



THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 926-2008

**SHOAL LAKE AQUEDUCT DRAINAGE SIPHON REPAIRS - MILES 50.31, 53.75
AND 55.23**

TABLE OF CONTENTS

PART A - BID SUBMISSION

Form A: Bid	1
Form B: Prices	4
Form G1: Bid Bond and Agreement to Bond	5
Form G2: Irrevocable Standby Letter of Credit and Undertaking	7

PART B - BIDDING PROCEDURES

B1. Contract Title	1
B2. Submission Deadline	1
B3. Site Investigation	1
B4. Enquiries	1
B5. Addenda	2
B6. Substitutes	2
B7. Bid Components	3
B8. Bid	4
B9. Prices	4
B10. Qualification	5
B11. Bid Security	5
B12. Opening of Bids and Release of Information	6
B13. Irrevocable Bid	6
B14. Withdrawal of Bids	7
B15. Evaluation of Bids	7
B16. Award of Contract	8

PART C - GENERAL CONDITIONS

C0. General Conditions	1
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PART D - SUPPLEMENTAL CONDITIONS

General

D1. General Conditions	1
D2. Scope of Work	1
D3. Definitions	1
D4. Contract Administrator	1
D5. Contractor's Supervisor	2
D6. Notices	2
D7. Furnishing of Documents	2

Submissions

D8. Authority to Carry on Business	2
D9. Safe Work Plan	3
D10. Insurance	3
D11. Performance Security	3
D12. Subcontractor List	4
D13. Equipment List	4
D14. Detailed Work Schedule	4

Schedule of Work

D15. Commencement	4
D16. Schedule Restrictions	5
D17. Working Days	5
D18. Substantial Performance	5
D19. Total Performance	6
D20. Liquidated Damages	6

Control of Work

D21. Job Meetings	6
D22. Prime Contractor – The Workplace Safety and Health Act (Manitoba)	6

D23. Office Facilities	7
D24. Damage To The Aqueduct	7
D25. Site Access and Restoration	7
Measurement and Payment	
D26. Payment	8
Warranty	
D27. Warranty	8
Form H1: Performance Bond	9
Form H2: Irrevocable Standby Letter of Credit	11
Form J: Subcontractor List	13
Form K: Equipment	14

PART E - SPECIFICATIONS

General	
E1. Applicable Specifications and Drawings	1
E2. Soils Investigation Report	1
E3. Condition, Protection of and Access to the Aqueduct	2
E4. Environmental Protection	4
E5. Erosion Protection and Sediment Control	6
E6. Use of GWWD Railway	7
E7. Site Preparation, Mobilization and Demobilization	10
E8. Clearing and Grubbing	11
E9. Drainage Siphon and Aqueduct Repairs	11
E10. Excavation and Backfill	14
E11. Water Control and Dewatering Systems	16
E12. Shoring Systems	17
E13. Cast-in-Place Concrete	19
E14. Patching and Crack Repair	23
E15. Supply and Installation of Precast Concrete Culvert and Appurtenances	28
E16. Metal Fabrications	31
E17. Riprap	32
E18. Drainage Ditch Restoration	34
E19. Final Grading and Seeding	35
E20. Fencing and Signs	36

PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 SHOAL LAKE AQUEDUCT DRAINAGE SIPHON REPAIRS - MILES 50.31, 53.75 AND 55.23

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, January 15, 2009.

B2.2 Bids 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 C3.1, the Contract Administrator or an authorized representative will be available at the Site from 09:00 to 12:00 on January 8, 2009 to provide Bidders access to the Site. The site viewing will take approximately 2 to 4 hours. The site tour will commence at the GWWD rail crossing at Spruce Siding, approximately 800 metres northwest of the intersection of Provincial Road 506 and the GWWD railway. All Bidders are requested to confirm the number of attendees via fax, to the Contract Administrator, no later than 4:30 p.m., January 7, 2009.

B3.2 The Bidder is advised that most sites are not readily accessible by road. The only developed road in this area is PR 506, at the east limit of the project. The only developed site access is via the GWWD Railway.

B3.3 Further to B3.1, Bidders wishing to visit the site outside of the arrangements made in B3.1, shall contact the GWWD Railway dispatcher at 986-4118, during normal working hours, (0:800 to 16:30) Monday to Friday, to obtain security clearance, a minimum of 24 hours prior to their planned site visit. The Bidder is advised that the security of the Aqueduct right-of-way is being monitored, and unauthorized access will be reported to the local detachment of the RCMP.

B3.4 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D4.1.

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.

B4.6 Bidders shall note that the offices of the Contract Administrator identified in D4.1 will be closed from December 25, 2008 to January 4, 2009 inclusive.

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 Division website at <http://www.winnipeg.ca/matmgt/bidopp.asp>

B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

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 may 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.
- B6.10 Notwithstanding B6.2 to B6.9, and in accordance with B7.6 deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B15.1(a).

B7. BID COMPONENTS

- B7.1 The Bid shall consist of the following components:
- (a) Form A: Bid;
 - (b) Form B: Prices;
 - (c) Bid Security
 - (i) 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 Further to B7.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B6.
- B7.3 All components of the Bid 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, to constitute a responsive Bid.
- B7.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.
- B7.4.1 Samples or other components of the Bid 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.
- B7.5 Bidders are advised not to include any information/literature except as requested in accordance with B7.1.
- B7.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, will be evaluated in accordance with B15.1(a).
- B7.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.
- B7.8 Bids shall be submitted to:
- The City of Winnipeg
Corporate Finance Department

Materials Management Division
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 should be printed below such signatures.
- 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 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.
- B9.4 Prices from Non-Resident Bidders are subject to a Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).

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; and
- (b) be financially capable of carrying out the terms of the Contract; and
- (c) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract.

B10.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

- (a) be responsible and not be suspended, debarred or in default of any obligations 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 Division website at <http://www.winnipeg.ca/matmgt/debar.stm>

B10.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

- (a) have successfully carried out work similar in nature, scope and value to the Work; and
- (b) be fully capable of performing the Work required to be in strict accordance with the terms and provisions of the Contract; and
- (c) have a written workplace safety and health program if required pursuant to The Workplace Safety and Health Act (Manitoba);

B10.4 Further to B10.3(c), the Bidder shall, within five (5) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder/Subcontractor 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 administered by the Manitoba Construction Safety Association or by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or
- (b) 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 Division website at <http://www.winnipeg.ca/matmgt>)

B10.5 The Bidder shall 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.

B10.6 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.
- B11.1.2 All signatures on bid securities shall be original.
- B11.1.3 The Bidder shall sign the Bid Bond.
- B11.1.4 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.
- 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 Bids will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Division, or in such other office as may be designated by the Manager of Materials.
- B12.1.1 Bidders or their representatives may attend.
- B12.2 Following the Submission Deadline, the names of the Bidders and their Total Bid Prices (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 Division website at <http://www.winnipeg.ca/matmgt/default.stm>
- 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 Division website at <http://www.winnipeg.ca/matmgt/default.stm>
- B12.4 The Bidder is advised that any information contained in any Bid 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 C23.3, 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 will:
- (a) retain the Bid until after the Submission Deadline has elapsed;
 - (b) open the Bid 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, or acceptable deviation there from (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 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 or minor informalities or irregularities, 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 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.

B15.4.2 Further to B15.1(a), in the event that a unit price is not provided on Form B: Prices, the City will determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

B16. AWARD OF CONTRACT

B16.1 The City will give notice of the award of the Contract 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, in accordance with B15.

B16.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

- C0.1 The *General Conditions for Construction* (Revision 2006 12 15) are applicable to the Work of the Contract.
- C0.1.1 The *General Conditions for Construction* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/gen_cond.stm
- C0.2 A reference in the Bid Opportunity to a section, clause or subclause with the prefix “**C**” designates a section, clause or subclause in the *General Conditions for Construction*.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of reconstruction and/or repair of three (3) concrete drainage siphons.

D2.2 The major components of the Work are as follows:

- (a) Site preparation
- (b) Excavation, shoring and dewatering
- (c) Demolition of existing cast-in-place structures
- (d) Siphon reconstruction by installation of pre-cast piping and end section units
- (e) Siphon reconstruction by means of cast-in-place concrete
- (f) Concrete restoration and crack grouting
- (g) Backfill of structures
- (h) Installation of gratings, signs and safety devices
- (i) Site ditching, grading and cleanup

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

- (a) "GWWD" means "Greater Winnipeg Water District"
- (b) "SLA" means "Shoal Lake Aqueduct"
- (c) "SMH" means "Standard Manhole"
- (d) "NSF" means "National Sanitation Foundation"
- (e) "CSA" means "Canadian Standards Association"
- (f) "ASTM" means "American Society for Testing and Materials"
- (g) "ACI" means "American Concrete Institute"
- (h) "SPMDD" means "Standard Proctor Maximum Dry Density"

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is UMA Engineering Ltd. doing business as AECOM, represented by:

Frank Iwanchuk
Senior Project Coordinator
1479 Buffalo Place, Winnipeg, MB R3T 1L7

Telephone No. (204) 284-0580
Facsimile No. (204) 475-3646

D4.2 At the pre-construction meeting, Frank Iwanchuk will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D5. CONTRACTOR'S SUPERVISOR

- D5.1 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.

D6. NOTICES

- D6.1 Except as provided for in C23.2.2, 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.
- D6.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.3, D6.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D4.1.

- D6.3 Notwithstanding C21., 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 Financial Officer
Administration Building, 3rd Floor
510 Main Street
Winnipeg MB R3B 1B9
Facsimile No.: (204) 949-1174

- D6.4 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
Internal Services Department
Legal Services Division
Attn: City Solicitor
185 King Street, 3rd Floor
Winnipeg MB R3B 1J1
Facsimile No.: (204) 947-9155

D7. FURNISHING OF DOCUMENTS

- D7.1 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

D8. AUTHORITY TO CARRY ON BUSINESS

- D8.1 The Contractor shall 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, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D9. SAFE WORK PLAN

- D9.1 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 C4.1 for the return of the executed Contract.
- D9.2 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 Division website at <http://www.winnipeg.ca/matmgmt/Safety/default.stm>

D10. INSURANCE

- D10.1 The Contractor shall provide and maintain the following insurance coverage:
- (a) commercial general liability insurance, in the amount of at least two million dollars (\$2,000,000.00) inclusive, with The City of Winnipeg and AECOM Canada Ltd. added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;
 - (b) automobile liability insurance for 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;
- D10.2 Deductibles shall be borne by the Contractor.
- D10.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in C4.1 for the return of the executed Contract.
- D10.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least thirty (30) Calendar Days prior written notice to the Contract Administrator.

D11. PERFORMANCE SECURITY

- D11.1 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.
- D11.1.1 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.
- D11.2 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 C4.1 for the return of the executed Contract.

D12. SUBCONTRACTOR LIST

D12.1 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 C4.1 for the return of the executed Contract.

D13. EQUIPMENT LIST

D13.1 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 C4.1 for the return of the executed Contract.

D14. DETAILED WORK SCHEDULE

D14.1 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 C4.1 for the return of the executed Contract.

D14.2 The detailed work schedule shall consist of the following:
(a) a Gantt chart for the Work acceptable to the Contract Administrator.

D14.3 Further to D14.2, the 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) Site mobilization
- (b) External and/or internal shoring
- (c) Dewatering
- (d) Excavation
- (e) Demolition
- (f) Installation of precast units and/or cast-in-place concrete repairs
- (g) Concrete repair and patching
- (h) Backfill
- (i) Site grading, fencing and cleanup
- (j) Substantial Performance
- (k) Total Performance

D14.4 Further to D14.2(a), 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.

SCHEDULE OF WORK

D15. COMMENCEMENT

D15.1 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.

D15.2 The Contractor shall not commence any Work on the Site until:
(a) the Contract Administrator has confirmed receipt and approval of:
(i) evidence of authority to carry on business specified in D8;
(ii) evidence of the workers compensation coverage specified in C6.15;

- (iii) the Safe Work Plan specified in D9;
 - (iv) evidence of the insurance specified in D10;
 - (v) the performance security specified in D11;
 - (vi) the Subcontractor list specified in D12;
 - (vii) the equipment list specified in D13; and
 - (viii) the detailed work schedule specified in D14
- (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.

D15.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

D15.4 The Contractor shall note that the City of Winnipeg intends to award this contract no later than January 30, 2009. In the event that award is not made by this date, and in the opinion of the Contract Administrator delay would reasonably result in inability to complete the Works in the 2008/2009 winter construction window, work or a portion of work may be permitted to be deferred until winter of 2009/2010.

D16. SCHEDULE RESTRICTIONS

D16.1 The Contractor is advised that the work shall be scheduled for the winter season of 2008/2009. The Contractor's schedule shall clearly indicate when specific portions of the work are scheduled.

D17. WORKING DAYS

D17.1 Further to C1.1(gg), the Contract Administrator's determination of whether or not atmospheric and Site conditions are such that a Working Day is deemed to have elapsed may be based at one time on one type of work while at another time a Working Day may be based on another type of work. When more than one type of major work is involved, the quantity of equipment that must be able to work in order to meet the requirements of a Working Day may vary considerably from that specified in the General Conditions.

