

**PART E**  
**SPECIFICATIONS**

## PART E - SPECIFICATIONS

### GENERAL

#### E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

- E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.
- E1.1.1 *The City of Winnipeg Standard Construction Specifications* is available in Adobe Acrobat (.pdf) format on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division internet site at <http://www.winnipeg.ca/matmgt>.
- E1.1.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.
- E1.1.3 Further to GC:2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.2 The following Drawings are applicable to the work:

<u>Drawing No.</u>	<u>Drawing</u>
Drawing_00-R0	Cover Sheet
LD-3073-R0	Site Location Plans
LD-3074-R0	Raquette Street Outfall (AS-16.1)
LD-3075-R0	Dunkirk Drive Outfall (RR-31)
LD-3076-R0	Archibald St. Underpass Outfall (RR-68)
LD-3077-R0	Larchdale Crescent Outfall (RR-96)
LD-3078-R0	Valhalla Drive Outfall (RR-103) (Douglas Ave. Outfall)
LD-3079-R0	Valhalla Drive Outfall Riverbank Stability Improvements Plan & Section A
LD-3080-R0	Debris Grate Details
LD-3081-R0	Hand Rail & Silt Fence Details

#### E2. GEOTECHNICAL INFORMATION

- E2.1 Further to GC: 3.1, geotechnical information from the testholes located in the work area are included as Test Hole Logs. The full geotechnical report is available for viewing at the KGS Group office, 3<sup>rd</sup> Floor – 865 Waverley St., Winnipeg, Manitoba R3T 5P4 during normal business hours.

#### E3. REVIEW OF SHOP DRAWINGS AND MATERIALS

- E3.1 Shop Drawings

Further to CW 1110, the Contractor will be allowed one submission of Shop Drawings for review by the Contract Administrator and a second review for confirmation of revisions only. Subsequent reviews will be made at the Contractor's expense.

#### **E4. SITE DEVELOPMENT AND RESTORATION**

##### **E4.1 Description**

This Specification shall cover all aspects of the Site Development and restoration work, including equipment mobilization and demobilization, erection and maintenance and removal of safety fencing, sediment control works, snow clearing, general access development, access maintenance and removal, Contract Administrator's site trailer, and site restoration.

##### **E4.2 Materials**

###### **E4.2.1 Equipment**

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

##### **E4.3 Construction Methods**

###### **E4.3.1 Site and Construction Access**

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

The Contractor is responsible for obtaining all required permits and permissions that are necessary for site access, including a Waterways Construction Access Permit, if required by the Waterways Authority. All construction access ramps from the top bank area down to the edge of the river shall be constructed by excavating to the necessary ramp grade and disposing of the material off site. Under no circumstances will the excavated material or any additional materials be placed as fill in the ramp area. Detailed construction access ramp drawings are to be submitted to the Contract Administrator for approval a minimum seven (7) days prior to any construction activity on site.

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

###### **E4.3.2 Frozen Waterways Permit**

The Contractor is responsible for obtaining the required Frozen Waterways Permits. Contact the City of Winnipeg Harbour Partol at 986-8504.

###### **E4.3.3 Vegetation Removal**

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

#### E4.3.4 Snow and Ice Removal

Snow cover shall be cleared from the riverbank prior to placement of the rockfill riprap. The methodology to clear the snow shall be subject to the approval of the Contract Administrator. The Contractor will also be responsible for all snow clearing along site access points for equipment access.

Ice at the shoreline of the River shall be broken and cleared before the placement of riprap below ice level. Care shall be taken to ensure that the ice is removed, and does not become trapped below rockfill riprap placement, as identified in E6 Rockfill Riprap of this Specification.

#### E4.3.5 Safety Fence

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

#### E4.3.6 Environmental Regulations

- (a) The Contractor shall adhere to all relevant Federal and Provincial environmental regulations during the entire duration of the construction process.
- (b) The Contractor shall plan to work in accordance with the current environmental regulations of "Manitoba Stream Crossing Guidelines for Protection of Fish and Fish Habitat", Fisheries and Oceans, and Manitoba Natural Resources.
- (c) The Contractor will supply, in writing, prior to commencement of work on-site, a detailed plan for sediment control on this project.
- (d) The Contractor shall ensure that a sufficient supply of suitable spill kits are on site to cleanup minor spills, should they occur. The Contractor shall supply the name, address and phone number of a local supplier, where additional kits are available on short notice, on the Emergency Phone List specified in D12.

