2 Maintenance Instructions.

.3 Installation Instructions.

.4 Operating Instructions.

.5 Electrical Schematics.

1.23 As-Built Drawings

.1 The Contractor shall provide two sets of record drawings bearing notations of all changes and variations from the originals. One set shall remain on site to assist in operation until the final as-builts are available. One set shall be delivered to the Engineer.

.1 The accuracy of these drawings shall be the responsibility of the Contractor, who shall bear all expenses of corrections thereto.

1.24 Training

.1 The Contractor shall provide two separate ½ day training sessions on the operation of the electrical and control equipment. These training days are to be co-ordinated with the City a minimum of two weeks in advance. The Contractor shall provide a certificate to the Contract Administrator signed by the City staff indicating that training has occurred.

1.25 Commissioning Support

.1 The Contractor shall provide full support / assistance over two days for the City – SCADA setup.

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

PART 2 RELATED SECTIONS

.1 Section 16010 - Electrical General Requirements.

PART 3 PRODUCTS

3.1 Markers

.1 Cable marker strip at depth indicated.

PART 4 EXECUTION

4.1 Direct Burial Of Cables

.1 After sand bed is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices not acceptable.

.4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm horizontal separation between low and high voltage cables.

.3 Installation configuration as per Canadian Electrical Code (CSA C22.1).

4.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.

.6 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

PART 1 GENERAL

1.1 Description

.1 Supply and install a complete grounding system. Securely and adequately ground all components of the electrical system in accordance with the requirements of all related sections in the current edition of the Canadian Electrical Code (CSA C22.1) (as adopted by the Province of Manitoba).

.2 The system to consist of cables, ground rods, supports, and all necessary materials and inter-connections to provide a complete system. Measured resistance to ground of the network shall not exceed 5 ohms.

PART 2 PRODUCTS

2.1 Equipment

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as required.

.3 Rod electrodes: copper clad 19 mm dia by 3 m long.

.4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

.7 Insulated grounding conductors to be stranded copper TWH complete with a green jacket.

PART 3 EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Install all grounding conductors in conduit.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 All bolted connections must be accessible.

.7 Soldered joints not permitted.

.8 Include a separate green ground wire in all power conduits including branch circuit wiring sized to Table 16 of the current edition of the Canadian Electrical Code.

.9 Expansion joints and telescoping sections of raceways shall be bonded using jumper cables as per the current edition of the Canadian Electrical Code.

.10 Use Burndy compression connectors or approved equal for all grounding splices and terminations unless otherwise shown on the Drawings. For bolted ground connections use Burndy Engineering Company's "Durium" or approved equal hardware.

.11 Connect all transformer neutrals to the main building ground wire, using compression terminations.

.12 Install rigid conduit sleeves c/w bushings where ground wires pass through concrete slabs.

.13 Use mechanical connectors for grounding connections to equipment provided with lugs.

.14 Connect building structural steel and metal siding to ground by welding copper to steel.

.15 Ground secondary service pedestals.

3.2 Electrodes

.1 Install rod electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 System and Circuit Grounding

.1 Install system and circuit grounding connections to neutral of secondary 120 V system.

3.4 Equipment Grounding

.1 All frames and metallic enclosures of all electrical equipment and electrically operated equipment shall be grounded through the conduit system or via a ground wire.

.2 All transformers, switchgear, motor control centres, panelboards and splitters fed from the main distribution center shall be grounded by grounding conductors sized in accordance with the current edition of the Canadian Electrical Code. The ground wire shall be terminated at each end with an appropriate grounding lug which shall be connected to the equipment ground bus.

.3 All sub panels such as lighting panels, local distribution panels, etc., shall be grounded with a green ground wire run back to the panel from which it is fed. The ground conductor shall be sized according to the current edition of the Canadian Electrical Code.

.4 All main distribution centres, switchgear, motor control centres, and all panels requiring equipment grounds shall contain a ground bus of adequate size, and tapped for lugs for the ground wire required.

.5 All motors shall be grounded by means of an adequately sized ground wire contained within the feeder conduit. Conduit shall not be considered to be ground.

3.5 Communication Systems

.1 Install grounding connections for telephone systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

3.6 Field Quality Control

.1 Perform tests in accordance with Section 16010- Electrical General Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

.1 Fastenings and supports: Section 01610 - Basic Product Requirements.

PART 2 PRODUCTS

2.1 Support Channels

.1 U shape, size 41 x 41 mm, 12 gauge, solid configuration.

.2 Surface mounted or suspended.

PART 3 EXECUTION

3.1 Installation

.1 Secure equipment to solid concrete or steel structures.

.2 Secure equipment to hollow or solid masonry with lead anchors and to toggle bolts.

.3 Secure equipment to poured concrete with expandable inserts.

.4 Secure equipment to wood trusses with ¼" lag screws.

.5 Support equipment, armoured cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.7 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.8 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.9 Fasten exposed armoured cable to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.10 For surface mounting of two or more conduits use channels at spacing as per Rule 12-1010(1) of the current edition of the Canadian Electrical Code.

.11 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.12 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.13 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.14 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.15 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 16151 - Wire and Box Connectors - 0 - 1000 V.

1.2 References

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.3 Product Data

.1 Submit product data.

PART 2 PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 1 kV TECK90 Power Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated (#12 AWG minimum where not indicated).

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material. Black in colour.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers to prevent cable from drooping.

.8 Connectors:

.1 Watertight, explosion proof approved for TECK cable.

2.3 600 V TECK90 Control Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: #14 AWG copper, number coded.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material. Black in colour.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers to prevent cable from drooping.

.8 Connectors:

.1 Watertight, explosion proof approved for TECK cable.

2.4 300 V Instrument Cable - Armoured

.1 Conductors: #16 AWG, 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.

.2 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.

.3 Twisted pairs/triads cabled with staggered lays.

.4 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100 % shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers to prevent cable from drooping.

.8 Connectors:

.1 Watertight, explosion proof approved for armoured cable.

2.5 Type RW90 Conductor

.1 In accordance with CSA C22.2 No.38

.2 Circuit conductors shall be concentric stranded soft copper, size as indicated (#12 AWG minimum where not indicated).