D17.2 In the event that incidental work is behind schedule which, in the opinion of the Contract Administrator, should have been or could have been carried out by the Contractor in conjunction with or immediately following work of a major type, the City hereby reserves the right to charge Working Days on the incidental work until such time as it is up to schedule.

D17.3 When the major type of work involves restoration of the site to the condition it was prior to rainfall, Working Days shall not be charged.

D17.4 The Contract Administrator will furnish the Contractor with a daily record for each major type of work showing various information concerning the equipment, the time it worked, could have worked and Working Days charged. This report is to be signed each day by an authorized representative of the Contractor.

D18. SUBSTANTIAL PERFORMANCE

D18.1 The Contractor shall achieve Substantial Performance within forty (40) consecutive Working Days of the commencement of the Work as specified in D15.

D18.2 Further to D16.1 and D18.1, the Contractor will be permitted one extended schedule interruption, to facilitate construction through winter construction seasons, and at sites with varying soil, groundwater and other site conditions.

D18.3 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.

- D18.4 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.

D19. TOTAL PERFORMANCE

- D19.1 The Contractor shall achieve Total Performance within fifty (50) consecutive Working Days of the commencement of the Work as specified in D15.
- D19.2 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.
- D19.3 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.

D20. LIQUIDATED DAMAGES

- D20.1 If the Contractor fails to achieve Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for same, the Contractor shall pay the City the following amounts per Working Day for each and every Working Day following the days fixed herein for same during which such failure continues:
- (a) Substantial Performance – Two Thousand dollars (\$2,000);
 - (b) Total Performance – Five Hundred dollars (\$500).
- D20.2 The amounts specified for liquidated damages in D20.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve critical stages, Substantial Performance or Total Performance by the days fixed herein for same.
- D20.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

CONTROL OF WORK

D21. JOB MEETINGS

- D21.1 Regular bi-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.
- D21.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D22. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

- D22.1 Further to C6.24, 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).

D23. OFFICE FACILITIES

- D23.1 The Contractor shall supply office facilities meeting the following requirements:
- (a) The field office shall be conveniently located near the site of the work.
 - (b) The building shall have a minimum floor area of 20 square metres, with a minimum window area of 3 square metres and a door entrance with suitable lock satisfactory to the Contract Administrator.
 - (c) The building shall be suitable for all-weather use. It shall be capable of maintaining a temperature range between 16°C and 25°C.
 - (d) The building shall be furnished with one desk, one drafting table, one filing cabinet and six chairs, all satisfactory to the Contract Administrator.
 - (e) A separate toilet with door lock for the Contract Administrator.
 - (f) The field office shall be cleaned weekly immediately prior to the Job Site Meetings to the satisfaction of the Contract Administrator.
 - (g) The provision of the field office with the aforementioned furnishings and equipment shall also include maintenance and removal of the field office, operating costs and any service installation costs.

D24. DAMAGE TO THE AQUEDUCT

- D24.1 Further to GC.5.02(11)(a), adequate care shall be taken to avoid damage to the Aqueduct, adjacent structures, or properties during the course of the work. The Aqueduct is a non-reinforced concrete structure and has limited structural capacity to withstand any additional loads imposed directly above or adjacent to it. It also has very limited structural capacity to withstand asymmetrical loading.
- D24.2 Bidders are advised that internal inspections of the Aqueduct within the work area will be carried out prior to construction, unless access to the Aqueduct is unavailable. The Contractor will be permitted to attend preconstruction inspections if they can be carried out. Details of previous inspections are included in Appendix B – Defect Maps, attached to these Specifications. Subsequent inspections will be carried out during and after construction to confirm that no damage to the Aqueduct has occurred as a result of construction activities.
- D24.3 The Contractor further covenants and agrees that should the Shoal Lake Aqueduct be damaged due to the fault of the Contractor during any construction phase of the work specified, the City reserves the right to handle all engineering and construction aspects of the repair.
- D24.4 In the event that the Aqueduct is damaged and this damage is unrelated to the Contractor's activities, the Contractor is advised that the City of Winnipeg has developed an Emergency Repair Plan to respond to a structural collapse of the Aqueduct. In the event of such an emergency, the highest priority would be the mobilization to the site of the necessary materials and equipment required to effect the repair.
- D24.5 Should it be necessary to invoke the Emergency Repair Plan, the Contractor may not be able to continue with the Work during this time.
- D24.6 During the course of emergency repairs, the City may request assistance from the Contractor and his equipment. Details of the Emergency Repair Plan will be discussed with the Contractor at the pre-construction meeting.

D25. SITE ACCESS AND RESTORATION

- D25.1 Further to Clause GC:5.05, the Contractor shall, at his expense, provide and maintain access roads within the work area, including any required ditch crossings and culverts to facilitate execution of the Works of this Contract and for the use by the Contractor, Contract Administrator and representatives thereof. All ditch crossings and culvert installations provided

shall be removed after the Works are completed and the areas restored to a condition equal to or better than was existing.

- D25.2 Further to GC:4.09, the Contractor shall at his expense, restore all surface areas damaged or disturbed by his construction activities at or adjacent to the site to a condition equal to or better than was existing as directed by the authority having jurisdiction and the Contract Administrator. Payment may be withheld if the Contractor fails to restore any damaged or disturbed surface areas.

MEASUREMENT AND PAYMENT

D26. PAYMENT

- D26.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

WARRANTY

D27. WARRANTY

- D27.1 Notwithstanding C13.2, the Contract Administrator may permit the warranty period for a portion or portions of the Work to begin prior to the date of Total Performance if:
- (a) a portion of the Work cannot be completed because of unseasonable weather or other conditions reasonably beyond the control of the Contractor but that portion does not prevent the balance of the Work from being put to its intended use; or
- D27.1.1 In such case, the date specified by the Contract Administrator for the warranty period to begin shall be substituted for the date specified in C13.2 for the warranty period to begin.

FORM H1: PERFORMANCE BOND
(See D11)

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 for

BID OPPORTUNITY NO. 926-2008

SHOAL LAKE AQUEDUCT DRAINAGE SIPHON REPAIRS - MILES 50.31, 53.75 AND 55.23

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 as to Principal if no seal)

(Name of Principal)

Per: _____ (Seal)

Per: _____

(Name of Surety)

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

**FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)**
(See D11)

(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 926-2008

SHOAL LAKE AQUEDUCT DRAINAGE SIPHON REPAIRS - MILES 50.31, 53.75 AND 55.23

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 K: EQUIPMENT
(See D13)

SHOAL LAKE AQUEDUCT DRAINAGE SIPHON REPAIRS - MILES 50.31, 53.75 AND 55.23

<p>1. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>2. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>3. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

FORM K: EQUIPMENT
(See D13)

SHOAL LAKE AQUEDUCT DRAINAGE SIPHON REPAIRS - MILES 50.31, 53.75 AND 55.23

<p>4. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>5. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>6. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

- E1.1 These Specifications shall apply to the Work.
- E1.2 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.
- E1.2.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/Spec/Default.stm>
- E1.2.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.
- E1.2.3 Further to C2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.3 The following are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
	Cover Sheet – Key Plan and Drawing List
D-11542	Key Plan and Site Access 1
D-11543	Key Plan and Site Access 2
D-11544	Drainage Siphon Mile 50.31 (Site 1) – Plans and Sections
D-11545	Drainage Siphon Mile 53.75 (Site 2) – Plans and Sections
D-11546	Drainage Siphon Mile 55.23 (Site 3) – Plans and Sections
D-11547	Miscellaneous Details (1)
D-11548	Miscellaneous Details (2)

<u>City Drawing No.</u>	<u>Historical Drawing</u>
D-209	GWWD Detail of Culvert at Sta. 2656+06
C-138	GWWD Details of Culvert at Sta. 2838+00 – Contract No. 32
D-395	GWWD Details of Culvert at Sta. 2916+00
D-657	GWWD Culvert as Constructed Sta. 2916+00

E2. SOILS INVESTIGATION REPORT

- E2.1 Further to GC:3.1, the test holes in Appendix A, and as shown on the drawings, are provided to supplement the Bidder's evaluation of the site conditions within the repair work areas. The information is considered accurate at the locations indicated and at the time of the investigation. However, variations in soil conditions may exist between test holes and fluctuations in groundwater levels can be expected seasonally and may occur as a result of construction activities or variations in flow level inside the Aqueduct.
- E2.2 Any test holes or test pits made by the bidder shall be done in accordance with the requirements of the Water and Waste Department. Bidders shall notify the Contract Administrator prior to proceeding with any subsurface investigations.

E3. CONDITION, PROTECTION OF AND ACCESS TO THE AQUEDUCT

E3.1 Condition of the Aqueduct

E3.1.1 The Aqueduct is constructed of non-reinforced concrete and in some areas, contains numerous cracks. The Aqueduct, therefore, shall be considered as a fragile structure. All Work procedures conducted by the Contractor on and/or near the Aqueduct shall be well planned and executed to ensure that the Aqueduct is not subjected to construction related loads, including excessive vibrations and concentrated or asymmetrical lateral loads during backfill placement.

E3.2 Protection of the Aqueduct

E3.2.1 Contractors carrying out repair work on the Aqueduct or working in the vicinity of it shall ensure that:

- (a) Equipment shall only be permitted to cross the Aqueduct at designated reinforced road crossing locations. Contractors are advised that some load restrictions may apply at reinforced crossing locations, depending on the existing cover, Aqueduct section type and equipment ground pressure.
- (b) Granular material, construction material, soil or other material shall not be stockpiled on the Aqueduct or within 10 metres of the Aqueduct center-line.
- (c) Construction practices shall not subject the Aqueduct arch to asymmetrical loading at any time.
- (d) Construction practices or procedures at or near the Aqueduct shall not impart excessive vibration loads on the Aqueduct and/or cause settlement of the subgrade below the Aqueduct.
- (e) Asymmetrical water pressures shall not be permitted to build up on one side of the Aqueduct arch.

E3.2.2 It is the Contractors' responsibility to ensure that all work crew members understand and observe the requirements of E3.1 and E3.2. Prior to commencement of on-site Work, the Contractor's superintendent, foreman and heavy equipment operators shall attend an orientation meeting that will outline restrictions for working on and around the Aqueduct. Failure to comply with these restrictions will be grounds for removing the offending personnel from the site.

E3.3 Security

E3.3.1 The Contractor is required to take measures necessary to secure the work areas when the work areas are vacated. The Contractor shall install a temporary lockable chain gate, acceptable to the Contract Administrator, at the entrance to all winter roads and site access points which shall be locked at all times when personnel are not on site. The City shall be permitted to include a "double lock" mechanism whereby the City can add a city of Winnipeg lock, to permit access to City personnel in off hours.

E3.4 Equipment Restrictions

E3.4.1 The Contractor shall be permitted to use light weight equipment above the Aqueduct for spreading and levelling material. The equipment shall be restricted to a maximum machine weight of 1,500 kilograms (including tracks) and a maximum ground pressure of 35 kilopascals. Any equipment not meeting these restrictions shall not be permitted within five (5) metres of the centerline of the Aqueduct. Equipment meeting the specified restrictions shall not pass each other or operate within 15 metres of each other while operating on the Aqueduct. Compaction equipment will not be permitted for use above the Aqueduct.

E3.4.2 Further to Clause 8 of CW 2030-R4, only smooth edged excavation buckets or hand excavation shall be used for excavation adjacent to and over the Aqueduct.

E3.5 Access Roads

E3.5.1 The Contractor shall be permitted to access the Aqueduct right-of-way between Mile 49.27 and Mile 56.69 (Provincial Road 506) via the GWWD Railway right-of-way, municipal road or via temporary roads. The Contractor shall utilize existing cut lines to a great of an extent as possible, and shall familiarize himself with condition of cut lines and access prior to construction of roads.

E3.5.2 The Contractor shall participate in an inspection of access routes proposed for use for this contract, with representatives of the Contract Administrator, the City of Winnipeg and the Rural Municipality of Reynolds, prior to the commencement and after the completion of the Works. The Contractor shall promptly repair any damage attributed to their construction activities.

E3.5.3 Temporary road construction to access the Aqueduct right-of-way and work area shall only be permitted under the following conditions:

- (a) Shall not come closer than 10 metres to the Aqueduct centerline.
- (b) Utilize only existing cut lines through the forest, if outside of the City right-of-way.
- (c) The Contractor is responsible for maintaining these roads during the course of construction. The Contractor shall ensure that no unauthorized personnel or vehicular traffic accesses the Aqueduct right-of-way during the construction period and shall put the necessary safeguards in place to ensure same.
- (d) Following completion of the Work, temporary roads shall be left in such condition that there is no vehicle access to the Aqueduct right-of-way.
- (e) All temporary road construction shall be licensed by Manitoba Conservation and must conform to the applicable regulations. The Contractor shall be responsible for obtaining a work permit from the local office of Manitoba Natural Resources prior to commencement of any site access or development activities. The permit may include requirements regarding site access, fire prevention, site clean-up and other concerns. All site development activities shall be conducted in accordance with the work permit. A copy of this permit shall be forwarded to the Contract Administrator prior to the commencement of on-site work.
 - (i) Where access roads block drainage, provide drainage culverts, of sufficient capacity, minimum 450 millimetres in diameter, to adequately convey natural flows across the road. Temporary drainage structures shall be completely removed and the site restored after the completion of construction.