#### E4.3.7 General Site Cleanup

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

#### E4.3.8 Topsoil and Sod

A limited amount of topsoil and sod has been included in the Contract for the restoration above the outfall pipe(s). All other areas to be restored to existing condition or better using topsoil and sod in accordance with CW 3510-R7. No payment will be made for topsoil and sod outside of the limit for the pipe restoration as specified in E12.

#### E4.4 Method of Measurement and Payment

##### Site Development and Restoration

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

### E5. GEOTEXTILE

#### E5.1 Description

This Specification shall cover the supply and placement of the geotextile fabric to be used as a separator between the rockfill riprap and the surrounding native soil material.

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.

#### E5.2 Materials

##### E5.2.1 Handling and Storage of Materials

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

##### E5.2.2 Testing

There shall be no charge for any materials taken by the Contract Administrator for testing purposes.

##### E5.2.3 Geotextile

The geotextile material shall be a non-woven geotextile filter fabric at least 4.6 m in width. All physical property requirements are minimum average roll values and shall conform to:

- (a) Tensile Strength 890 N (ASTM D4632 Grab test or CSGB Standard 4-GP-2, Method 9.2);
- (b) Trapezoid Tear 360 N (ASTM D4533 or CSGB Standard 4-GP-2, Method 11.2);
- (c) Equivalent Opening Size 0.210 mm (ASTM D 4751);

Acceptable products shall be Amoco 4553, Armtec 250, or approved equal.

##### E5.2.4 Submittals

The Contractor shall submit all manufacturer recommendations for storage, handling, installation and splicing to the Contract Administrator.

##### E5.2.5 Equipment

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

### E5.3 Construction Methods

#### E5.3.1 General

All work related to the geotextile storage, handling, and installation shall comply with the procedures and recommendations of the manufacturers.

#### E5.3.2 Placing of Fabric

Prior to laying the fabric, the riverbank shall be cleared of snow and all deleterious materials (rocks, roots, branches, bricks, glass, etc.) down to the bare in-situ soil surface, and graded to provide a smooth uniform surface to prevent puncturing or tearing of the fabric.

The fabric shall be loosely laid in order to allow conformity to the riverbank surface. Folds and wrinkles in the fabric shall be avoided. Pins, nails or weights, as recommended by the manufacturer, shall be installed to hold the fabric in place. A minimum of 300 mm of rockfill riprap material shall be placed over the fabric prior to any equipment passage. The fabric shall be overlapped in a downstream direction (upstream panel overtop of downstream panel). All joints shall be overlapped a minimum of 600 mm. The overlap shall be pinned or secured.

Damaged geotextile shall be repaired immediately. All fill material shall be cleared a minimum of 1 m around the damaged area. The damaged area shall be covered with a geotextile patch extending 1 m beyond the perimeter of the damage. The fill material shall be replaced and compacted to the specific density.

#### E5.3.3 Inspection

Workmanship and materials used and placed under this Specification are subject to inspection and testing by the Contract Administrator, including all operation from the selection and separation of the materials, through to final acceptance of the specified work. The Contractor shall be responsible for the control of all operations incidental thereto, notwithstanding any inspection or approval that may have previously been given. The Contract Administrator reserves the right to reject any materials or works which are not in accordance with the requirements of this Specification. The Contract Administrator shall approve all materials at least five (5) days before any construction is undertaken.

#### E5.3.4 Access

The Contract Administrator shall be afforded full access for the inspection and control testing of materials at the site to determine whether the material is being selected and placed in accordance with this Specification.

### E5.4 Method of Measurement and Payment

#### E5.4.1 Geotextile

The supply and placement of the geotextile will be measured on an area basis. The area to be paid for shall be the total number of square meters of ground covered by the geotextile (i.e. Overlap, at all joints shall be considered a single layer), placed in accordance with this Specification, acceptable to the Contract Administrator, as computed from measurements made by the Contract Administrator.

Geotextile will be paid for at the Contract Unit Price for "Geotextile", measured as specified herein, which price shall be payment in full for performing all operations and providing all other items incidental to the work included in this Specification.