.3 Insulation to be chemically cross-lined thermosetting polyethylene rated type RW90 XLP, 600V

.4 Suitable for installation in temperatures down to minus 40 °C.

.5 90 °C conductor operating temperature.

2.6 Type TEW Conductor

.1 Circuit conductors shall be stranded soft copper, as per ASTM B-3 and B-8.

.2 Insulation to be thermoplastic compound meeting the requirements of Canadian Standards Association Type TEW, per CSA 22.2 Part 1, No.127.

.3 Isulation rated to 600 Volts.

.4 Suitable for installation in temperatures down to minus 40 °C

.5 105 °C conductor operating temperature.

.6 Use #14 AWG for control cabinet internal wiring where applicable.

PART 3 EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 16133 – Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conduit system shall not be used for a ground. All wiring shall have a separate propoerty sized ground and bonding conductor.

3.2 Installation of TECK Cable 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 16151- Wire and Box Connectors - 0 - 1000 V.

3.3 Installation of Control Cables

.1 Install control cables in cable troughs where quantity warrants it.

.2 Ground control cable shield.

END OF SECTION

PART 1 GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data for cabinets.

PART 2 PRODUCTS

2.1 Splitters

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 Junction and Pull Boxes

.1 PVC construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

PART 3 EXECUTION

3.1 Splitter Installation

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 Junction and Pull Boxes Installation

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Current edition of the Canadian Electrical Code (CSA C22.1).

PART 2 PRODUCTS

2.1 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Conduit Boxes

.1 Cast FS or FD copper free aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles for rigid conduit or Teck Cable.

.2 PVC boxes for PVC conduit.

.3 Pressed steel boxes for EMT conduit.

2.3 Fittings - General

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 EXECUTION

3.1 Installation

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Provide correct size of openings in boxes for conduit or armoured cable connections. Reducing washers are not allowed.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 45-M1981(R1999), Rigid Metal Conduit.

.2 CSA C22.2 No. 211.2-M1984(R1999), Rigid PVC (Unplasticized) Conduit.

1.2 Preferences

.1 In general power and control wiring shall be by TECK or armoured cable. Where suitable, PVC conduit may be used in wet areas and RGS may be used in dry areas.

PART 2 PRODUCTS

2.1 Conduits

.1 Rigid metal conduit: to CSA C22.2 No. 45, Aluminum

.2 Rigid pvc conduit: to CSA C22.2 No. 211.2.

2.2 Conduit Fastenings

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole stainless steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 0.75 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 Conduit Fittings

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90º bends are required for 25 mm and larger conduits.

2.4 Expansion Fittings for Rigid Conduit

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 Fish Cord

.1 Polypropylene.

PART 3 EXECUTION

3.1 Installation

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Surface mount conduits.

.3 Minimum conduit size for lighting and power circuits: 19 mm.

.4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.5 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.6 Install fish cord in empty conduits.

.7 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.8 Dry conduits out before installing wire.

.9 Connect conduit to equipment securely to maintain continuity for the purpose of bonding to ground.

.10 Provide for expansion and contraction of the conduit system.

3.2 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Run conduits in flanged portion of structural steel.

.3 Group conduits wherever possible on suspended surface channels.

.4 Do not pass conduits through structural members except as indicated.

3.3 Concealed Conduits

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

3.4 Conduits in Cast-in-place Concrete

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 Conduits Underground

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

END OF SECTION

PART 1 GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data.

PART 2 PRODUCTS

2.1 Switches

.1 15 A, 120 V, single pole, double pole, three-way, four-way industrial grade switches as required.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver cadmium oxide contacts.

.3 Fully enclosed with urea or melamine molding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Brown toggle.

.3 Toggle operated fully rated for fluorescent lamps and resistance loads, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 1200 Series or equivalent.

2.2 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground industrial grade, with following features:

.1 Brown urea molded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground industrial grade, with following features:

.1 Brown urea molded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 5252 or equivalent.

2.3 Cover Plates

.1 Stainless steel or pvc cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Weatherproof double lift spring-loaded stainless steel or pvc cover plates, complete with gaskets for duplex receptacles as indicated on the drawings.

.6 Weatherproof spring-loaded stainless steel or pvc cover plates, complete with gaskets for single receptacles or switches as indicated on the drawings.

PART 3 EXECUTION

3.1 Installation

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Section 16010- Electrical General Requirements or as indicated.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Section 16010- Electrical General Requirements or as indicated.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mount lighting fixture receptacles local to fixtures.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

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

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 Most recent CSA C22.2No.65-1956Wire Connectors.

.2 Most recent EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

PART 2 - PRODUCTS

2.1 Materials

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armored cable, flexible conduit, non-metallic sheathed cable as required.

PART 3 - EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:
- .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer.
- .2 Install fixture type connectors and tighten. Replace Insulating cap.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 16010 - Electrical General Requirements.

1.2 References

.1 NEMA/EEMAC ICS 2, Industrial Controls and Systems

.2 CSA 22.2 No.14-95, Industrial Control Equipment

1.3 Extra Materials

.1 Provide maintenance materials.

.2 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.

.2 3 contacts, movable.

.3 1 contacts, auxiliary.

.4 1 control transformer.

.5 1 operating coil.

.6 2 fuses.

.7 10% indicating lamp bulbs used.

PART 2 PRODUCTS

2.1 Manual Motor Starters

.1 Single and three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One or three overload heater(s) as required, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch: Heavy duty oil tight labelled as indicated.

.2 Indicating light: Heavy duty LED oil tight type and colour as indicated.

.3 Locking tab to permit padlocking in "OFF" position.

2.2 Full Voltage Magnetic Starters

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fuse or circuit breaker with operating lever on outside of enclosure to control circuit breaker, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Selector switches: Heavy duty oil tight labelled as indicated.

.2 Indicating lights: Heavy LED duty oil tight type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.3 Control Transformer

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.4 Finishes

.1 Apply finishes to enclosure in accordance with Section 16010 - Electrical General Requirements.

2.5 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Manual starter designation label, white plate, black letters, size 1, engraved.

.3 Magnetic starter designation label, white plate, black letters, size 1, engraved.