E3.6 Aqueduct Crossings

E3.6.1 Aqueduct crossing will be permitted at designated reinforced road crossings at the following locations:

- (a) Mile 56.69 (Provincial Road 506)
- (b) Undeveloped Aqueduct road crossings at Mile 49.27, Mile 53.44, Mile 54.05, and Mile 55.22.

E3.6.2 Load restrictions for road crossings on developed roadways shall be limited to the load limitations in place for the road.

E3.6.3 Equipment crossing and load restriction for undeveloped roadways shall be restricted as follows;

- (a) The Contractor must submit details of the equipment proposed for the crossing, including operating weight, track or wheel dimensions and spacing and developed

ground pressure, for review by the Contract Administrator, a minimum of 10 Working days prior to on site construction activities.

- (b) Equipment must not be loaded.
- (c) Equipment must cross the Aqueduct in a responsible, careful manner (i.e. slowly).
- (d) Crossings shall be constructed and levelled for a sufficient length as to fully support and distribute the weight of the equipment (i.e. entire track length and width) while crossing the Aqueduct. Minimum earth cover restrictions will also be applied.

E3.7 Temporary Aqueduct Bridging Structure

E3.7.1 Temporary Aqueduct bridging structures may be employed at other locations where the Contractor plans to access the work areas via temporary roads. The Contractor shall submit shop drawings for the temporary Aqueduct bridging structure in accordance with 0.

E3.7.2 The temporary Aqueduct bridging structure shall be designed and constructed in such a manner so as to prevent any additional loads (live or dead loads) being transmitted to the Aqueduct during construction, launching or operation. In this regard, structures less than 24 metres in total length may require specialized (deep) foundations at the end supports to prevent the imposition of loads to the Aqueduct structure. All temporary bridging structures shall be removed when they are no longer required to facilitate construction.

E4. ENVIRONMENTAL PROTECTION

E4.1 The Contractor shall be aware that the Shoal Lake Aqueduct is for potable water supply and no contamination by fuel, chemicals, etc. shall be permitted at any time. Fuels or chemicals shall not be stored within 30 metres of the Aqueduct.

E4.2 The Contractor shall plan and implement the Work of this Contract strictly in accordance with the requirements of the environmental protection measures as herein specified.

E4.3 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

E4.3.1 Federal

- (a) Canadian Environmental Protection Act (CEPA) c.16
- (b) Transportation of Dangerous Goods Act and Regulations c.34

E4.3.2 Provincial

- (a) The Dangerous Goods Handling and Transportation Act D12
- (b) The Endangered Species Act E111
- (c) The Environment Act c.E125
- (d) The Fire Prevention Act F80
- (e) The Manitoba Nuisance Act N120
- (f) The Public Health Act c.P210
- (g) The Workplace Safety and Health Act W120
- (h) And current applicable associated regulations.

E4.4 The Contractor is advised that the following environmental protection measures apply to the Work.

E4.4.1 Materials Handling and Storage

- (a) Construction materials shall not be stored within ten (10) metres of the Aqueduct centerline.

E4.4.2 Fuel Handling and Storage

- (a) The Contractor shall abide by the requirements of Manitoba Environment for handling and storage of fuel products.
- (b) 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.
- (c) 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.
- (d) The Contractor shall ensure that all fuel storage containers are inspected daily for leaks and spillage.
- (e) Products transferred from the fuel storage area(s) to specific work sites shall not exceed the daily usage requirement.
- (f) 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.
- (g) Refueling of mobile equipment and vehicles shall take place at least 100 metres from a watercourse.
- (h) 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.
- (i) 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.

E4.4.3 Waste Handling and Disposal

- (a) The construction area shall be kept clean and orderly at all times during and at completion of construction.
- (b) 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.
- (c) Indiscriminate dumping, littering, or abandonment shall not take place.
- (d) No on-site burning of waste is permitted.
- (e) Equipment shall not be cleaned near watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.

E4.4.4 Dangerous Goods/Hazardous Waste Handling and Disposal

- (a) Dangerous goods/hazardous waste are identified by, and shall be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.
- (b) The Contractor shall be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.

E4.4.5 Emergency Spill Response

- (a) The Contractor shall ensure that due care and caution is taken to prevent spills.
- (b) The Contractor shall report all major spills of petroleum products or other hazardous substances with the potential for impacting the environment and threat to human

health and safety to the Contract Administrator and Manitoba Environment, immediately after occurrence of the environmental accident, by calling the 24-hour emergency telephone phone number (204) 945-4888.

- (c) The Contractor shall designate a qualified supervisor as the on-site emergency response coordinator for the project. The emergency response coordinator shall have the authority to redirect manpower in order to respond in the event of a spill.
- (d) 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 coordinator:
 - (i) Notify emergency-response coordinator of the accident:
 - identify exact location and time of accident
 - indicate injuries, if any
 - request assistance as required by magnitude of accident (Manitoba Environment 24-hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup)
 - (ii) 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 and the Aqueduct
 - (iii) 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
 - dyke spill material with dry, inert sorbent material or dry clay soil or sand
 - prevent spill material from entering waterways and utilities by dyking
 - prevent spill material from entering Aqueduct manholes and other openings by covering with rubber spill mats or dyking
 - (iv) Resume any effective action to contain, clean up, or stop the flow of the spilled product.
- (e) The emergency response coordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to the Manitoba Environment according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.

E4.5 Controlled Products

- (a) Materials classified as "Controlled Products" under Regulation 52/88, "Workplace Hazardous Materials Information System", including amendments, are prohibited inside the Aqueduct, unless the material will be directly employed in the Work.
- (b) Notwithstanding the aforementioned requirement, materials have been tested by an ANSI accredited laboratory and meet the requirements of ANSI/NSF 60, "Standard for Drinking Water Treatment and Chemicals – Health Effects", and ANSI/NSF 61, "Standard for Drinking Water System Components – Health Effects", including the patching repair material, and epoxy resin adhesive, as specified in the Specifications, shall be permitted inside the Aqueduct.

E5. EROSION PROTECTION AND SEDIMENT CONTROL

E5.1 Description

- E5.1.1 The Contactor shall conduct his operations to comply with federal and provincial fisheries and environmental protection legislation, including preventing the loss or destruction of fish

habitat, and minimizing the impact of sedimentation, silting or otherwise causing a degradation in water quality.

E5.2 Construction Methods

E5.2.1 Stream Crossings

- (a) Temporary stream crossings, where required, shall be constructed in accordance to "Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat" (1996)

E5.2.2 Dewatering

- (a) Discharge from dewatering operations will not be permitted to be discharged directly into a watercourse. Dewatering discharge shall be directed to a constructed or natural settlement basin to allow for settlement of silts and debris
- (b) Discharge points of dewatering pumps and hoses shall be constructed to properly dissipate flow to prevent erosion, by means of discharging onto riprap, a properly anchored geotextile fabric or other means in order to reduce velocity of discharge to less than 0.3 metres per second.
- (c) Diversion ditches shall be constructed to minimize flow velocities and erosion by minimizing ditch slopes, and /or use of ditch berming devices or riprap. Outlets to water courses shall be constructed to minimize discharge of silts and sediments by use of silt fencing, brush barriers, riprap and / or sediment basins

E5.2.3 Limits of Work Area

- (a) The Contractor shall keep his work area to an absolute minimum area, to avoid disturbance of ground and vegetation that would increase the risk or severity of erosion.
- (b) Areas disturbed by the Contractors operations, including temporary access roads, shall be restored and re-vegetated to a condition equal to those existing prior to construction
- (c) Areas immediately adjacent to water courses, and sloped areas susceptible to erosion shall be protected from erosion upon the completion of construction until the site is adequately re-vegetated, by applying a temporary ground cover, such as: straw mulch; slash from clearing and grubbing; or erosion control blankets.

E5.2.4 Site Cleanup

- (a) Upon completion of site restoration and re-establishment of vegetation, remove all temporary devices including synthetic silt fences, geotextile fabrics, ditch berms and temporary riprap. Biodegradable products such as straw bales may be broken up and left on site. Synthetic materials shall be removed from site and properly disposed of.

E5.3 Method of Measurement and Basis of Payment

- E5.3.1 No measurement or payment will be made for Erosion Protection and Sediment Control. It will be considered incidental to construction works.

E6. USE OF GWWD RAILWAY

E6.1 General

- E6.1.1 The City of Winnipeg owns and operates the Greater Winnipeg Water District (GWWD) Railway between the Railway Yard in St. Boniface (598 Plinquet Street) and the Intake at Shoal Lake. Work trains routinely deliver chlorine and other supplies to the Intake and materials for track upgrading and maintenance. Two diesel locomotives are available along with an assortment of rolling stock. The GWWD Railway is available to the

Contractor to deliver equipment and material to the work area. Use of the GWWD Railway will be charged to the Contractor at the tariff specified in E6.4.

E6.1.2 The Contractor shall not have unlimited use of the GWWD Railway facilities. The Contractor shall develop a schedule outlining all required GWWD Railway activities and resources and the associated timetable prior to the commencement of construction. The City requires this schedule to deploy the necessary level of railway resources to the project in a timely manner and to schedule the Contractor's requirements with routine track usage.

E6.1.3 Bidders are advised that emergency railway services will take precedence over material and equipment deliveries. Neither the City, nor the Contract Administrator shall be held liable for failing to provide rail transportation in any event.

E6.1.4 The Contractor shall ensure that all equipment, vehicles, personnel, and materials are kept off the railway and away from the trackbed, unless instructed otherwise by the Contract Administrator. The Contractor shall provide all labour and equipment necessary for loading and unloading equipment and materials including all equipment necessary to tie down loads. The City of Winnipeg will provide an operator to operate the side dump cars during unloading.

E6.2 Train Service

E6.2.1 Available Rolling Stock

(a) The following rolling stock are available for the Contractor's use on this project:

- | | |
|----------------------------|--|
| (i) Flat Bed Cars | number available = 5
deck width = 2.44 metres
deck length = 12.0 metres
maximum load capacity = 36,000 kilograms |
| (ii) Side Dump Gravel Cars | number available = 15
hopper capacity = 20 cubic metres |
| (iii) Ramp Cars | number available = 1
deck width = 2.4 metres (9 metres length)
= 3.2 metres (5 metres length at ramp end of car)
deck length = 14 metres
maximum load capacity = 50,000 kilograms
number available = 1
deck width = 2.4 metres
deck length = 6 metres
maximum load capacity = 40,000 kilograms |
| (iv) Caboose | number available = 1 |

(b) The GWWD Railway right-of-way has sufficient horizontal clearances to transport loads up to 3.66 metres wide.

E6.2.2 Train Use and Scheduling

(a) A train consists of one (1) locomotive, one (1) caboose and any combination of the remaining rolling stock identified in E6.2.1.

(b) A train crew shift consists of a train as previously described and the train crew (2 people). A third crew member will be added as required to operate the side dump cars during ballast unloading. The maximum train crew shift duration allowed is 12 hours per calendar day.

(c) The GWWD Railway can provide one (1) train crews for use on this project. Each train crew can work a maximum of one full train crew shift per calendar day and a maximum of ten (10) train crew shifts per fourteen (14) calendar day period.

E6.2.3 Transportation of Contractor's Equipment

- (a) Rolling stock identified in E6.2.1 will be made available to the Contractor for the transportation of equipment to and from the work area. Equipment shall be loaded at either the GWWD Railway's St. Boniface Yards, or Mile 64 (Hadashville, Manitoba). Contractors are also advised that equipment such as an excavator will be required to raise and lower the steel equipment ramps on the ramp car.
- (b) Loading ramps are available at the St. Boniface Yards to load equipment onto flat cars. Similar ramps are not available at the Mile 38 loading point.
- (c) The Contractor is advised that some tracked construction equipment may be moved between work sites by travelling on the railbed, provided the railway infrastructure is not damaged during movement of the equipment. Approval for moving equipment on the railbed may be granted by the GWWD Railway upon review of the type of equipment. Any damage to the railway infrastructure resulting from equipment moving along the railbed shall be corrected by the Contractor at their expense. In no case shall the Contractor move equipment along the railway without prior approval and track support by a City of Winnipeg GWWD Operator.

E6.2.4 Transportation of Contractor's Fuel

- (a) It is incumbent upon the Contractor to arrange for the delivery of fuel to the work area in accordance with all Federal and Provincial requirements for the transportation and handling of fuel products.

E6.3 Transportation of Personnel

E6.3.1 GWWD Railway Track Car Units

- (a) One track car unit stationed at Hadashville are available to transport the Contractor's personnel to and from the work area. Only one (1) track car unit is permitted to be used at any given time for the purposes of transporting the Contractor's personnel.
- (b) Transportation of the Contractor's personnel will be provided such that there is no interference with GWWD staff duties during normal working hours (0800 to 1630 hours, Monday to Friday).
- (c) Arrangements for transportation of Contractor's personnel shall be made through the Section Foreman no later than 1500 hours at least one (1) day prior to the requested date of travel.

E6.4 Tariffs

E6.4.1 The Contractor will be invoiced by the City of Winnipeg for use of the GWWD Railway equipment and personnel as detailed herein below.