## **E6. ROCKFILL RIPRAP**

### **E6.1 Description**

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

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

### **E6.2 Materials**

#### **E6.2.1 Handling and Storage of Materials**

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

#### **E6.2.2 Testing and Approval**

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

#### **E6.2.3 Rockfill Riprap**

The rockfill material for use as riprap shall consist of a clean free draining material, free from organics, roots, silts, sand, clay, snow, ice or any other material that would detract from the strength and drainage characteristics of clean rockfill. The rockfill material shall meet the following requirements:

- (a) Maximum aggregate size of 450 millimetres;
- (b) Minimum bulk specific gravity of 2.6 (ASTM C127);
- (c) Maximum Los Angeles abrasion loss of 30% (ASTM C131);
- (d) Maximum soundness loss of 13% (ASTM C88);
- (e) Gradation requirements as measured in the smallest dimension:

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

The riprap shall be durable, comprised of limestone, granite or other quality dense crushed rock. Should the Contractor choose to use limestone, it shall be durable white crystalline limestone. Softer buff to yellow dolomite or dolostone will not be accepted. No rockfill will be permitted for use without providing the source and supplier.

Individual particles shall be shaped such that the longest dimension does not exceed two times the minimum dimension. Flat, platy, or elongated particle shapes shall not be acceptable. Rounded fieldstones will not be acceptable.

#### E6.2.4 Submittals

Rock samples shall be submitted for approval (min. 500kg) to the lab, determined by the Contract Administrator, a minimum of ten (10) days prior to their use, or the Contract Administrator at his discretion, shall visit the quarry for inspection a minimum of ten (10) days prior to use.

#### E6.2.5 Equipment

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

### E6.3 Construction Methods

#### E6.3.1 General

The rockfill shall be sub-cut into the bank as shown on the drawings and pushed or rolled into place in such a manner that the large rocks are uniformly distributed and the smaller rocks serve to fill the places between the larger stones, and that excessive segregation of the various particle sizes does not occur. Sufficient levelling shall be done to procure a neat and uniform surface, conforming to the shape and dimensions shown on the Drawings, and accepted by the Contract Administrator. The allowable fill tolerances shall be within 50 mm of the grade and thickness as shown on the Drawings. Care shall be taken when placing the outside edges of the riprap to provide a smooth flow transition from the existing river bottom to the riprap areas, as identified on the Drawings.

#### E6.3.2 Inspection

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through the final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.

#### E6.3.3 Access

The Contract Administrator shall be afforded full access for the inspection and control testing of materials as the site to determine whether the material is being selected and placed in accordance with this Specification.

### E6.4 Method of Measurement and Payment

#### E6.4.1 Rockfill Riprap

The supply and placement of the Rockfill Riprap will be measured on a weight basis. The weight to be paid for shall be the total number of metric tonnes of Rockfill Riprap material, supplied and placed in accordance with the Specification, acceptable to the Contract Administrator, as measured on a certified weight scale.

The Contractor shall provide the weigh tickets to the Contract Administrator for the material supplied to the site at the time of delivery. No payment will be made for any weigh tickets that are not supplied at the time of delivery.

Rockfill Riprap will be paid for at the Contract Unit Price for "Rockfill Riprap", measured as specified herein, which price shall be payment in full for performing all operations and providing all other items incidental to the work included in this Specification.

## **E7. ROCKFILL COLUMNS**

### **E7.1 Description**

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

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

### **E7.2 Materials**

#### **E7.2.1 Handling and Storage of Materials**

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

#### **E7.2.2 Rockfill Backfill**

Rockfill for backfilling the columns shall consist of a blasted or crushed rockfill material, free from organics, roots, sand, silt, clay, snow, ice or any other material that would detract from the strength and drainage characteristics of rockfill. The rockfill for the rockfill columns shall conform to the following specifications:

- (a) Minimum bulk specific gravity of 2.6 (ASTM C127);
- (b) Maximum Los Angeles abrasion loss of 30% (ASTM C131);
- (c) Maximum soundness of loss of 13% (ASTM C88);
- (d) The rockfill backfill shall be a well graded crushed material ranging in size from 50-mm to 150-mm in diameter with less than 5% finer than 5-mm diameter.
- (e) Maximum absorption of 2.5% (ASTM C127)

The rockfill shall be durable, comprised of limestone, granite, or other quality dense rock. Should the contractor choose to use limestone, it shall be durable white crystalline limestone. Softer buff to yellow dolomite or dolostone will not be acceptable. Rock samples shall either be submitted to the Contract Administrator for approval ten (10) days prior to their use, or the Contract Administrator shall visit the quarry for inspection a minimum of ten (10) days prior to use. No rockfill will be permitted without providing the source and supplier.