PART 3 EXECUTION

3.1 Installation

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 CSAC9-M1981 (R1997), Dry-Type Transformers.

1.2 Source Quality Control

.1 Submit to Contract Administrator 6 copies of standard factory test certificates of each transformer and type test of each transformer in accordance with CSAC9.

1.3 Shop Drawings

.1 Submit shop drawings.

.2 Include:

.1 Dimensioned drawing showing enclosure, mounting devices, terminals, taps, internal and external component layout.

.2 Technical data:

.1 kVA rating.

.2 Primary and secondary voltages.

.3 Frequency.

.4 Number of phases.

.5 Polarity or angular displacement.

.6 Full load efficiency.

.7 Regulation at unity pf.

.8 BIL.

.9 Insulation type.

.10 Sound rating.

1.4 Closeout Submittals

.1 Provide operation and maintenance data for dry type transformers for incorporation into manual specified in Section 01330 - Supplemental Conditions.

.2 Operation and maintenance instructions to include:

.1 Tap changing.

.2 Recommended environmental conditions.

.3 Recommended periodic inspection and maintenance.

PART 2 PRODUCTS

2.1 Materials

.1 Dry-type transformers: to CSAC9.

.2 Bushings: to EEMACGL1-3.

2.2 Transformer Characteristics

.1 Type: ANN.

.2 Rating: As specified on drawings.

.3 220 ºC insulation system class, 115 ºC temperature rise.

.4 Impedance: 4 - 6 %.

.5 Primary winding: 600 V, delta, BIL 10 kV.

.6 Secondary winding: Voltage and winding connection as specified on drawing.

.7 No load losses not to exceed 1 % of kVA rating.

.8 Full load losses not to exceed 6 % of kVA rating.

.9 Sound rating: 50 dB maximum.

.10 Transformer shall be high durability type typically weighing 200 lbs or more.

2.3 Enclosure

.1 Heavy duty ventilated NEMA type 1, Fabricated from sheet steel.

.2 Bolted removable panels for access to access separated primary and secondary terminals.

.3 Conductor entry: Knockouts

.4 Designed for universal floor, wall mounting or trapeze hung.

.5 Indoor, ventilated, self cooled type. Temperature of exposed metal parts not to exceed 90ºC rise.

2.4 Voltage Taps

.1 Three phase units:

.1 Units rated to 15 kVA, 1 ± 5 % FCAN & 1 ± 5 % FCBN.

2.5 Windings

.1 High grade, non-aging grain oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum flux densities shall be substantially below the saturation point.

.2 Core volume shall allow for efficient transformer operation at 10 % above the nominal voltage.

.3 Core laminations shall be tightly clamped and compressed.

.4 Coils shall be wound of electrical grade copper with continuous wound construction.

.5 Core and coil to be vacuum pressure impregnated with polyester varnish or epoxy resin.

.6 The assembly shall be mounted on vibration absorbing pads.

2.6 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Equipment nameplate size 7.

2.7 Acceptable Material Manufacturer

.1 Hammond Power System

.2 Delta.

PART 3 EXECUTION

3.1 Installation

.1 Wall mount dry type transformers.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformer in level upright position.

.4 Remove shipping supports only after transformer is installed and just before putting into service.

.5 Loosen isolation pad bolts until no compression is visible.

.6 Set and secure transformers in place, rigid plumb and square.

.7 Connect primary terminals to high voltage circuit.

.8 Connect secondary terminals to secondary circuit.

.9 Energize transformers and check secondary no-load voltage.

.10 Adjust primary taps as necessary to produce rated secondary voltage at no-load.

.11 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.

.12 Check transformer for dryness before putting it into service and if it has not been energized for some considerable time.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The moulded case circuit breakers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of the following:

.1 CSA C22.2 No. 5.1, Moulded Case Circuit Breakers

1.2 Regulatory Requirements

.1 Circuit breakers shall be CSA certified.

PART 2 PRODUCTS

2.1 Moulded Case Circuit Breakers

.1 Moulded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics and shall be Cutler-Hammer type Series C or approved equal.

.2 Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handler position. Contacts shall be nonwelding silver alloy, and arc extinguishing shall be accomplished by means of DE-ION arc chutes.

.3 Circuit breakers to have minimum symmetrical interrupting capacity rating as indicated on the drawings.

.4 Where indicated, circuit breakers shall be current limiting.

.5 Circuit breakers 400 ampere frame and below shall be Cutler-Hammer type Westinghouse Series C with thermal-magnetic trip units and inverse time-current characteristics.

.6 Circuit breakers identified as MCP will operate on the magnetic principle with a current sensing element in each pole.

.7 Circuit breakers 600 ampere and larger shall be Cutler-Hammer type Westinghouse Series C with microprocessor-based RMS sensing trip units or approved equal.

.1 Each moulded case circuit breaker microprocessor-based tripping system shall consist of three current transformers, and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analysing the secondary current signals received from the circuit breaker current transformers and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached.

.2 Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed. Rating plugs shall be interlocked such that a breaker cannot be closed and latched with the rating plug removed.

.3 The microprocessor-based trip unit shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.

.4 When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override. Internal ground fault protection adjustable pick-up ratings shall not exceed 1200 amperes.

.5 Breakers shall have built-in test points for testing the long time delay, instantaneous, and ground fault functions of the breaker by means of a 120 Volt operated test set. Provide one test set capable of testing all breakers 600 ampere frame and above.

Main breaker shall have loss of phase detection.

.6 System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:

.1 Adjustable long time pick-up and delay.

.2 Adjustable short time pick-up and delay.

.3 Adjustable instantaneous pick-up.

.7 Circuit Breakers shall be Cutler-Hammer type Westinghouse Series C circuit breakers, microprocessor-based RMS sensing trip units type Digitrip RMS 310 LSI or LSIG trip units or approved equal.

.8 Accessories:

.1 Provide shunt trips, auxiliary loss of power / phase contact bell alarms, and auxiliary switches as shown on the contract drawings.

.9 Enclosure:

.1 All enclosed circuit breakers shall have EEMAC 1 general purpose enclosures.

.2 All enclosed circuit breakers shall have metal nameplates, front cover mounted, that contain a permanent record of catalog number and maximum rating. Provide handle mechanisms that are padlockable in the “OFF” position.