E6.4.2 Charges for using GWWD Railway train(s), including the train crew(s), shall be

- (a) \$70.00/hour for the locomotive including the train crew
- (b) \$20.00/hour/car for each additional piece of rolling stock requested
- (c) minimum charge of eight (8) hours per trip
- (d) rolling stock and the locomotive charges shall not be subject to overtime charges
- (e) an additional \$90.00/hour overtime rate shall be charged for train crew time, for time in excess of eight (8) hours per day
- (f) Charges for each GWWD Track Car and GWWD Operator based from the Hadashville Yard, for transportation to and from the work sites only, shall be seventy dollars (\$70.00) per hour, or portion thereof rounded up to the nearest one-half (0.5) hour, plus applicable taxes. A minimum charge is for one (1) hours.

E7. SITE PREPARATION, MOBILIZATION AND DEMOBILIZATION

E7.1 Description

E7.1.1 This specification covers site preparation including mobilization, equipment and fuel compounds and storage areas, field office establishment, adequate site drainage, demobilization, final site clean up, and other contractor related tasks required as a portion of the Works for this Contract.

E7.1.2 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.

E7.1.3 Right-of-Way

- (a) The Contractor shall be apprised that a right-of-way exists along the length of the Aqueduct, that can be used for access, and stockpiling and storage of materials and equipment for the Contractor's use for the duration of the Project.
- (b) The Contractor shall also be advised that the Greater Winnipeg Water District (GWWD) railway runs parallel to the Aqueduct, south of the centreline of the Aqueduct. The GWWD railway shall not be blocked at any time during this Contract.
- (c) Equipment and material stockpiles within the Aqueduct right-of-way, shall be limited to the portion of the Aqueduct right-of-way between Aqueduct and the GWWD Railway, or north of the Aqueduct. No material shall be stockpiled within 10 metres of the Aqueduct centerline nor shall the GWWD Railway and any public roads be blocked at any time.
- (d) The Contractor shall note that other contracts may be in progress in the vicinity of this project. Reconstruction work at Mile 56.69 may be in progress. The Contractors operations must not interfere or impede work at this location. Establishment of site access will be permitted from PR 506, but must be coordinated with other Contractors.

E7.1.4 Compounds and Field Offices

- (a) The area within the Aqueduct right-of-way shall be used for the establishment of the equipment and fuel compounds, storage areas, and field offices as required to perform the Works associated with this Contract. The Contractor shall be permitted to establish a temporary storage and site facilities near PR 506, within restrictions outlined in E3 Condition, Protection of and Access to the Aqueduct, and as set out by the Contract Administrator. The Contractor shall note that other Contractors may be working and have temporary facilities set up at this location. The Contractor shall coordinate set-up of site facilities with others.

E7.1.5 Site Drainage

- (a) Provision of adequate site drainage during the entire construction phase shall be the Contractor's responsibility. No extra payment or time extension will be granted as a result of difficulties associated with site access resulting from poor site drainage during any part of the construction phase.
- (b) Drainage ditches shall be left operational during the Work of this Contract. Culverts of adequate diameter (450 millimetres minimum) shall be installed where access across a ditch is required, and removed at the completion of this Contract.

E7.1.6 Final Site Cleanup

- (a) The Contractor shall clean up and remove repair work related surplus materials, tools, equipment, waste, and debris, including but not limited to loose geotextile fabric, wood blocking, waste concrete cores, and concrete wash-out from Ready-mix concrete trucks.

E7.2 Method of Measurement and Basis of Payment

E7.2.1 Method of Measurement

(a) Site Preparation, Mobilization and Demobilization

- (i) No measurement will be made for site preparation, mobilization and demobilization. It will be considered incidental to the price bid for the Drainage Siphon Reconstruction.

E8. CLEARING AND GRUBBING

E8.1 Description

- E8.1.1 Clearing and grubbing shall be in accordance with Specification CW 3010-R4, "Clearing and Grubbing", except where revised or supplemented in this Specification.

E8.2 Construction Methods

- E8.2.1 Areas of the Aqueduct berm designated for clearing shall be cleared by means of a remote brush mower or shredder. Equipment used for this operation shall be capable of operating within the restrictions set out in E3.4 Equipment Restrictions.

- E8.2.2 Other areas of the Aqueduct right-of-way designated on the drawings for clearing and grubbing, or required for the establishment of temporary access roads, shall be cleared as per CW 3110-R4 Clearing And Grubbing. Equipment used for this operation shall be capable of operating within the restrictions set out in E3.4 Equipment Restrictions. Trees from the clearing operation shall be cut into 2.5 metre lengths and stacked neatly adjacent to the GWWD Railway. Alternately, trees and brush may be shredded by use of a bush mower and left on site. Slash from clearing and grubbing operations shall be uniformly spread out in the cleared area upon completion of Work.

- E8.2.3 Areas outside the Aqueduct right-of-way that require clearing for establishment of access roads and field facilities shall the responsibility of the Contractor. The Contractor shall obtain all necessary permits or agreements for access to Crown and private lands.

- E8.2.4 Burning or burying of any materials from clearing and grubbing operations will not be allowed within the Aqueduct right-of-way.

E8.3 Method of Measurement and Basis of Payment

E8.3.1 Method of Measurement

- (a) Clearing and Grubbing within the Aqueduct right-of-way will not be measured. It will be considered incidental to the siphon repair works.

E9. DRAINAGE SIPHON AND AQUEDUCT REPAIRS

E9.1 Description

- E9.1.1 This Specification shall cover the Work required for the repair or reconstruction of existing cast in place concrete inlet and outlet structures and Aqueduct Arch Strengthening.

- E9.1.2 The following table summarizes general works to be completed at each site:

Work Item	Mile 50.31 (Site 1)	Mile 53.75 (Site 2)	Mile 55.23 (Site 3)
PRECAST PIPE SIPHON RECONSTRUCTION	X	X	X
CAST-IN-PLACE CONCRETE CONSTRUCTION	X	X	X
SAFETY GRATING	X	X	X
SAFETY FENCING AND SIGNS	X	X	X
SITE GRADING AND DITCHING	X	X	X
RIPRAP	X	X	X

E9.2 Existing Conditions

- (a) Drainage siphons in this area have been assessed utilizing different inspection techniques. All siphon superstructures (visible) have been assessed for structural deterioration. The lower portions of the siphons (below grade) have been assessed by the following methods;
- Dewatering siphon and conducting visual examinations and concrete quality testing, March 2000
 - Inspection via diver and closed circuit video, May 2002
 - No inspection

Siphon	Method	Date
Mile 50.31	Dewatered and Inspected	February 2003
Mile 53.75	Dewatered and Inspected	March 2000
Mile 55.23	Diver and Video	May 23,2002

- (b) Defects observed during inspections are noted on the drawings
- (c) Video of inspections conducted by diver are available for viewing at the office of the Contract Administrator, by appointment, during normal business hours

E9.3 Construction Methods

E9.3.1 Drainage Siphons - Mile 50.31 (Site 1) to Mile 55.23 (Site 3)

- (a) General construction sequence:
- (i) Install coffer dams and dewatering systems as required.
 - (ii) Strip Aqueduct berm and install excavation shoring systems. (where required)
 - (iii) Provide continuous full depth saw cuts at limit of proposed new construction (where required).
 - (iv) Dewater and clean siphons. The Contractor shall note that the siphons may contain silt, rocks, vegetation and other debris. All debris shall be removed from the siphon.

- (v) Demolish designated parts of existing structure, taking care not to damage portions of structures to be left in place, and not cause damage or excess vibrations to the Aqueduct.
- (vi) Complete excavation
- (vii) Install pre-cast or construct cast-in-place concrete elements and connect to existing structure.
- (viii) Complete concrete restoration and crack repair
- (ix) Backfill structures
- (x) Remove coffer dams/dewatering systems
- (xi) Install rip rap
- (xii) Install safety devices, fencing and gratings
- (xiii) Site grading and ditching
- (xiv) Complete final grading and seeding
- (xv) Final demobilization and cleanup

E9.4 Acceptance Inspection

- (a) Immediately prior to expiration of the one year warranty period, the Contractor shall arrange to have the drainage siphons dewatered for the purpose of re-inspection of the siphons. The Contractor shall attend the inspection with the Contract Administrator. Any defects in the Contractor's Work shall be remedied at the Contractor's expense. The City will provide, at no cost to the Contractor, railway transportation of the Contractors equipment to the various locations where siphon dewatering is required for the acceptance inspection.

E9.5 Method of Measurement and Basis of Payment

E9.5.1 Method of Measurement

(a) Drainage Siphon Repairs

- (i) Drainage siphon repairs will be measured on a lump sum basis. The lump sum amount for each site shall include all site mobilization, site preparation and demobilization, excavation, backfill, shoring and dewatering, demolition of the existing structure, supply and installation of new precast inlet and outlet structures, construction of cast-in-place inlet and outlet structures, fencing, signs and other safety devices, site grading and cleanup and all work associated with the Acceptance Inspection outlined in E9.4 Acceptance Inspection. Separate lump sum measurement shall be made for the following items of work:
 - Drainage Siphon Mile 50.31 Reconstruction (Site 1)
 - Drainage Siphon Mile 53.75 Reconstruction (Site 2)
 - Drainage Siphon Mile 55.23 Reconstruction (Site 3)

E9.5.2 Basis of Payment

(a) Drainage Siphon Repairs

- (i) Payment will be made at the Contract Lump Sum Price for the "Items of Work" listed on Form B: Prices, measured as specified herein, 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.
- (ii) For each of the Work Sites where Drainage Siphon Repairs are required, ninety-eight percent (98%) of the unit price bid for this Work will be paid upon reaching Total Performance. Two percent (2%) of the bid price will be held back until the acceptance inspection is completed (E9.4). The two percent

(2%) holdback will not affect the determination or issuance of Total Performance for the Contract.

E10. EXCAVATION AND BACKFILL

E10.1 Description

E10.1.1 Excavation and Backfill shall be in accordance with Specification CW-2020, "Specification for Rock Excavation" and CW 2030-R4, "Excavation and Backfill" except where noted, revised, or supplemented in this Specification.

E10.1.2 Excavation of rock shall be defined as any native material that cannot be removed by excavation equipment without splitting, breaking, or special equipment, including large boulders with a maximum dimension of one metre.

E10.1.3 Excavated material shall include the excavation and disposal of earth, peat and construction debris which may be encountered.

E10.2 Materials

E10.2.1 Excavated Material

(a) All excavated material shall be disposed of within the Work Area at a location identified by the Contract Administrator.

E10.2.2 Foundation Fill Material

(a) Foundation fill shall consist of crushed rock material, maximum particle size of 100 mm, conforming to CW 3110-R5. 5.4 "Sub-base Materials".

E10.2.3 Granular Backfill Material

(a) Granular material for backfill shall consist of sound, hard, pit run, crushed rock or gravel, and shall be free from organic or soft material which would disintegrate through decay or weathering. The granular material shall conform to the following gradation requirements:

Canadian Metric Sieve Sizes	Percent of Total Dry Weight Passing Each Sieve
75000	100
5000	50-90
2500	30-85
630	10-45
315	7-32
80	0-6

E10.2.4 Select Site Backfill

(a) Select site backfill shall consist of unfrozen excavated material, free of vegetation, debris, large rocks in excess of 100 mm in diameter.

E10.2.5 Submittals

(a) The Contractor shall submit a sample, and name the aggregate source of the granular backfill materials to the Contract Administrator prior to the pre-construction meeting. The sample shall be submitted to the testing laboratory designated by the City of Winnipeg.