#### **E7.2.3 Clay Cap**

The impervious clay cap at the top of the rockfill columns shall consist of a high plasticity clay material with a Liquid Limit in excess of 50%. The clay shall be free of deleterious material such as roots, organic material, ice, snow, or other unsuitable materials and maybe salvaged from the on-site excavation, as approved by the Contract Administrator. Frozen material will not be accepted. The supply and placement of the impervious clay cap shall be considered incidental to the rockfill column installation, and no separate measurement or payment will be made.

#### **E7.2.4 Rock Column Sleeves**

During augering of the rockfill columns, it may be necessary to use steel sleeves to prevent the sidewalls of the columns from caving. The sleeves shall be a minimum of 2.1 m in

diameter (inside diameter) and be of a length suitable to extend from ground surface down through areas of caving.

#### E7.2.5 Equipment

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

### E7.3 Construction Methods

#### E7.3.1 General

The excavation shall be supervised at all times, and open excavations shall be adequately guarded or covered to protect worker safety.

#### E7.3.2 Excavation

- (a) The rock column shafts shall be excavated by drill rig augers to achieve a minimum penetration into competent glacial till, as shown on the drawing. Note that the glacial till contact elevation may vary and the depth of excavation may differ from that shown on the drawings.
- (b) Drilling shall not commence until the rockfill is on site to backfill the shaft.
- (c) Any deleterious or sloughed material shall be removed from the rock column shaft prior to backfilling.
- (d) Water infiltration and bottom blow out may occur as excavation approaches the till. Discharge of water contained within the auger hole from displacement of the rockfill during backfill will be acceptable. The Contractor shall be responsible to contain and direct any displaced water such that it will not affect other construction work or cause excessive erosion of the native riverbank soils. The control of the water shall be considered incidental to the work.
- (e) The construction of the rock columns shall be a continuous operation with backfilling immediately following excavation.
- (f) The Contractor must complete backfilling of each rock column before commencing to excavate adjacent rock columns.
- (g) Excavated material shall be removed from the riverbank area immediately upon excavation and disposed of offsite. Stockpiling of excavated material on the riverbank area will not be permitted.

#### E7.3.3 Rock Column Sleeves

- (a) The Contractor shall install steel sleeving as required to control sloughing and caving of the shafts.
- (b) Shafts shall only be sleeved where it is not possible to advance and maintain an open hole during the excavation and backfilling procedures and the Contractor shall only be paid for sleeving approved by the Contract Administrator.
- (c) There will be no additional payment for excess rockfill backfill that is used because the Contractor used a sleeve diameter larger than the rockfill column diameter shown on the drawings.

#### E7.3.4 Backfilling

The rockfill shall be placed ensuring no voids or bridging occurs, subject to the approval of procedure by the Contract Administrator.

E7.3.5 Supply of Rockfill

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

E7.3.6 Stockpiling of Rockfill Material

The stockpiling of rockfill material on the riverbank will not be permitted at locations where rockfill columns have not been installed. The methodology for stockpiling of rockfill on the riverbank where rockfill columns have been installed shall be subject to the approval of the Contract Administrator.

E7.3.7 Contaminated Rockfill Material

Where crushed rockfill has become contaminated with silt, clay, or other deleterious material due to the Contractor's method of operation, negligence, failure to backfill in a timely manner, etc. the material shall be classified as rejected backfill. The contaminated material shall be weighed and deducted from the total weight of crushed rockfill measured for payment, prior to disposal. The cost to have contaminated material weighed and hauled away shall be the responsibility of the Contractor.

E7.3.8 Inspection

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through the final acceptance of the specified work. The Contractor shall be responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.

The Contract Administrator shall be afforded full access for the inspection and control testing of materials installation and compaction at the site to determine whether the material is being selected and placed in accordance with this Specification.

E7.4 Method of Measurement and Payment

E7.4.1 Shaft Drilling

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

Drilling of the rockfill column shafts will be paid for at the Contract Unit Price per vertical metre for Shaft Drilling, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

E7.4.2 Rockfill Backfill

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

The supply and placement of rockfill in the rockfill columns will be paid for at the Contract Unit Price per tonne for "Rockfill Backfill", measured as specified herein, which price shall

be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

**E7.4.3 Rock Column Sleeves**

Sleeving of the rockfill caissons will be measured on a unit basis. The Contractor shall be paid for the total number of caissons sleeved in accordance with this Specification, as measured by the Contract Administrator. Only the holes directed by the Contract Administrator to be sleeved will be paid for.