PART 3 EXECUTION

3.1 Factory Testing

.1 Standard factory tests shall be preformed on the equipment under this section. All tests shall be in accordance with the latest version of EEMAC and CA standard.

3.2 Installation

.1 The Contractor shall install all equipment per the manufacturers recommendations and the contract drawings.

3.3 Field Settings

.1 The Contractor shall perform field adjustments of the circuit breakers as required to place the equipment in final operating condition. The settings shall be in accordance with the drawings.

END OF SECTION

PART 1 GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 01330 - Supplemental Conditions.

PART 2 PRODUCTS

2.1 Disconnect Switches

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure as required on the drawings sized as indicated.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, to Section 16491- Fuses - Low Voltage.

.5 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 EXECUTION

3.1 Installation

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 CSA C22.2 No.29 Panelboards and Enclosed Panelboards.

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01330 - Supplemental Conditions.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 PRODUCTS

2.1 Panelboards

.1 Panelboards: Product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: Bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated.

.3 600 V panelboards: Bus and breakers rated for 25,000 A (symmetrical) interrupting capacity or as indicated.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

2.2 Breakers

.1 Breakers: to Section 16412- Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to City of Winnipeg.

2.3 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 EXECUTION

3.1 Installation

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 16010 - Electrical General Requirements or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

1.0 Scope

1.1 This specification shall apply to the materials, design, fabrication, inspection, and testing of 600V Reduced Voltage Starters (RVS)

1.2 Detailed specifications on the RVS shall be as indicated on the respective data sheets, this specification, drawings and attachments. In case of a conflict between the various specifications, the Contractor shall contact the Contract Administrator for clarification.

2.0 Reference Documents

2.1 The RVS shall be designed, manufactured and tested in accordance with the latest applicable standards of CSA, NEMA, ANSI and UL, including but not limited to:

CSA C22.2 No. 14-M91—Industrial Control Equipment

NEMA ICS7—Industrial Control and Systems Adjustable Frequency Drives

NEMA MG1—Motors and Generators

NEMA ICS 7.1—Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Frequency Drives

2.2 In all cases where more than one regulation, code, standard or specification applies to the same conditions, the most stringent one shall apply. Conflicts among any of the provisions of these listed codes, standards or specifications shall be referred to the Contract Administrator for resolution.

3.0 Design

3.1 General

3.1.1 All RVS will be fed from a CDP provided by others and protected by Breakers. Manufacturer shall indicate recommended breaker size.

3.1.2 The RVS shall consist of a disconnect, logic board, keypad, SCRs, and bypass contactors for up to speed paralleling and full voltage starting, under emergency conditons.

3.1.3 The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs, and SCR gate firing output circuits. The logic board shall be identical for all ampere ratings and voltage classes specified.

3.2 Enclosure

3.2.1 NEMA 12 Gasketted. The RVS shall have complete front accessibility with easily removable assemblies.

3.2.2 All RVS shall be suitable for mounting back to wall.

3.2.3 Lamacoid nameplates shall be permanently attached with screws.

3.2.4 The enclosure shall have appropriate warning labels indicating “CAUTION MULTIPLE CONTROL POWER SOURCES”

3.2.5 Nameplates shall give the equipment tag number and the service description.

3.3 Ratings

3.3.1 The RVS shall be designed for heavy-duty applications and in accordance with applicable datasheets.

3.3.2 The RVS shall operate normally with incoming voltage and frequency of 600V 60 Hz ±10% and have an overload capability of 125% continuous, 500% for 60 seconds and 600% for 30 seconds

3.3.3 The RVS shall consist of six SCR rated for a minimum of 1600V peak inverse voltage and sized to withstand starting circuits of 500% for 60 seconds.

3.3.4 Operating Conditions: Suitable for 0°C to 40°C and 5% to 95% relative humidity.

3.4 Protection

3.4.1 Motor overload protection shall be two staged based upon an inverse time algorithm, one overload protection characteristic for starting and another for running. The overload characteristics shall be selectable by programming between Classes 5, 10, 20 and 30.

3.4.2 Motor protection in the by-pass mode shall be provided by bimetallic overloads.

3.4.3 Overload resets shall be mechanical pushbuttons from outside the enclosure and be capable of being electrically or automatically reset upon a fault condition.

3.4.4 The SCR shall be complete with snubber networks to prevent false firing due to dV/dT effects.

3.4.2 The RVS shall be capable of being setup and tested without a motor connected.

3.4.3 Over-temperature protection shall be provided on the heat sink and the control board.

3.4.4 Phase Current Imbalance Protection: Trip level: 5-30% of motor FLA between any two phases and 1-20 second delay

3.4.5 Overcurrent Protection: Trip level:50-300 of motor FLA and 1-20 second delay

3.4.6 Load Loss Trip Protection: Under current trip level: 10-90% of motor FLA and 1-60 second delay

3.4.7 Coast down Lockout Timer: 1-60 minutes

3.4.8 Starts-Per-Hour Lockout Timer: Range: 1-10 successful starts per hour. Time between starts: 1-60 minutes between start attempts

3.5 Adjustments and Configurations

3.5.1 Acceleration adjustments shall be programmable and shall be capable of dual ramp settings with the following ranges:

- Programmable Ramp Types: Voltage Ramp (VR) or Current Ramp (CR)
- Starting Torque: 0-100% of line voltage (VR) or 0-600% of motor FLA (CR)
- Ramp Time: 1-120 seconds
- Current Limit: 200-600% (VR or CR).

3.5.2 Deceleration adjustments shall be programmable with the following ranges:

- Begin Deceleration Level: 0-100% of line voltage
- Stop Level: 0-1% less than Begin Deceleration Level
- Deceleration Time: 1-60 seconds

3.5.3 The RVS shall be capable of being programmed that in the event of a fault, the motor either coasts to stop or decelerates according to the deceleration adjustment levels.

3.6 Interface

3.6.1 The operator interface terminal shall have an alphanumeric, high resolution, high brightness LCD display, door mounted and complete with the following status indicators:

- Control “Power On”
- Full Voltage “At Speed”
- Shorted SCR
- Phase loss
- Shunt trip
- Overload
- Over Temperature
- Overcurrent

3.6.2 The operator interface terminal shall allow complete control of the RVS and modification of adjustments and configuration parameters. All electrical values, parameters, application and activity function access, faults, local control shall be in plain English. .