E10.3 Construction Methods

- E10.3.1 Excavation shall not commence until the Contract Administrator is on site, and shoring and bracing, where required, have been installed.
- E10.3.2 The Contractor shall provide a copy of the Drawing containing the geometry and design dimensions of the cross section for the applicable arch type(s) to the excavation equipment operators.
- E10.3.3 The Contractor shall ensure that all excavation equipment operators understand and strictly follow the requirements of D24 Damage To The Aqueduct, of the Supplemental Conditions and E3 of the Specifications at all times.
- E10.3.4 Excavation and backfill shall proceed simultaneously on both sides of the Aqueduct, with not more than a 0.6 metre of grade differential maintained between both sides of the pipe at any time. Where shoring is not installed, the Contractor shall maintain safe excavation sideslopes, to suit excavated material and site conditions, minimum of 1 horizontal to 1 vertical (1H:1V).
- E10.3.5 When excavating in frozen ground, employ methods which will not cause damage to the Aqueduct. Alternatively, thaw out the frozen ground by heating and hoarding the excavation area prior to excavating with conventional equipment. The Contractor will be permitted to install a secure layer of insulating material over the proposed excavation areas, prior to freeze-up, to minimize frost penetration in the proposed excavated areas.
- E10.3.6 Prior to winter freezing, install an insulating layer consisting of a minimum of 300 millimetre thick layer of straw, to prevent freezing of the ground adjacent to the Aqueduct and other structures.
- E10.3.7 When excavation involves reducing ground cover over the Aqueduct in freezing temperatures, the excavation shall be covered with insulated tarpaulins, or a minimum 300 millimetre thickness of straw, to prevent freezing of the ground surrounding the Aqueduct.
- E10.3.8 Non-frozen excavated material required for backfill shall be stockpiled and protected from freezing by means of insulated tarpaulins, or a minimum 300 millimetres thickness of straw, to prevent freezing
- E10.3.9 Concrete material from concrete demolition operations may remain on site for use as riprap, provided it is demolished to a maximum particle size of 300 mm, and exposed reinforcing steel is cut off. Reinforcing steel shall be disposed of off-site.
- E10.3.10 If bedrock is encountered in the excavation, it shall be removed from the excavation by ripping, pneumatic splitters or breaking. **USE OF EXPLOSIVES WILL NOT BE PERMITTED.** The Contractor shall ensure that whatever method is chosen does not cause damage to the Aqueduct or other surrounding structures, including excessive vibration.
- E10.3.11 If the foundation soils below the proposed structures are unsuitable, the Contractor shall remove the unsuitable material to the limits and depths directed. Unsuitable material shall be replaced with foundation fill, compacted to 90 percent of Standard Proctor Maximum Dry Density (SPMDD). Compaction equipment will be subject to limitations outlined below. If required foundation fill is less than 300 mm in thickness, the Contractor may utilize additional pipe bedding material, compacted to 90 % SPMDD.
- E10.3.12 Initial backfill around structures and as shown on the Drawings shall be granular backfill compacted to between 90 % and 95 % Standard Proctor Maximum Dry Density. Compaction equipment for use within 5 metres of the centre of the aqueduct shall be light weight plate or walk behind roller equipment with a maximum weight of 450 kilograms.
- E10.3.13 Remaining backfill shall be unfrozen select site backfill, compacted to a density equivalent to that of the surrounding unexcavated material. Backfill directly above the aqueduct shall

be carefully placed and lightly compacted. Backfill berm a maximum of 300 millimetres higher than adjacent undisturbed berms, to allow for subsidence.

E10.3.14 Any subsidence in backfilled areas shall be regarded at the Contractor's expense.

E10.4 Method of Measurement

E10.4.1 Excavation and Backfill, except for unsuitable foundation soils and rock excavation, but including foundation materials shown on the detail drawings, will not be measured for payment. It will be considered incidental to E9 Drainage Siphon and Aqueduct Repairs.

E10.4.2 Excavation and replacement of unsuitable foundation soils will be measured on a volume basis. The amount measured shall be the total number of cubic metres of unsuitable foundation soils removed and replaced, acceptably completed in accordance to this Specification, as determined by measurements made by the Contract Administrator. No measurement will be made for areas excavated outside the limits specified for removal by the Contract Administrator.

E10.5 Basis of Payment

E10.5.1 Excavation and replacement of unsuitable foundation soils shall be paid at the Contract Unit Price for "Excavation and Replacement of Unsuitable Foundation Soils", measured as Specified herein, which payment shall be compensation in full for performing operations herein described, and all items incidental to the Work included in this Specification.

E11. WATER CONTROL AND DEWATERING SYSTEMS

E11.1 Description

E11.1.1 This specification shall cover the design, installation and operation of water control and dewatering systems for excavations. It shall amend and supplement CW 2030-R4.

E11.2 Design Requirements

E11.2.1 Water Control and Dewatering may be required to complete the drainage siphon repairs. The Contractor shall be responsible for the design, construction and operation of a dewatering system to control ground water and surface run-off so that all repair work activities can be completed under dry conditions. (Note that different work sites may require different dewatering procedures).

E11.2.2 Prevent surface run-off from entering excavations. Facilitate re-routing of existing ditches and/or surface run-off around the work site as per requirements of Section E5 Erosion Protection and Sediment Control. Water control and dewatering systems shall not cause water backup that may cause damage to properties along the course of, or adjacent to the drainage feature.

E11.2.3 The Contractor shall note that the Aqueduct is not watertight, and contains numerous cracks and defects which are known to actively leak. Detailed maps of all known cracks and defects and a qualitative assessment of level of leakage are included in the Appendix.

E11.2.4 A timber box drain, which was placed during original construction to control trench water, may also exist below the invert of the Aqueduct. Records of box drain construction exist for the approximate areas noted below. Existence and location of this box drain, in other areas is unknown. The Contractor's dewatering system shall be designed to accommodate this leakage.

(a) Mile 49.24 to Mile 50.30 – Box Drain

(b) Mile 55.95 to East Limit of Contract – Box Drain

- E11.2.5 Maintain groundwater level a minimum of 300 mm below the bottom of the excavation and prevent damage to the Aqueduct caused by groundwater pressures, either directly or indirectly. Maintain a firm dry undisturbed subgrade in the bottom of the excavation upon which backfill material may be placed and compacted upon completion of the repair work.
- E11.2.6 Prevent destabilization, heaving or shear failure of the sides or bottom of the excavation.
- E11.3 Submittals
- E11.3.1 The Contractor shall submit a water control and dewatering plan for each site, addressing the following minimum considerations:
- (a) Proposed method of dewatering and equipment;
 - (b) Operational considerations to prevent damage to the Aqueduct and adjacent structures;
 - (c) relationship between dewatering equipment, the Aqueduct and the excavation shoring system;
 - (d) additional design considerations based on the Contractors proposed methodology;
 - (e) any temporary culverts or other drainage structures required to facilitate the repair work;
 - (f) plans to decommission the dewatering system upon completion of the Work.
- E11.3.2 These submittals are required for record purposes only and will not be reviewed for adequacy by the Contract Administrator. Full responsibility for the design, installation, and maintenance of the dewatering system rests with the Contractor.
- E11.4 Equipment
- E11.4.1 Pumps, hoses and other dewatering equipment required shall be provided in sufficient number and capacity to maintain excavations in a dry condition.
- E11.5 Construction Methods
- E11.5.1 Install dewatering equipment and dewater to the design requirements.
- E11.5.2 Take corrective measures as required to maintain groundwater at a sufficiently low level to meet performance requirements.
- E11.5.3 Protect the Aqueduct and repair work from damage resulting from dewatering equipment failure by providing standby dewatering equipment, connected directly to electrical generators, engaging automatically in case of power failure.
- E11.5.4 Water from dewatering operations shall be handled in accordance to E5 Erosion Protection and Sediment Control
- E11.5.5 Method of Measurement and Basis of Payment
- E11.5.6 Method of Measurement
- (a) The Dewatering Systems shall not be measured for payment. Dewatering Systems, including all materials and operations herein described will considered incidental to the price for to E9 Drainage Siphon and Aqueduct Repairs.

E12. SHORING SYSTEMS

E12.1 Description

- E12.1.1 This Specification covers the design and installation of excavation shoring required for the repair work covered by these Specifications. It shall amend and supplement CW-2030-R4.

E12.2 Definitions

E12.2.1 Excavation Shoring: A temporary structure, such as steel liner plates, steel-sheet piling, soldier piles and lagging, steel rib and lagging, or similar system required to retain earth and water in order to facilitate construction of permanent work.

E12.2.2 Cofferdam: A watertight excavation shoring system enclosing an area within which construction of permanent works can be safely carried out.

E12.3 General

E12.3.1 Unless otherwise shown on plans, Excavation Shoring System is not limited to one or a combination of an Excavation Shoring and a Cofferdam. If surface run-off could be prevented from entering excavations by other means such as ditches, berms, clay dikes and similar, design these systems to meet the requirements of these Specifications.

E12.3.2 The Contractor shall provide and install excavation shoring systems, and dewatering systems prior to commencing excavation.

E12.3.3 The Contractor shall design, install and maintain suitable excavation shoring systems and, where required, cofferdams at the Aqueduct repair locations. Such Works shall meet the performance criteria specified below and also be compatible with dewatering requirements and other requirements to successfully enable execution of the specified Aqueduct repair work.

E12.4 Design Requirements

E12.4.1 Excavation Shoring

- (a) The excavation shoring/cofferdam shall meet the following performance requirements:
 - (i) be substantially watertight;
 - (ii) prevent disturbance, destabilization or failure of the sides and/or bottom of the excavation;
 - (iii) resist all loads to which it will be subjected, including vertical and lateral loads from construction equipment, without transmitting such loads onto the Aqueduct, either directly or indirectly. See clause E3 Condition, Protection of and Access to the Aqueduct
- (b) Excavation shoring shall be designed independent from the Aqueduct. No additional loads shall be imposed to the Aqueduct by shoring design.
- (c) Design Excavation Shoring System based on recognized geotechnical and structural theories for conditions present. Consider applicable loads and load combinations, including lateral pressures from groundwater, soil, unsymmetrical surcharge loads from construction operations, and frost action on retained soil.
- (d) Bracing to remain fully effective during construction. Coordinate design of excavation shoring system and dewatering system to meet performance requirements specified.
- (e) Piling installation methods must consider the impact of installation on the Aqueduct and adjacent structures. Damage caused directly by shoring activities, or indirectly by vibration or other installation forces shall be rectified at the Contractors expense. The Contractor shall closely monitor shoring installation, and report any suspected movement or damage immediately to the Contract Administrator. As a minimum, the following requirements shall apply:
 - (i) For soldier pile installations, the piles shall be pre-bored.
 - (ii) For sheet piling installations, piling shall be installed by low energy vibratory hammers.
- (f) If sheet piling is used, design section properties of steel-sheet piling based on complete slippage at interlocks.

- (g) Design splices in walers and bracing in accordance with requirements of CAN/CSA-S16.1-M.

E12.5 Submittals

- E12.5.1 The Contractor shall submit shop drawings detailing the excavation shoring systems in accordance with CW 1110, prior to the pre-construction meeting. Shop drawings shall be stamped by a competent Professional Engineer registered in the Province of Manitoba, experienced in the design of excavation shoring systems.
- E12.5.2 Submit shop drawings of Excavation Shoring Systems and Internal Bracing and Shoring for record purposes. Excavation Shoring Systems and Internal Bracing and Shoring drawings will not be reviewed for structural adequacy. Full responsibility for the design, installation, and maintenance of Excavation Shoring Systems rests with the Contractor.

E12.6 Construction Methods

- E12.6.1 Construction Methods for Excavation Shoring System shall be in accordance with Specification CW 2030-R4, "Excavation and Backfill" Section 9.
- E12.6.2 Removal of Excavation Shoring Systems
 - (a) The Contract Administrator may direct the Contractor to leave the Excavation Shoring System in place. If so directed, the Contractor will be compensated for the actual substantiated value of the materials directed to be ordered left in place.
 - (b) If the Contract Administrator requests the Excavation Shoring System to be left in place, the inside, and if necessary the outside, of the Excavation Shoring System shall be backfilled with compacted material as specified and the top of the Excavation Shoring System cut 0.5 m below the specified finished surface. All grading work over the left-in-place shoring work is to be completed as specified and as if the Excavation Shoring System had not been left in place.

E12.7 Method of Measurement and Basis of Payment

- E12.7.1 Method of Measurement
 - (a) Notwithstanding Clause 12 of Specification CW 2030-R4, the Excavation Shoring Systems will not be measured for payment. It will be considered incidental Drainage Siphon and Aqueduct Repairs.

E13. CAST-IN-PLACE CONCRETE

E13.1 Description

- E13.1.1 This Specification shall cover the installation of reinforcing steel and construction of cast-in-place concrete elements for the drainage siphon repairs. It shall amend and supplement CW 2160-R4

E13.2 Materials

- E13.2.1 Aggregates
 - (a) Aggregates shall be free from alkali expansivity or other deleterious reactivity with Portland Cement, when used in concrete mixes, and in a potentially wet environment.
 - (b) Aggregates shall be normal density and conform to CSA A23.1-M00, Section 5, Aggregates. The grading for fine aggregates shall conform to requirements of Table 1 of CSA A23.1-94, and the grading of the coarse aggregates shall conform to the requirements of Table 2 of CSA A23.1-M00, Group I, nominal aggregate size of 20 millimetres.

E13.2.2 Reinforcing Steel

- (a) Further to Clause 5.4.6 of Specification CW 2160-R4, all reinforcing steel shall conform to CAN/CSA-G30.18-M92, Billet-Steel Bars for Concrete Reinforcement, Grade 400W, deformed bars.
 - (i) Reinforcing steel shall be shipped in bundles with identifying tags or marks and shall be stored above ground on platforms, skids, or racks adequately protected from prolonged exposure to weather.
- (b) Reinforcing Chairs, Bolsters, Bar Supports, and Spacers
 - (i) Reinforcing chairs, bolsters, bar supports, and spacers shall be adequate for accurate placing of reinforcing steel and supporting construction loads. Precast concrete, plastic or steel units shall be used.

E13.2.3 Formwork

- (a) Lumber for formwork and falsework: Grade-marked sawn lumber graded in accordance with National Lumber Grades Authority (NLGA)
- (b) Plywood for formwork: CSA A23.1; high density overlay (plastic overlay) grade plywood.

E13.2.4 Asphalt Impregnated Fibre Board

- (a) Asphalt impregnated fibre board shall conform to ASTM D1751-83 (Reapproved 1991), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types), 20 millimetres thick, Sternboard by Sternson Ltd., or Sealtight Fibre Expansion Joint Filler Product No. 3250-121 by W.R. Meadows of Canada Ltd., or approved equal in accordance with B6.