There will be no additional payment for excess rockfill backfill that is used because the Contractor used a sleeve diameter larger than the rockfill column diameter shown on the drawings.

The rockfill column sleeving will be paid for at the Contract Unit Price per "Rock Column Sleeves" for the Sleeving measured as specified herein described and all other items incidental to the work included in this Specification.

**E8. CLEARING AND GRUBBING**

**E8.1 Description**

This specification shall amend and supplement Standard Specifications CW3010-R4.

**E8.2 Method of Measurement and Payment**

**E8.2.1 Clearing and Grubbing**

Clearing and grubbing will be measured on a unit basis. The amount to be paid for shall be the amount of trees cleared and grubbed as required and approved by the Contract Administrator.

Clearing and grubbing will be paid for at the Contract Unit Price for "Clearing and Grubbing", measured as specified herein, which price shall be payment in full for performing all operations described and all other items incidental to the work included in the Specification.

**E9. OUTFALL SEWER REPAIRS**

**E9.1 Description**

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

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

**E9.2 Materials**

**E9.2.1 Handling and Storage of Materials**

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

**E9.2.2 Testing and Approval**

All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract

Administrator. There shall be no charge to the City for any materials supplied for testing purposes.

E9.2.3 Slip Joint

Shop drawings shall be submitted for all slip joints. The slip joint shall be installed as shown on the drawings. Galvanizing shall be hot-dip conforming to the requirements of CSA G164-N1981, to a minimum net retention of 600 g/m<sup>2</sup>. All bolts and nuts shall be galvanized steel conforming to ASTM A-325. All welding shall be fully approved by the Canadian Welding Bureau in conformance with CSA Standard W.47.1. Welding splatter and other fabricator burrs, where exposed, shall be ground off and/or field smooth, and left ready for subsequent operations. All miscellaneous metal, after fabrication, shall be hot-dip galvanized.

E9.2.4 Galvanized Primer

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

E9.2.5 Bedding and Backfill Material

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

E9.2.6 CSP Outfall Pipe and CSP Manhole Riser

- a) Shall be the wall thickness as shown on the construction drawings, CSP as per Clause 5.3 of CW 3610.
- b) CSP manhole riser to be premanufactured complete with rungs and top ring suitable to accept a C.O.W. SD-104 frame and cover.

E9.2.7 CSP Couplers, CSP Saddles and Concrete Transition Coupler

- a) Material for CSP to CSP connections shall conform to CSA Specification CAN3-G401. Standard or dimpled with bolt and angle attachments.
- b) Material for CSP saddle connections shall conform to CSA Specification CAN3-G401. Galvanized primer for repair of damaged coating shall be zinc rich, ready mix to CGSB-1-GP-181M.
- c) Material for concrete transition collars shall be in accordance with CW 2160 Type B concrete.

E9.2.8 Debris Grating

Shop drawings shall be submitted for the debris gratings and shall be installed as shown on the drawings. Galvanizing shall be hot-dip conforming to requirements of CSA G164-N1981 to a minimum net retention of 600g/m<sup>2</sup>. All bolts and nuts shall be typical steel, conforming to ASTM A-320 Grade B8M. All welding shall be fully approved by the Canadian Welding Bureau in conformance with CSA Standard W47.1. Welding shall be done by currently licensed welders only. Welding splatter and other fabricator burrs, where exposed, shall be ground off and/or filed smooth, and left ready for subsequent operations. All miscellaneous metal, after fabrication, shall be hot-dip galvanized. No separate measurement will be made for hot-dip galvanizing.

E9.2.9 Handrails and Pipe Sleeve

Shop drawings shall be submitted for the three-rail handrail and pipe sleeve and shall be installed as shown on the drawings. Galvanizing shall be hot-dip conforming to requirements of CSA G164-N1981 to a minimum net retention of 600g/m<sup>2</sup>. All bolts and

nuts shall be type 316 stainless steel conforming to ASTM A-320 Grade B8M. All welding shall be fully approved by the Canadian Welding Bureau in conformance with CSA Standard W47.1. Currently licensed welders shall do the welding. Welding splatter and other fabricator burrs where exposed, shall be ground off and/or filed smooth, and left ready for subsequent operations. All miscellaneous metal, after fabrication, shall be hot-dip galvanized. No separate measurement will be made for hot-dip galvanizing.