3.6.3 The following monitoring values shall be available when in the operating mode:

- Phase currents
- Power factor
- Torque
- Remaining thermal capacity
- Elapse time
- Run cycle counter
- Lockout time values
- Fault codes
- Fault history complete with time and date stamps for the last three faults

3.6.4 A reset key will allow a parameter to return the existing value if adjustment is not required and the value is displayed.

3.6.5 The RVS shall have the following door mounted pilot light indicators (LED or neon type, colour as indicated), selector switches and push bottons:

- Running- Bypass Contactor Indicating Light (Green)
- Overload – Bypass Contactor Indicating Light (Yellow)
- Bypass Contactor -Overload Reset Pushbutton
- Soft Starter/Off/Bypass Contactor Selector Switch

3.6.6 The RVS shall have Modbus (2 wire - multidrop) interface for remote status

3.7 Control Systems - Analog and Digital I/O

3.7.1 RVS shall have a minimum of 3 dry programmable relay outputs used to indicate:

- Fault (O/P)
- Run (O/P)
- Ready (O/P)

3.7.2 The control power for the digital outputs shall be 120 VAC and be derived from the RVS control power transformer.

4.0 Testing

4.1 Factory Testing

4.1.1 The manufacturer's standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of CSA and NEMA standards. Results from the tests shall be provided

4.2 Field Testing

4.2.1 Factory trained field personnel shall setup, test, and comission RVS.

5.0 Handling

5.1 The Supplier shall recommend handling and installation requirements and ship the equipment accordingly.

5.2 One copy of assembly drawings and operating instructions shall accompany the shipment.

6.0 Equipment Guarantee and Performance Warranty

6.1 Equipment shall be guaranteed for satisfactory performance at all operating conditions specified on the data sheet.

6.2 Equipment shall be free from defects in design, workmanship and material as per the terms and conditions of the request for quotation, purchase order or contract. Unless specified otherwise, the warranty period shall be a minimum of 12 months from energization by City or 18 months from receipt, whichever comes first.

7.0 Submittal Requirements

7.1 Documentation submittal shall be in accordance with the drawings and data submittal requirements. Drawings shall be in SI units. If imperial units are used as well, they shall be shown in parenthesis after the SI units. In case of conflict between the two, SI units shall be considered to be correct.

7.2 Equipment tag number, and project name shall be shown on all Supplier supplied drawings. Data shall be located close to the title block.

7.3 All drawings and data shall be submitted in a form that is easily reproduced. All data and drawings shall be submitted in both paper and electronic form. Final drawings are all required to be as-built.

7.4 Review or approval of Supplier's drawings, design calculations and other documentation does not relieve Supplier of any responsibility for correctness of such drawings, calculations or other documentation.

7.5 The following information shall be submitted to the Contract Administrator for approval:

- Master Drawing Index
- Dimensioned Front view elevation
- Dimensioned Floor plan
- Dimensioned Top view
- Unit control schematics and wiring diagrams
- Nameplate schedule
- Cable entry/exit locations
- Assembly ratings, including short circuit, voltage, and continuous current ratings
- Major component ratings
- Minimum clearances to other equipment.
- Manufacturers technical data sheets

7.6 The following information shall be submitted to Contract Administrator for record purposes:

- Final as-built drawings and information
- Certified production test reports
- Installation information
- Seismic certification and equipment anchorage details (where applicable)
- Operation and maintenance manuals. Manuals shall include as a minimum: Instruction books and/or leaflets, recommended renewal parts list and a complete set of as-built drawings

PART 1 - GENERAL

1.1 References

.1 American National Standards Institute (ANSI)
  .1 Most recent ANSI C82.1- 1995, Specifications For Fluorescent Lamp Ballasts.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaries where specified, for approval by Consultant.

.3 photometric data to include: VCP Table spacing criterion, polarplot candela distribution, IES photometric file on computer disk.

PART 2 - PRODUCTS

2.1 Lamps

.1 Fluorescent lamps.

Wattage	Bulb	Base	Type	Initial Lumens	Life h	Notes	Colour
-	T8-32	md.bip	RS	3150	24000	Cool	4000 White

2.2 Ballasts

.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, discrete electronic IC electronic IC.
  .1 Rating: 120V, 60 Hz, for use with, rapid start lamps.
  .2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.
  .3 Totally encased and designed for 40 C ambient temperature.
  .4 Power factor: minimum 95 % with 95% of rated lamp lumens.
  .5 Crest factor: 1.5 maximum current, 2.0 maximum voltage.
  .6 Capacitor: thermally protected.
  .7 Thermal protection: non-resettable on coil.
  .8 Harmonics: 10 % maximum THD, including 49th for electronic discrete and hybrid ballasts, 25 % maximum THD including 49th for electromagnetic ballasts.
  .9 Operating frequency of electronic ballast: 21 khz minimum.
  .10 Total Circuit Power: 62 Watts.
  .11 Ballast Factor: greater than 0.90.
  .12 Sound rated: Class A.
  .13 Mounting: integral with luminaire.
  .14 Where available use premium electronic ballasts compliant with the Manitoba Hydro power smart program. Submit breakdown with tender documents.

2.3 Finishes

.1 Baked enamel finish:
  .1 Conditioning of metal before painting:
    .1 For corrosion resistance conversion coating to ASTM F 1137.
    .2 For paint base, conversion coating to ASTM F 1137.

.2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel polyester powdercoat alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.

.3 Reflector and other inside surfaces finished as follows:

.1 White, minimum reflection factor 85%.

.2 Colour fastness: yellowness factor not above 0.02 and after 250 h exposure in Atlas fade-ometer not to exceed 0.05.

.3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.

.4 Gloss not less than 80 units as measured with Gardner 60 gloss meter.

.5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.

.6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

PART 3 - EXECUTION

3.1 Installation

.1 Locate and install luminaries as indicated.

3.2 Luminaire Supports

.1 For suspended ceiling installations support luminaries from ceiling in accordance with local inspection requirements.