E13.2.5 Rigid Insulation

- (a) Rigid insulation shall be high density extruded polystyrene insulation CAN/CGSB-S1.20-M87 (Type 4), minimum 40 psi compressive strength, Styrofoam HI40 by Dow Chemicals or approved equal in accordance with B6.

E13.3 Design Requirements

E13.3.1 Cast-in-place Concrete Mix Design

- (a) Cast-in-place concrete shall be in accordance with Specification CW 2160-R4, "Concrete To Be Used in Underground Works", Table A., of these Specifications, except where noted, revised, or supplemented in this Specification.
- (b) Proportioning of the Portland Cement, water, aggregates, accelerating admixture, superplasticizing admixture, and air-entraining admixture, shall be as required to produce concrete material meeting the following requirements
 - (i) 28-day compressive strength shall be 30 MPa, minimum.
 - (ii) Water-cementing materials ratio shall be 0.40, maximum.
 - (iii) Air content shall be 5-8% at the time of discharge from the mixer.
 - (iv) Slump, before the addition of the superplasticizing admixture, shall be 60±20 millimetres at the time of discharge from the mixer.
 - (v) Slump, when superplasticizing admixture is added, for high-slump non-flowing and flowing concrete shall be 150±40 and 190±40 millimetres, respectively, at the time of discharge from the mixer and prior to placement.
 - (vi) Air-entraining admixture shall be used and shall be added to the concrete material at the time of batching in accordance with the manufacturer's printed instructions.

- (vii) Superplasticizing admixture may be used, and shall be added to the concrete material at the time of batching in accordance with the manufacturer's printed instructions.
- (viii) Type 50 cement.

E13.4 Submittals

E13.4.1 Cast-in-place Concrete Mix Design

- (a) The Contractor shall submit the mix design, stating the constituent materials and mix proportions that will be used to the Contract Administrator prior to the pre-construction meeting for review and acceptance.

E13.4.2 Reinforcing Steel

- (a) The Contractor shall submit reinforcing steel shop-drawings.

E13.5 Construction Methods

E13.5.1 Forming

- (a) The formwork shall conform to the geometry detailed on the Drawings. The forms shall be equipped with a sufficient number and appropriately located entry ports to permit proper inspection, placement, and consolidation of the concrete.

E13.5.2 Securing and Support of Reinforcing Steel

- (a) Reinforcing steel shall be secured so that no displacement occurs prior to or during the concrete placement.

E13.5.3 Stripping Forms

- (a) Further to the requirements of Clause 9.4 of CW 2160-R4, the conventional forms shall not be stripped prior to 16 hours after the concrete has been placed.
- (b) All surface defects, including but not limited to honeycombed concrete, bug holes, fins, offsets, and other protrusions shall be corrected by the Contractor at no cost to the City.

E13.5.4 Curing

- (a) During the first 16 hours after opening the wall forms, the concrete shall be cured by wet curing methods using trickling hose placed along the top of the formwork. Following the removal of the formwork, curing compound shall be applied to the exposed concrete surface at the coverage recommended by the manufacturer.

E13.5.5 Placing and Consolidating Concrete

- (a) Further to the requirements of Clauses 9.5 and 9.6 of CW 2160-R4, the concrete shall be placed and thoroughly consolidated by the use of vibrators in such a manner as to obtain a dense concrete material meeting the design requirements detailed herein above.
- (b) All concrete to be placed in the dry.
- (c) All concrete to be placed in accordance with requirements detailed in CSA 23.1.
- (d) Do not provide horizontal construction joints in walls unless approved by the Contract Administrator.

E13.5.6 Construction Joints

- (a) Prior to placement of abutting concrete, clean contact surface:
 - (i) Remove laitance and spillage from reinforcing steel and dowels.

- (ii) Remove surface to a minimum of 6 millimetres amplitude by high-pressure water blasting and/or hand tools.

E13.5.7 Cold and Adverse Weather Requirements

- (a) Further to the requirements of CSA A23.1-00, Clause 21.2.3 - Cold-Weather Protection, the Contractor shall provide adequate protection of the concrete materials and finished concrete repairs from inclement weather, rain, snow, wind, and similar adverse conditions.
- (b) Whenever ambient air temperature is, or is anticipated to be, 5 degrees Celsius or lower, the Contractor shall provide temperature controlled enclosures prior to, during, and after the concrete placement. Substrate concrete and reinforcing steel shall be maintained at a temperature above 10 degrees Celsius (10° C) minimum prior to placing concrete commencing immediately following excavation. Finished concrete repairs shall be maintained at a temperature of at least 10 degrees Celsius (10°C) until backfilling commences, or for a minimum of three (3) days.
- (c) The substrate concrete and cast-in-place concrete material shall be protected from the adverse effects of space heated enclosures, including local overheating and combustion products. Combustion heaters shall be located to the outside of the Aqueduct.
- (d) The mix water, aggregates and cement material, shall be heated as necessary when the ambient air temperature is, or is anticipated to be, 5 degrees Celsius or lower at any time during the 24 hours following the application of the concrete. Mix water and concrete material shall be maintained at a temperature between 10 degrees Celsius and 65 degrees Celsius, and free from frozen material.

E13.6 Quality Control

(a) Materials

(i) General

The visual appearance, compressive strength, density, and other characteristics of the concrete material shall be verified by cylinders, or core samples from the placed concrete material, as detailed herein below.

(ii) Cylinders

Further to the requirements of Clause 10.2 of CW 2160-R4, compressive strength tests shall be carried out on standard-cured test cylinders by the Testing Laboratory designated by the Contract Administrator.

(iii) Field-Cured Cylinders for Early Compressive Strength Tests

Early compressive strengths for the concrete material shall be determined by a set of three (3) field cured cylinders cast and tested by the Testing Laboratory designated by the Contract Administrator using methods in accordance with CSA A23.2-94, Methods of Test for Concrete.

(iv) Air Content and Slump

The air content and slump of the concrete will be verified by the Testing Laboratory designated by the Contract Administrator using methods in accordance with CSA A23.2-94, Methods of Test for Concrete.

E13.7 Method of Measurement and Basis of Payment

- E13.7.1 Cast-in-place concrete work will not be measured. It is to be included in the price for Siphon Repairs.

E14. PATCHING AND CRACK REPAIR

E14.1 Description

E14.1.1 This Specification shall cover the Work of removing, preparing, and patching areas of defective concrete and cracks on the interior surfaces of the existing box culverts.

E14.1.2 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 of all Work as hereinafter specified.

E14.2 Materials

E14.2.1 General

- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.
- (b) Materials required to contain a spill in accordance with manufacturers printed instructions and Material Safety Data Sheet (MSDS) shall be kept near the immediate repair work area inside the Aqueduct at all times.

E14.2.2 Delivery, Storage, and Handling of Materials

- (a) All material shall be delivered to the Work site, stored, and handled in a careful and workmanlike manner in accordance with manufacturers' printed instructions and recommendations.
- (b) Store materials in a manner which will prevent deterioration and contamination. Deteriorated or contaminated materials shall be removed from site.

E14.2.3 Testing

- (a) There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.
- (b) Any materials which, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations shall be replaced by the Contractor at their own expense.

E14.2.4 Patching Repair Material

- (a) Patching repair material shall be polymer modified mortar based SikaTop 122 Plus or SikaTop 123 Plus by Sika Canada Inc., Emaco S88-CA by Master Builders Technologies division of Chemrex, or approved equal in accordance with B6.

E14.2.5 Epoxy Bonding Adhesive

- (a) Epoxy bonding adhesive shall be Sikadur 32, Hi Mod by Sika Canada Inc., SCB Concreative 1422 by Master Builders Technologies division of Chemrex, or approved equal in accordance with B6.

E14.2.6 Reinforcing Steel

- (a) Reinforcing steel shall be as detailed in E13 Cast-in-Place Concrete of these Specifications.

E14.2.7 Non-Shrink Grout

- (a) Non-shrink grout shall be cement based Grout 212 by Sika Canada Inc., or Special Grout 110 by Five Star Products Inc., or approved equal in accordance with B6.

E14.2.8 Polyurethane Grout

(a) Acid Flushing Solution

- (i) Acid flushing solution shall be pre-mixed solution of food grade phosphoric acid meeting the requirements of ANSI/NSF 60, "Standard for Drinking Water Treatment and Chemicals -- Health Effects", diluted to a 5%±0.5% solution, by volume, with potable water prior to delivery to site. Diluting concentrated (>5%) phosphoric acid solution on site is prohibited.

(b) Polyurethane Injection Resin

- (i) Polyurethane injection resin shall be single-component Diphenylmethane Diisocyanate (MDI) based, water-activated, hydrophobic type Specton Flex F1000 Polyurethane Resin and Accelerator by Specton Construction Chemicals Ltd., Spetec LF/PUR F1000 Flexible Resin and Accelerator by Tecinvest NV, Belgium, or Hydro Active Flex LV and Hydro Active Flex Cat by DeNeef Construction Chemicals (U.S.) Inc., or approved equal in accordance with B6, meeting the requirements of ANSI/NSF 61, "Standard for Drinking Water System Components -- Health Effects" Surface Seal.

(c) Surface Seal

- (i) Surface seal material shall be polymer modified mortar SikaTop 122 PLUS or SikaTop 123 PLUS by Sika Canada Inc., epoxy based Sikadur 31 Hi-Mod Gel or Sikadur Injection Gel by Sika Canada Inc., cementitious based Thoro Waterplug by Harris Specialty Chemicals Canada Inc., or approved equal in accordance with B6, meeting the requirements of ANSI/NSF 61, "Standard for Drinking Water System Components -- Health Effects".

(d) Injection Packers and Ports

- (i) Injection packers and ports shall be as recommended by the manufacturer of the polyurethane injection resin. Injection packers and ports shall be supplied with a removable zerk coupling, or other one-way ball or check valve.

(e) Injection Pump Cleaner

- (i) Injection pump cleaner shall be as recommended by the manufacturer of the polyurethane injection resin. Injection pump cleaner shall not contain acetone, toluene, MEK, or other flammable petroleum solvents.

E14.3 Submittals

E14.3.1 Product Literature

- (a) The Contractor shall submit product literature consisting of general product brochure, technical data sheet(s), Material Safety Data Sheet(s), mixing instructions, and installation instructions for the patching repair material to the Contract Administrator prior to the pre-construction meeting.

E14.4 Equipment

E14.4.1 General

- (a) All equipment, tools, and facilities used shall be suitable for the Work and shall be kept in good working order.
- (b) Mechanical chipping hammers shall be limited to maximum lightweight (15-pound) hammers.

E14.4.2 Polyurethane Injection Equipment

- (a) Polyurethane injection resin shall be installed using a positive displacement type pump. The polyurethane injection equipment shall be equipped with pail heater(s) suitable for plastic pails capable of maintaining the polyurethane resin and accelerator

mixture between 10° and 70° Celsius. A thermometer shall be provided with each pump for monitoring the temperature of the polyurethane resin. All polyurethane injection equipment inside the Aqueduct shall be removed from the Aqueduct at the end of the work inside the Aqueduct.

E14.5 Construction Methods

E14.5.1 Concrete Patching

- (a) Provide suitable protective clothing, and gloves for persons working with restoration materials.
- (b) During installation and curing of restoration materials, if the ambient temperature is expected to go below the manufacturer's recommended minimum temperature provide enclosures and heat as required.
- (c) Use restoration materials in accordance with manufacturer's printed instructions, and as specified.
- (d) Continuously check materials and applications for correct use.
- (e) Identify and delineate areas of defective concrete, including but not limited to honeycombed, spalled, and delaminated concrete, by sounding techniques for review by the Contract Administrator. The Contract Administrator shall designate the limits of the defective concrete to be repaired.
- (f) Remove delaminated, loose, and spalled concrete using lightweight mechanical chipping hammers or other suitable means to sound concrete. Protect reinforcing bars during removal.
- (g) Cut into sound concrete 50 to 100 mm beyond the areas of delaminated, loose, and spalled concrete, and remove concrete to a depth of 19 mm minimum. Prevent feathering of the patches by providing vertically saw-cut edges.
- (h) Cut and remove concrete a minimum of 25 mm behind exposed reinforcing bars.
- (i) Thoroughly clean all surfaces previously chipped of any loose concrete and/or laitance and prepare surface for patching in accordance with printed instructions from the manufacturer of the patching mortar. Use pressure washing to clean and prepare concrete surfaces. Do not damage the structures. Carry out cleaning in accordance with Steel Structures Painting Council, 1982 (SSPC)-SP 13.
- (j) Repair any damage caused by the cleaning.
- (k) Prime exposed reinforcing bars with epoxy bonding adhesive, in accordance with manufacturer's written instructions.
- (l) Provide supplementary reinforcing bars where required.
- (m) Apply patching material to concrete substrate in accordance with the manufacturer's printed instructions required.
- (n) The patch shall be finished to match the profile of the surrounding concrete.
- (o) Cure patches in accordance with manufacturer's printed instructions.

E14.5.2 Polyurethane Injection and Crack Repairs

- (a) General
 - (i) The Contractor shall locate, prepare, acid flush, test for watertightness, and inject with polyurethane injection resin and accelerator mixture non-watertight cracks and joints designated for repair in each Aqueduct segment located within the repair work area, unless noted otherwise.
 - (ii) The Contractor shall be advised that the width of the cracks may vary along the length and through the thickness of the concrete section.

- (iii) The Contractor shall carry out the injection work in a manner consistent with achieving the objective of a watertight repair.
 - (iv) Once the drill holes for watertightness testing and injection have been installed along cracks and joints, the interior surface of the roof slab, walls, and invert slab shall be kept clean and free of dirt and standing water until the injection work has been completed and acceptable quality control core drilled samples have been obtained.
 - (v) All excess unused polyurethane materials shall be removed from the work area.
- (b) Drilling Holes for Watertightness Testing and Injection
- (i) Drill holes shall be installed along cracks and joints designated for repair to test the watertightness of the cracks and joints as required to meet the performance requirements for injection where the cracks and joints are found to be non-watertight.
 - (ii) The requirements for installing drill holes for watertightness testing and injection provided below represent acceptable minimum standards of practice.
 - (iii) The drill holes for watertightness testing and injection shall be drilled at an angle between forty-five (45) degrees and thirty (30) degrees from perpendicular to the surface of the concrete and perpendicular to the alignment of the cracks or joints, as indicated on the Drawings.
 - (iv) The drill holes shall intersect the cracks at the midpoint of the concrete section, and intersect the joints at the midpoint between the waterstop and interior concrete surface of the Aqueduct, except as noted otherwise. In reinforced invert slabs the depth of the intersection of the drill holes and the crack shall be adjusted as required to meet the performance requirements.
 - (v) The drill holes shall be located on alternate sides of the crack or joint where possible, unless the orientation of the crack or joint is known or has been verified by non-destructive testing techniques or core drilling.
 - (vi) The spacing of the drill holes shall not exceed 300 millimetres, except as noted otherwise. The location and angle of the drill holes shall be adjusted to suit the orientation of the crack or joint and at locations where a crack intersects with the crack or joint.
 - (vii) Measures shall be taken to assist in locating the drill holes at the required distance from the crack or joint and at the required angle, such as using a template, during the Work especially at the commencement of drilling holes for watertightness testing and injection and at the beginning of each subsequent shift.
 - (viii) Measures shall be taken to prevent drilling the holes for watertightness testing and injection too shallow, too deep, and/or damaging the existing waterstop in the joints.
 - (ix) Dust and debris in the drill holes and on the interior surface of the arch and invert slab resulting from the drilling operation, shall be removed by flushing with water prior to installing the injection packers or ports.
 - (x) Install injection packers or ports in the drill holes in accordance with the manufacturer's printed instructions with the zerk coupling, or other one-way ball or check valve, to permit testing for watertightness and acid flushing of the cracks and joints.
- (c) Watertightness Testing and Acid Flushing of Cracks and Joints
- (i) Test the watertightness and flush the cracks and joints with the acid flushing solution at a pressure of 7 MPa (1000 psi), or the resin injection pressure, whichever is greater. The acid flushing solution shall be applied for a sufficient duration to test the watertightness of the cracks and joints. Where the cracks

- and joints are found to be non-watertight, the acid flushing solution shall be permitted to penetrate the full depth and length of the cracks or joints.
- (ii) Following the acid flushing, the cracks and joints shall be flushed with copious quantities of potable water at a pressure of 7 MPa (1000 psi), or the resin injection pressure, whichever is greater, until there is no more evidence of acid flushing solution visible in the flush water.
 - (iii) At locations where the cracks or joints are determined to be watertight, remove the injection packers or ports, and repair the drill holes with patching repair material.
 - (iv) Where the cracks or joints are determined to be non-watertight, carry out injection work to satisfy the performance requirements of the Specification.
 - (v) Drill holes located along cracks or joints that are found to be watertight shall be clearly identified by means of a chalk mark on the arch or invert slab alongside the drill hole.
 - (vi) The worker who is carrying out the acid flushing operations shall be clearly identified by wearing a reflective safety vest and signs indicating "Acid Flushing".
 - (vii) The portion of the work area where acid flushing is being carried out shall be clearly identified by signs and isolated by placing orange pylons, or other temporary barriers, and signs indicating "Acid Flushing" at either end of the siphon.
- (d) Application of Surface Seal along Cracks and Joints
- (i) Apply a surface seal along the length of the cracks and joints found to be non-watertight in order to contain the polyurethane injection resin and accelerator mixture during injection.
 - (ii) A smooth trowel or sponge float finish shall be provided on the surface seal to provide a uniform surface free of projections. At locations where the required finish is not provided, re-finish by grinding or other suitable means.
 - (iii) Cure the surface seal in accordance with manufacturer's printed instructions.
- (e) Polyurethane Injection Resin and Accelerator Mixture
- (i) Add accelerator to the polyurethane injection resin at the required dosage to produce a cured polyurethane material meeting the performance requirements, and mix thoroughly in accordance with the manufacturer's printed instructions until a homogeneous mixture is obtained.
 - (ii) Heat the polyurethane injection resin and accelerator materials prior to and during the mixing and injection to a temperature between 30° and 55° Celsius. Injection shall not take place when the polyurethane injection resin and accelerator mixture is less than 30° Celsius or more than 55° Celsius.
- (f) Injection of Cracks and Joints
- (i) Inject the polyurethane injection resin and accelerator mixture with water, or in a neat form into cracks and joints in a sequential manner, and re-inject as required, to meet the performance requirements.
 - (ii) The procedure suggested below for injection of invert cracks has been found to be effective in meeting the performance requirements during previous repairs, as it permits excess water, dirt, and other residue present in the crack to be vented out through adjacent injection packers or ports. Prior to commencing the injection work along an invert crack, remove the zerk couplings from the injection packers or ports except for the two packers located where the injection work will commence. Commence injection work in the first two packers. Once clean polyurethane resin is vented from the third injection packer, cease injection at the first packer, and install the zerk coupling and commence

injection at the third packer. Repeat the process for the fourth and subsequent packers until the full length of the invert crack has been injected.

- (g) Repair of Isolated Locations of Infiltration
 - (i) Drill holes for injection, acid flush, apply surface seal, and carry out injection work as detailed herein above.
 - (ii) At locations where the infiltration is significant, apply cementitious based surface seal in accordance with manufacturer's printed instructions to minimize the infiltration prior to commencing the injection work.
 - (iii) Carry out multiple injections as required to meet the performance requirement.
- (h) Removal of Packers and Ports and Patching
 - (i) Following the completion of the injection work, the Contractor shall remove the remaining injection packers and ports, and patch the remaining holes with the patching repair material.

E14.6 Quality Control

E14.6.1 Testing of Repaired Cracks

- (a) Test grouted cracks in the existing lower box by coring a minimum of 3 (three) 75 millimetres in diameter cores to a depth of 80% of existing wall/slab thickness. Cores will be visually inspected for a depth of penetration. In order to pass the test, observed depth of penetration must exceed 90% of length of cored sample.
- (b) Patch core holes by completely filling with non-shrink grout.

E14.6.2 Corrective Action

- (a) The Contractor shall at their own expense, correct such Work or replace such materials found to be defective under this Specification and carry out additional quality control testing.

E14.7 Method of Measurement and Basis of Payment

E14.7.1 The Crack Repairs will be measured on a length basis. The amount to be measured shall be the total number of lineal metres of crack repaired or tested only, for the items of Work listed below, carried out in accordance with the requirements of this Specification.

- (a) Polyurethane Injection of Cracks and Joints
- (b) Watertight Testing Only of Cracks and Joints

E14.7.2 The Concrete Patching Repairs will be measured on a volume basis. The volume measured will be the total number of litres of repair material applied to the repair, carried out in accordance with the requirements of this Specification. No measurement will be made for waste material, materials mixed in excess of required volume, or materials placed outside the limits set out by the Contract Administrator.

E15. SUPPLY AND INSTALLATION OF PRECAST CONCRETE CULVERT AND APPURTENANCES

E15.1 Description

E15.1.1 This Specification covers the design and installation of the precast concrete elements to reconstruct the drainage siphons. It shall amend and supplement Specification CW 2130-R5. 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 of all Work as hereinafter specified.

E15.2 Materials

E15.2.1 Precast Concrete Pipe Culvert

- (a) Precast concrete pipe sections shall conform to ASTM C76-95, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, Class III (minimum). Pipe to be designed to the following criteria:
 - (i) Height of cover to assume maximum berm elevation
 - (ii) Design to assume trench width greater than transition width (positive projecting embankment)
 - (iii) HS 20 live loading condition
 - (iv) Non-cohesive Granular backfill, 2160 kilograms per cubic metre density.
 - (v) ASCE Standard Installation Direct Design (SIDD) Type 3 Bedding
 - (vi) Approximate pipe lengths are as shown on the following table. Final pipe lengths shall be determined after determination of existing box culvert inverts.
- (b) The precast pipe sections shall be constructed using Type 50 Portland Cement.

E15.2.2 Precast Concrete Bends, Fittings and Specials

- (a) Precast Transition Sections, Bends and Flared End Sections
 - (i) Transition bend sections and bends as noted on the following table have been precast and are available for pick-up at the City of Winnipeg Dawson Road Yard. Precast flared end sections are also constructed and available for pickup. The Contractor shall contact the Contract Administrator to arrange for pickup a minimum of 24 hours prior to pickup. The Contractor shall be responsible for loading and off-loading of the precast units and transportation to the jobsite.

Site	Size	Proposed Inlet/Outlet Invert	Existing Box Culvert Invert	Transition Section L.L.	Upper Bend L.L.	Req'd Pipe L (Approx)
Site 1	N -1350 mm	283.75	281.50	0.88	0.77	2.84
(Mile 50.31)	S -1350 mm	283.75	281.50	0.96	0.47	3.06
Site 2	N -1350 mm	287.15	284.80	0.96	0.67	3.06
(Mile 53.75)	S -1350 mm	287.15	284.80	0.92	0.70	3.07
Site 3	N – 1200 mm	288.60	286.07	1.23	0.90	2.93
(Mile 55.23)	S - 1200 mm	288.60	286.07	0.86	0.88	3.32

Notes:

L.L = Slope Lay Length as measured along pipe invert
 Existing Inverts to be confirmed prior to pipe fabrication
 Lay Length based on 30 degree pipe slope

- (b) Steel Pipe Restraint Straps
 - (i) Steel for pipe straps shall be Can/CSA G40.21, Grade 38W. Pipe straps shall be galvanized in accordance with Can/CSA-G164.

- (ii) Anchors for pipe straps shall be stainless steel through bolts, AISI Type 316. The anchor rod assemblies shall be electrically isolated from the pipe restraints using non-metallic washers and inserts.

E15.2.3 Pipe Joints

- (a) Pipe gaskets for new pipe joints shall be standard rubber gaskets conforming to ASTM C443M.
- (b) Polyurethane activated gasket shall be used for sealing connection of new precast elements to existing box culvert. Gasket material shall be oil free oakum, or open cell foam backer rod of sufficient section to fill joint. Polyurethane shall be a hydrophilic resin, Hydro Active SealFoam by De Neef Construction Chemicals, ST-520 by Strata Tech, Inc., or approved equal in accordance with B6.
- (c) Gun grade waterstop shall be hydrophilic caulking, Sikaswell S by Sika Construction Products, Swellseal Gun grade by De Neef Construction Chemicals, Leakmaster by Multiurethanes, or approved equal in accordance with B6.

E15.2.4 Pipe foundation, Bedding and Initial Backfill

- (a) Pipe bedding and initial backfill shall be free draining crushed rock material, maximum particle size 20 millimetres, containing less than 5 percent material passing the 80 micron sieve, compacted to 90 % SPMDD.

E15.3 Shop Drawings

- E15.3.1 The Contractor shall submit shop drawings of the precast pipe sections, showing design criteria, overall geometry of the installation, and laying lengths. The Shop Drawing submission shall be prepared and submitted in accordance with CW 1100.

E15.4 Construction Methods

E15.4.1 Installation of Precast Concrete Sections

- (a) Expose existing box culverts and verify existing inverts
- (b) Excavate and demolish existing structure. Provide full depth saw cut in the existing box culvert, square in the horizontal and vertical planes to the existing structure. Prepare pipe foundation, compacted to 95 % Standard Proctor Maximum Dry Density (SPMDD).
- (c) Install transition section, butted up to existing box culvert. Connect transition section to existing box culvert by means of cast-in-place collar of prefabricated bell section. Collar shall be constructed to allow for longitudinal and rotational movement, as to not transmit excessive stress to the existing structure.
- (d) Install remaining elements to the line and grades shown on the drawings. Adjustments in pipe joints of up to one degree will be permitted in order to adjust for pipe grade and alignment, up to a maximum joint opening of 25 millimetres.
- (e) Strap all pipe joints at the horizontal mid point of the pipe or as detailed on the drawings.
- (f) Place and compact initial and final backfill.

E15.5 Method of Measurement and Basis of Payment

- E15.5.1 Precast Concrete Culvert and Appurtenances will not be measured. It is to be included in the price for Siphon Repairs.

E16. METAL FABRICATIONS

E16.1 Description

E16.1.1 This specification covers the supply, fabrication and installation of metal fabrications..