3.3 Luminaire Alignment

.1 Align luminaries mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaries mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

PART 1 GENERAL

1.1 Requirements of Work

.1 Supply, install, commission, and provide warranty for a complete and fully documented instrumentation and control system as specified herein. The Work includes all hardware, software, and services necessary to provide fully functional, coordinated control system for the flood pumping equipment.

.2 Component subsystems of the instrumentation and control system will include, but are not limited to the following:

.1 Primary elements and transmitters.

.2 Instrumentation and control field devices.

.3 Instrumentation cabling.

.4 Conduit.

.5 Control panels.

.3 Documentation referred to includes as a minimum:

.1 Equipment descriptive data.

.2 Equipment installation, service manuals, operation and maintenance manuals, and recommended spare parts lists.

.3 Schematics and interconnecting wiring diagrams.

.4 The recording of conductor identification, field terminals, changes, etc., on the Instrument Loop Diagrams (ILDs) provided as part of this specification or by others as it relates to the equipment with this scope of supply.

.5 Instrumentation and control panel shop drawings, face layouts, schematics and point-topoint wiring diagrams.

1.2 References:

.1 This specification contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section prevail.

.1	ISA S51.1	Process Instrumentation Terminology
.2	NEMA 250	Enclosures for Industrial Controls and System
.3	NEMA ICS 1	General Standards for Industrial Control and Systems
.4	NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
.5	SAMA PMC 17-10	Bushings and Wells for Temperature Sensing Elements

1.3 Codes, Rules, Permits, and Fees:

.1 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this work.

.2 Comply with CSA Standards, Canadian Underwriters' Laboratories and the applicable building codes.

1.4 Standards of Workmanship

.1 Execute all work in a manner which will result in the completed installation presenting an acceptable appearance, to a level of quality defined in the general conditions of this specification.

.2 Employ a competent supervisor and all necessary licensed tradesmen to complete the work in the required time.

.3 Arrange and install products to fit properly into designated building spaces.

.4 Ensure products are installed in accordance with the recommendations and ratings of the product manufacturers.

.5 The Contractor shall be responsible for the correct installation and assembly of all items of equipment. Manufacturer's instructions shall be carefully read and rigidly adhered to in the installation. Any damage resulting from failure to observe the manufacturer's instructions or as a result of proceeding with the work without responsibility. Make good any loss or damage resulting from malpractice.

1.5 Contract Drawings and Specifications

.1 Supply all items and accessories specified in the quality and quantity required. Perform all operations as designated by the specification according to the methods prescribed, complete with all necessary labour and incidentals.

.2 Treat any item or subject omitted from this Division's specifications, but which is mentioned or reasonably specified in other Divisions' specifications or drawings and pertains to the instrumentation and control system, as being integral to the overall system. Provide such specified items or subjects.

.3 Provide all minor items and work that are reasonably necessary to complete the work.

.4 If discrepancies or omissions in the specifications are found, or if intent or meaning is not clear, consult the Contract Administrator for clarification before submitting tender.

.5 The responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.

.6 The drawings are intended to show the major details of the control and instrumentation work, but it shall be the Contractor's responsibility to examine the existing electrical, process, mechanical, structural, and architectural detail at site before beginning the work and report to the Contract Administrator any discrepancies or interferences which exist.

.7 Control and instrumentation system layouts shown on the drawings are generally diagrammatic, and the locations of equipment are approximate. Exact routing of conduits, cables, wiring, tubing and air headers shall be governed by the process, mechanical, structural and architectural conditions which prevail. The Contractor shall be responsible

for making all required control and instrumentation connections to equipment supplied under this contract and interconnection to pre-selected equipment. The control and instrumentation work is to be installed consistent with the architectural, process, mechanical and/or structural conditions that exist at site.

.8 The Contract Administrator reserves the right to change the location of any piece of equipment without extra payment thereof, provided that the change is requested before installation and that the new location is within 2.0 metres of the original location.

1.6 Environmental Requirements

.1 Unless otherwise noted, all equipment wiring methods in the wet well or manholes meet or exceed NEMA 4 rating.

.2 In rooms or electrical rooms NEMA 1 rating is acceptable.

.3 For areas where corrosion protection is required, use NEMA 4X equipment.

1.7 Equipment

.1 Receiving, Storing, and Protection of Components During Construction.

.1 Examine each component upon delivery to site. Report all damage noted to the Contract Administrator prior to accepting or rejecting delivery.

.2 Make provision for off-loading for all equipment deliveries. Off-loading should only be performed by trained and qualified personnel.

.3 Perform a preliminary examination upon delivery to ensure that:

.1 All instrumentation and control components supplied for this project under this section of the specifications comply with the requirements stated in the instrument specification sheets.

.2 All instrumentation and control components that have been supplied under other sections of this specification, or that have been pre-purchased under previous contracts and are to be connected to instrumentation and control components supplied under this section of the specifications, comply with the requirements stated in the instrument specification sheets and as defined by the specifications.

.2 Itemize all non-conformities noted above and forward them to the Contract Administrator. Any delays in construction resulting from the delivery to site of non-conforming instrumentation and control components supplied under this contract are to be borne by the Contractor.

.3 Do not allow installation of primary elements or other sensitive equipment until construction is sufficiently completed to provide an “operating condition” environment. Notify the Engineer prior to installing any equipment of this type.

.4 Ensure that covers, where required, are properly installed on all equipment. Provide all covers, padding, guards, etc., as required to guard any equipment against damage to finish, proper operation, or life expectancy.

.5 Instrument devices including accessories shall be located where they will be accessible from structural platforms, permanent ladders, or grade. Locally mounted indicating instruments shall face toward, in line of sight and within reading distance of the normal operating area.

.6 Sufficient clearance shall be allowed for removal of equipment such as level displacers and floats, rotameter floats, control valves and plugs.

.7 Field located items of instrumentation shall be mounted on building columns and walls where such building columns or walls are accessible. Pipe stands and/or other means of support shall be provided where mounting on columns or walls is not practical.

.8 Manifolding for pressure sensing deices shall be in accordance with the manufacturers instructions. Where a pressure gauge or other pressure device is supported by a manifold, and conditions of pulsating pressure or mechanical vibration exist, the manifold shall be fastened so that no stress is exerted on the pressure connection from a vessel or line.

.9 Return all damaged equipment to the factory for total corrective repairs. If deemed necessary by the Contract Administrator, the damaged equipment shall be replaced with new product. The Contractor shall bear any costs due to construction delays resulting from the delay in delivery of acceptable equipment supplied under this contract.

1.8 Documentation

.1 Submittals:

.1 Submit a schedule within 30 days of award of the Contract to the Contract Administrator showing projected ordering and delivery dates of all products to meet the required construction schedule. Provide all necessary information regarding ordering and delivery dates for electrical and control products as required for scheduling.

.2 Provide catalog cuts of all equipment, devices and materials where requested by the individual specification sub-sections. Catalog information includes technical specifications and application information, including ratings, range, weight, accuracy, adjustability, etc. Edit the catalog cuts to show only the information which applies to the proposed product for this project.

.3 Assemble the catalog cuts in a folder or binder. Each folder or binder shall contain a cover sheet that is indexed by item and cross-referenced to the appropriate specification sub-section.

.4 After receiving approval of the list of products and equipment from the Contract Administrator, but prior to delivery of any products or equipment to job site and sufficiently in advance to allow ample time for checking, submit shop drawings for review. The list of equipment for which shop drawings are to be provided includes, but is not limited to:

.1 Instrument enclosures.

.2 Instrument equipment (include instrument specification sheet for each device as per Section 17701).

.3 All specially fabricated materials and equipment.

.4 Control equipment including all hardware, software, and associated control panel assemblies.

.5 UPS power supplies to support computer systems as specified herein

.5 Shop drawings shall be submitted, as specified, and shall include the following material:

.1 Catalogue information, descriptive literature and shop drawings indicating manufacturer’s construction, installation and connection details for each control and instrumentation element in the system, bearing the tag designation, including:

.1 Analysis elements, transmitters, controllers, monitors.

.2 Primary and final elements.

.3 Indicators.

.4 Transmitters.

.5 Transducers.

.6 Switches.

.7 Cabling/tubing

.2 Individual data/specification sheets for each instrument and control element, bearing the tag designation, citing features for each component including:

.1 Complete model and catalog number.

.2 Input and output range and span.

.3 Scales.

.4 Materials of construction.

.5 Configuration.

.6 Alarm and control options.

.6 Review, modify, and approve the shop drawings prior to submitting shop drawings to the Contract Administrator for review. Contractor approval of a drawing indicates the following:

.1 The drawing has been checked by the person making the approval.

.2 The equipment or material complies in all respects with the requirements of the specifications and drawings.

.3 The quantities, if indicated on the drawing, are correct.

.4 The physical dimensions of the components are such that they can be installed without interference with the building structure or other equipment, and that after installation, there are sufficient clearances on all sides for maintenance, servicing, and operation of the equipment.

.5 The points of attachment are clearly indicated, i.e., TOP, BOTTOM, SIDE, etc.

.6 The arrangement and location are properly oriented.

.7 The product is suitable for its intended use.

.7 Stamp and sign the shop drawing to show approval, indicating the above has been complied with. If Contractor revisions are too extensive, return the submission to the supplier for revision, then repeat the shop drawing approval process before submitting them to the Contract Administrator.

.8 Manufacture of products shall conform to shop drawings marked as reviewed by the Contract Administrator and returned to the Contractor.

.9 Keep one complete, maintained set of shop drawings at the job site during the construction period.

.10 Refer to the specifications for further information on shop drawing submittals.

1.9 Operations and Maintenance Manuals

.1 Refer to specifications for general O&M manual submittal information.

.2 In addition to the requirements specified, provide the following information:

.1 Table of Contents - Arrange contents sequentially by systems under section numbers. Label tabs of dividers between each to match section numbers in the Table of Contents.

.2 Systems Descriptions - A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate.

.3 Maintenance and operating instructions for all electrical equipment and controls - These operating instructions need not be manufacturer's data, but may be typewritten instructions in simple language to guide the Contract Administrator in the proper operation and maintenance of his installation.

.4 A copy of all wiring diagrams complete with wire coding.

.5 Include type and accuracy of instruments used.

.6 Set of final reviewed shop drawings.

.7 Provide a tabulated list of all consumables utilized (fuses, lamps, etc.) indicating where used, type, rating, and reorder details.

.8 Provide a tabulated list of all components supplied (hardware and software) for the installation, complete with make, model, manufacturer, part order number, and source of supply.

PART 2 PRODUCTS

2.1 General

.1 Selected Products

.1 Provide products and materials that are new and free from all defects.

.2 Products and materials called for on the drawings or in the specifications by trade names, manufacturer's name, and catalogue reference are those which are to be used as the basis for the Bid Opportunity.

.3 The design has been based on the use of the first named product, where acceptable products are listed in the specification.

.2 Review of Products

.1 Immediately after notification of award of the Contract, review with the Contract Administrator the list of products proposed, including any alternatives submitted with Bid Opportunity.

.2 After agreement on product list has been reached, no subsequent changes will be permitted except as specified hereafter.

.3 Substitution of Products After Contract Award

.1 After acceptance of the list of products, no substitution of any item will be permitted unless the approved item cannot be delivered in time to comply with the work schedule.

.2 To receive acceptance, proposed alternates are to equal or exceed the quality, finish and performance of those specified and/or shown, and not to exceed the physical space allotted.

.3 Provide to the Contract Administrator documentary proof of equality, difference in price (if any), and delivery dates, in the form of certified quotations from suppliers of both specified items and proposed substitutions.

.4 Include costs for any required revisions to other structures and products to accommodate such substitutions. All extra costs are, unless negotiated otherwise, the responsibility of the Contractor.

.5 Refer to Section 01330 - Supplemental Conditions for additional information on substitutions.

.4 Quality of Products

.1 All products provided to be CSA Approved, Canadian Underwriters' Laboratory approved or with other equally acceptable approval marking.

.2 If products specified are not CSA approved, obtain approval of the relevant provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, to be of a quality best suited to the purpose required and their use is subject to approval by the Contract Administrator.