E16.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tool supplies, support, and all things necessary for and incidental to the satisfactory performance of all Work as hereinafter specified

E16.2 Materials

E16.2.1 Grating

(a) Grating shall be fabricated from steel shapes conforming to CAN/CSA G40.21-M, Grade 300W.

E16.2.2 Hot-Dip Galvanizing

(a) Where indicated on drawings, steel shapes shall be hot-dip galvanized steel conforming to CSA G164M.

E16.2.3 Primer for Repairing Damaged Galvanized Surfaces

(a) Zinc-rich primer: CGSB 1-GP-181M, Sealtight Galvafruid Zinc-Rich Coating by W.R. Meadows Ltd.

E16.2.4 Adhesive Anchors

(a) Adhesive anchors shall be HVA Adhesive Anchor System consisting of all-threaded HAS stainless steel anchor rods with HVU adhesive capsules by Hilti Inc. or approved equal in accordance with B6.

E16.3 Submittals

E16.3.1 Welding

(a) Submit welding certificate in accordance with CSA W47.1.

E16.3.2 Steel Gratings

(a) The Contractor shall submit shop drawings for each size and type of steel gratings. Submission shall include fabrication and installation details. The Contractor shall confirm the dimensions of all inlet/ outlet components prior to preparation of the drawings. These dimensions are to be included on the shop drawing submission

E16.4 Construction Methods

E16.4.1 Steel Grating

(a) Hot-Dip Galvanizing

(i) Hot-dip galvanize items after fabrication.

(ii) Clean surfaces to be galvanized of slag and impurities immediately before being galvanized.

(iii) Where specified or detailed, galvanize plates and other structural shapes in accordance with CSA G164M. Where fabrications are too large to be hot-dipped, employ zinc metallizing.

(b) Repair of Damaged Galvanized Surfaces

(i) Repair hot-dip galvanized coatings damaged by welding, cutting, rough handling during shipping or erection or otherwise, in accordance with ASTM

A780 using organic zinc-rich primer. Dry film thickness on repairs to exceed original coating thickness by 25%.

E16.5 Method of Measurement and Basis of Payment

E16.5.1 Method of Measurement

(a) **Safety Grating**

- (i) Safety Grating will be measured on a unit basis. The total units measured will be the number of safety gratings, manufactured and installed in accordance with the Specifications.

E16.5.2 Basis of Payment

- (a) Safety Grating will be paid at the Contract Unit Price for Safety Grating, measured as specified herein, and shall be compensation in full for fabrication and installation of the grating.

E17. RIPRAP

E17.1 Description

E17.1.1 This Specification shall amend and supplement Standard Specification CW 3615-R2.

E17.2 Materials

E17.2.1 Testing and Approval

- (a) 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. A representative sample of the riprap shall be submitted to the Contract Administrator a minimum of three (3) weeks prior to placement. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.

E17.2.2 Quarried Rip Rap

- (a) The type of granular material to be used for quarried riprap may consist of non-igneous (i.e. dolomitic limestone) or igneous (i.e. granite rock), providing the gradation, physical properties specified below are met. Quarried riprap shall consist of hard, dense and durable rock fragments, free of cracks, seams and other defects that would tend to increase their susceptibility to destruction by water and frost.

Physical properties shall meet or exceed the following:

PROPERTY	TEST METHOD	VALUE
Maximum Aggregate Size		450 millimetres
Minimum Bulk Specific Gravity	ASTM C127	2.6
Maximum Los Angeles Abrasion Loss	ASTM C131 - A Grading	30 percent
Maximum Soundness Loss	ASTM C88	13 percent

E17.2.3 Gradation

- (a) Rip rap, quarried or fieldstone, shall conform to the following gradation:

Equivalent Stone Diameter		Gradation Limits Percent Passing by Weight
Metric Sieve (mm)	U.S. Standard	
450	18 inch	100
300	12 inch	50
100	4 inch	0-5

E17.2.4 Salvaged Riprap

- (a) Existing riprap salvaged from excavation operations, and demolished concrete may be incorporated into the riprap, providing it meets the requirements outlined above.

E17.2.5 Geotextile

- (a) Geotextile shall be a non-woven geotextile fabric meeting specification CW 3120.

E17.3 Construction Methods

E17.3.1 Geotextile

- (a) Geotextile shall be placed under all riprap, on a smooth graded surface. The geotextile shall be placed in such a manner that it will not excessively stretch or tear upon placement of the overlying materials. Care shall be taken to ensure that the geotextile is in intimate contact with the subgrade and that there are no void spaces between the subgrade and the geotextile.
- (b) Joints in the geotextile shall be minimized. Geotextile sheets shall be joined by overlapping a minimum of 1000mm. Overlaps shall be constructed with the upstream sheet placed over the downstream sheet or the upslope sheet placed over the downslope sheet. All overlaps shall be pinned on 1000mm centres to hold the overlap in place during stone placement. Pins shall be 5mm diameter, 450mm long steel pins pointed at one end and fitted with a 38mm diameter washer at the other.

E17.3.2 Riprap

- (a) Installation of random riprap shall be as per Clause 9.2 of CW 3615-R2.
- (b) Riprap shall not be dropped onto the geotextile from a height greater than 300mm. Any geotextile damaged during placement of the riprap shall be replaced as directed by the Contract Administrator at the Contractors expense.

E17.3.3 Miscellaneous Riprap

- (a) Miscellaneous riprap, including excavation and geotextile, shall be placed at locations directed by the Contract Administrator to supplement and repair existing riprap areas, or to extend riprap areas indicated on the Drawings. Riprap and geotextile to be installed in accordance with this Specification.

E17.4 Method of Measurement

E17.4.1 Random riprap as indicated on the Drawings will not be measured for payment. It is to be included in the price for Drainage Siphon Repairs.

E17.4.2 Miscellaneous riprap shall be measured on a volume basis. The volume measured shall be the number of cubic metres of riprap placed, in accordance with this Specification, including excavation and geotextile.

E17.5 Basis of Payment

E17.5.1 Miscellaneous riprap will be paid for at the Contract Unit Price for "Miscellaneous Riprap" measured as specified herein, 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.

E18. DRAINAGE DITCH RESTORATION

E18.1 Description

E18.1.1 This Specification shall amend and supplement CW 3170-R3 and CW 3615-R2 and covers all aspects of the restoration of drainage ditches adjacent to the Aqueduct.

E18.2 Construction Methods

E18.2.1 Crossings and Diversions

(a) The Contractor shall be responsible for all necessary temporary ditch crossings, cofferdams, channels, diversions, and all necessary dewatering operations which might be required to complete the Work under this Specification. All such Works shall be considered incidental to "Drainage Ditch Restoration".

E18.2.2 Ditch Restoration

(a) The Contractor shall excavate the ditches to the lines and grades shown on the Drawings and/or as directed by the Contract Administrator.

E18.2.3 Disposal of Material

(a) All excavated material shall be disposed of on site by side casting and levelling to the satisfaction of the Contract Administrator. The material shall not be placed in any adjacent watercourses or ditches. All on site disposal shall be within the Aqueduct right-of-way. Disposed material shall be placed in such a manner as not to impede surface drainage.

E18.2.4 Protection of Survey Monuments

(a) The Contractor is advised that there are several high precision survey monuments, within the work areas, located along the GWWD Railway. In general, these monuments are located 4 metres north or south of the GWWD railway centerline, as shown on the Drawings. The Contractor shall familiarize himself with the location of these monuments and clearly mark them. No fill or excavation shall take place within 3 metres of these monuments. Any damage to, removal or movement of these monuments shall be rectified at the Contractors expense, including survey costs to re-establish monuments.

E18.3 Method of Measurement

E18.3.1 Ditch Restoration

- (a) Ditch excavation and cleaning as indicated on the site drawings shall not be measured. It is to be included in the lump sum price per site for Drainage Siphon Repairs.
- (b) Ditch cleaning outside the limits shown on the drawings will be measured on a unit basis. The units measured will be the total number of lineal metres of ditch cleaning and excavation, as determined by measurements made by the Contract Administrator, successfully completed in accordance to the Specifications.

E18.4 Basis of Payment

E18.4.1 Ditch Excavation and Cleaning

(a) Ditch excavation and cleaning, outside the limits shown on the drawings, will be paid for at the contract unit price per lineal metre, for "Ditch Excavation and Cleaning", measured as specified herein, 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.

E19. FINAL GRADING AND SEEDING

E19.1 Description

E19.1.1 This Specification shall amend and supplement Standard Specification CW 3520-R3, Seeding and shall cover the supply and installation of grass seeds and cover crop.

E19.2 Materials

E19.2.1 Cover Crop

- (a) If seeded in the spring, seed oats (#1 grade) shall be used as a cover crop for the grass seed. If seeded in the fall, fall rye (#1 grade) shall be used.
- (b) Application rate shall be 56kg per hectare.

E19.2.2 Low Maintenance Grass Seed

- (a) Where noted a low maintenance grass seed mixture shall be used. The seed mixture shall consist of:

- 30% Kentucky Bluegrass
- 26% Creeping Red Fescue
- 13% Beaumont Meadow Fescue
- 9% Perennial Ryegrass
- 9% Alsike Clover
- 4% Leo Birdsfoot Trefoil
- 9% White Dutch Clover

- (b) The trefoil and clover seed are to be inoculated with their required rhizobium. All seed are to be certified Canada No. 1 having minimum purity of 97 percent.
- (c) Application rate shall be 115 kg per hectare.

E19.2.3 Quality Control

- (a) The Contractor shall provide a sample of the grass seed mixtures and the sealing tags from the seed bags to the Contract Administrator. The Contract Administrator reserves the right to obtain an analysis of the grass seed mixtures.

E19.2.4 Fertilizer

- (a) 11-52-0 granular fertilizer or equivalent granular or liquid fertilizer.
- (b) Application rate shall be 90 kg per hectare.

E19.3 Construction Methods

E19.3.1 Final Grading

- (a) Final grading shall include grading of all berm and ditch areas to be seeded. The grading shall be completed immediately prior to seeding, to provide a uniform finish surface, free of ruts, erosion channels and excessive undulations. Final grading includes general levelling and filling of variations in grade of up to +/- 100mm. If seeding is not anticipated to be completed until the spring of 2001, the contractor may delay this operation until that time. Notwithstanding a delay in final grading, the ditches and berm shall be left in a neat, trimmed and usable condition upon completion of excavation operations. If the contractor chooses to complete the final grading prior to seeding, he assumes the responsibility for regrading of eroded or otherwise unacceptable areas prior to seeding at a later date.

E19.3.2 Areas to be Seeded

- (a) All areas within the Aqueduct right-of-way, as detailed on the drawings, and all areas disturbed during construction works, including access roads and office compound and storage areas, shall be restored with low maintenance grass seed.

E19.3.3 Seeding

- (a) The subgrade shall be prepared as specified under Final Grading. The subgrade shall be harrowed twice to prepare the seed bed. The Contractor shall then seed the grass seed mixture and cover crop if required and apply the fertilizer as specified. Seeding shall be completed using a billion seeder parallel to the top of the embankments. The Contractor shall then harrow the seeded areas after the fertilizer application.
- (b) The harrowing operation on the Aqueduct berm shall be subject to the operational constraints listed under E10.

E19.4 Completion Acceptance

E19.4.1 Date of Acceptance for Completion

- (a) Areas seeded with grass/cover crop and low maintenance grass seed will be accepted by the Contract Administrator provided that:
 - (i) The certified seed sowed meets the requirements of this Specification and the Seed Mix Tables.
 - (ii) Areas are uniformly established; in a healthy vigorous condition; free of rutted, eroded, bare or dead spots, and have minimal weed growth.
 - (iii) Areas have been cut to a height of 75mm within 24 hours of the final inspection.
- (b) Areas seeded after September 15 will be accepted for Completion in the following spring, one month after the start of the growing season, provided all acceptance conditions are fulfilled.

E19.5 Method of Measurement and Basis of Payment

E19.5.1 Final Grading and Seeding

- (a) Final Grading and Seeding will not be measured. It is to be included in the price for E9 Drainage Siphon and Aqueduct Repairs.

E20. FENCING AND SIGNS

E20.1 Description

E20.1.1 This Specification shall amend and supplement Standard Specification CW3550.

E20.2 Materials

E20.2.1 Chain Link Fencing

- (a) As per CW3550-R1, complete with bottom rail.

E20.2.2 Sign Attaching Hardware

- (a) 9.52 mm x 51 mm Electro Galvanized bolts, c/w washers, nuts and sign post spacers, as supplied by Armtec, or approved equal in accordance with B6.

E20.2.3 Signs

- (a) Signs to be constructed from 2 millimetre thick type 5052-H38 aluminium sheeting. Reflectorized sheeting shall be ASTM D4956.90 Type III. Dimensions and wording as shown on the drawings.

E20.3 Construction Procedures

E20.3.1 Chain Link Fencing

- (a) As per CW3550 and shown on the drawings. Fencing shall be constructed complete with bottom rail.

E20.4 Method of Measurement

E20.4.1 Chain Link Fencing

- (a) Chain Link fencing will not be measured. It is to be included in the lump sum price for Drainage Siphon Repairs.

E20.4.2 Warning Signs

- (a) Warning Signs will not be measured. They are to be included in the lump sum price for Drainage Siphon Repairs.