.5 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the specification, uniformity of manufacture is to be maintained for similar products throughout the work.

.6 Product Finishes

.1 The Contractor is to specify proposed finishes to be used for Contract Administrator's review.

.7 Use of Products During Construction

.1 Any equipment used for temporary or construction purposes are to be approved by the Contract Administrator and in accordance with Division 1 of this specification. Clean and restore to "as new" condition all equipment prior to the time of substantial completion. All computers supplied for the Work shall be new and unused.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 17010 – Instrumental & Control General Requirements.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings in accordance with the specifications

1.3 Field Instrument Installation

.1 The Contractor shall install each item in accordance with manufacturer's instructions and other applicable drawings. The term "installation" includes specifically the physical mounting of remote devices as well as all electrical/instrument cable/connections. The Contractor shall identify and provide all necessary mounting hardware not purchased with the instrument.

.2 Flow meters and pressure transmitters shall be handed over to the mechanical division for installation. Co-ordinate activities with mechanical.

1.4 Field Instruments

.1 Receive, calibrate, tag, and store all instruments.

.2 Install all necessary conduit and wiring from the field instruments or field control panel.

.3 Make all wiring terminations at the field instruments, field control panel, and the field junction box. Label all cables and wires.

.4 Isolate all applicable instruments for line testing and return to service after testing.

.5 Inspect all wiring, terminations and labelling.

.6 Unload control panel sections and racks which may be shipped at different times from different shippers.

.7 Move control panel sections and racks to their specified installation locations and permanently set in place. Unloading and moving may be done as one operation depending upon construction status.

PART 2 PRODUCTS

2.1 Level Transmitters

.1 Device LT-1

.1 Acceptable Product: Miltronics MultiRanger 100 with XRS 15 Transducer.

PART 3 EXECUTION

3.1 Installation

.1 Instrument systems components not specifically located on drawings, but located on the drawings shall be field located as defined by mechanical piping and in accordance with the following:

.1 Instrument components shall not be attached to vibrating equipment, but shall be remotely mounted to a solid structure or on approved instrument mounting stands.

.2 Location of instruments, when shown on the drawings, is only approximate. The Contractor is responsible for actual location of field devices and must avoid interferences between conduit, pipes, equipment and instruments while providing maximum accessibility.

.3 Locate instrument components at eye level and in an easily accessible location.

.4 Instrument components that must be removed for servicing shall be installed with re-usable connectors, unions and flexible conduit.

.5 Electrical connections and terminations for field instruments and other field devices shall be in strict compliance with the manufacturer's instructions and loop drawings. This will include wire, wire termination, labeling, rigid and flexible conduit, fittings, and seals where required.

.2 Provide and route all instrument signal armoured cable (or conduit and conductors).

.3 For instruments with pre-terminated cable lengths provide a junction box as close as practical to connect with armoured cable or cable in conduit.

.4 Allow for a variation of 3 meters from locations of devices as shown on drawings without extra cost provided pertinent information is provided prior to installation. Exact location will be determined by the installation of piping and mechanical equipment.

.5 Threaded fastenings for mounting instrument components shall have either lock nuts or double nuts.

.6 Install wall and pipe stand mounted transmitters on approved mounting brackets or stands at a nominal height of 1.4 meters off floor.

.7 Cover locally mounted instrument components, after installation, with plastic bags to protect them from dust, dirt, paint spray, insulation materials, etc. Protect from mechanical damage.

.8 Set output pressure of local air sets to pressure recommended for instrument to which it is to be connected.

.9 Independently support solenoids, regulators or similar control devices on solid, vibration-free structures and not on control valves. Minimize load on pneumatic tubing.

.10 Field instruments located out doors shall be winterized to prevent process or measurement fluids from freezing. The use of steam or electrical tracing, fill fluids, or enclosures will be shown on the Installation Detail drawings.

.11 All instrument signal wiring and 120 V ac wiring shall be run by the Contractor from the field instrument to the field device as shown on the Loop drawings. This includes wiring, rigid and flexible conduit, fittings and seals where shown. Conduit penetrations are not permitted into the top of any field junction box.

3.2 Instrument Installation

.1 Level transmitters

.1 Provide, install and terminate power and control cables at remote electronics. Install, route and terminate primary-converter cable as per manufacturers instructions and guidelines.

3.3 Instrument Supports

.1 Clean and paint fabricated galvanized carbon steel mounting stands and brackets.

.2 Before a mounting stand is attached to a concrete floor the surface of the concrete to be in contact with grout shall be roughed and cleaned of all dirt, oil, grease and loose material.

3.4 Calibration Tagging

.1 When satisfactorily inspected and calibrated, the item shall have a tag affixed to it in an immediately visible location, which shall indicate that the device has been calibrated, by whom and the date of the calibration. Calibration procedures and records shall be available to the Contract Administrator throughout the course of the project and shall be delivered to the Contract Administrator upon the completion of the work.

3.5 Permanent Instrument Identification Tagging

.1 All field-mounted instrument items shall have an approved identification tag permanently attached by the Contractor upon completion of the initial inspection and calibration. This tag shall reflect the device's identification as shown on the appropriate drawing.

.2 The tag will be permanently attached to the instrument with screws, rivets, or stainless steel or Monel wire, as appropriate. If an instrument is inside a protective enclosure or mounted behind a panel, instrument identity tags shall be mounted twice, once on the instrument and again on the enclosure. All instruments mounted on a control panel shall have an identity tag mounted on the instrument body and again on the face of the panel below the instrument face.

3.6 Wire, Cable and Terminal Tagging

.1 Each wire in alternating current applications and each wire in direct current applications shall be identified at each termination by a permanent label displaying the wire numbers. Each multiconductor cable shall be identified at each end with a permanent label displaying its cable number.

3.7 Documentation Responsiblities

.1 The Contractor shall maintain a current, complete set of prints for all instrument and electrical drawings, wire list, and specifications with markups reflecting all approved changes and actual as-installed status of equipment. These shall be kept in a neat and legible manner to facilitate direct transfer to The City of Winnipeg. One complete set of these marked-up drawings, wire lists, and specifications shall be provided to The City of Winnipeg after construction has been completed and before plant startup.

END OF SECTION