#### E9.2.10 Equipment

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

### E9.3 Construction Methods

#### E9.3.1 Bedding

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

#### E9.3.2 Backfill

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

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

#### E9.3.3 Excavation

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

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

#### E9.3.4 Diversion of Flows

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

#### E9.3.5 Temporary Shoring

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

#### E9.3.6 Removal and Installation of CSP

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

Work performed on Asbestos Cement Pipe shall be in accordance with current Workplace Safety and Health regulations.

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

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

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

#### E9.3.7 Connections

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

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

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

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

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

#### E9.3.8 Installation of Debris Grate

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

#### E9.3.9 Shop Drawings

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

### E9.4 Method of Measurement and Payment

#### E9.4.1 Removal and Installation of CSP

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

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

**E9.4.2**      Supply and Installation of Slip Joints

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

**E9.4.3**      Supply and Installation of Debris Grate

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

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

**E9.4.4**      Supply and Installation of Handrails and Pipe Sleeves

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

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

**E9.4.5**      Supply and Installation of Concrete Transition Collar

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

**E10.      MAN ENTRY SEWER STABILIZATION**

**E10.1**      Description

Sewer stabilization shall mean the internal repair of sewers and manholes by man entry techniques. Sewer stabilization shall be classified by the diameter range or height of the pipe being repaired and shall broadly be grouped into man-accessible sewers, 600-1050mm diameter or height, or man-entry, 1200mm and diameter or height and larger, or manholes. Repairs are varied and may consist of holes with voids in sewers, missing sections in sewers, spalling and deteriorated concrete, obstructions and manhole base or riser repairs. Sewer stabilization repairs shall be carried out at the locations noted. The Contractor will review the repairs and method of repairs with the Contract Administrator prior to starting the work.

The scope of work involved in sewer stabilization is as follows:

- a) Secure the site and provide temporary traffic control;
- b) Obtain all necessary underground clearances;
- c) Conduct a hazard assessment, including identification and evaluation;
- d) Develop a safe work plan;
- e) Implement the necessary procedures and controls to control hazards and maintain a safe working environment;
- f) Enter the manhole/sewer and perform the required repairs.
- g) Clean up the site.

## E10.2 Materials

### E10.2.1 Equipment

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

### E10.2.2 Concrete

Concrete for large repairs to concrete sewers and manholes shall conform to CW 2160 Type A.

Patching and grouting of smaller repairs to concrete sewers and manholes shall be with a sulphate resistant, non-shrink, cementitious grout, Sika grout 212 SR or approved equal.

### E10.2.3 Grout Products

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

#### (a) Void Filling

Polyurethane grout for interior void filling by pressure injection techniques shall be single component Diphenylmethane Diisocyanate (MDI) based, water activated, hydrophobic type Flexible Resin and Flexible Accelerator by Multiurethanes Limited or Hydro Active Flex LV and Hydro Active Flex Cat by DeNeef Construction Chemicals Inc. or approved equal.

Concrete for interior void filling shall conform to CW 2160 Type A.

#### (b) Cementitious Crack Injection

Cementitious grout for pressure injection of cracks 2 mm – 6 mm shall be hydrophobic type Flexible Resin and Flexible Accelerator by Multiurethanes Limited or approved equal. Cracks larger than 6 mm shall be injected with Sika 212 SR or approved equal.

#### (c) Spalling and Eroded Pipe Repairs

Grout for general repair, host pipe/linear pipe transition and other areas shall be sulphate resistant, non-shrinking, cementitious grout, Sika grout 212 SR, or approved equal.

### E10.2.4 Other Requirements

#### (a) Sand

- (i) Sand for grout shall be clean and consist of hard, tough, durable, un-coated particles. The shape of the particles shall be generally rounded or cubical. The

- sand shall be generally well graded from fine to coarse in accordance with ASTM C 136 with 100% passing the No. 8 sieve.
- (ii) The percentage of surface moisture in terms of the saturated surface-dried sand will be determined in accordance with ASTM C 70, or other method giving comparable results.
  - (iii) Sand shall be stored in such a manner as to avoid the inclusion of any foreign materials in the grout. All sand shall remain in free draining storage for at least 72 hours prior to use.

Water shall be potable water, which shall be imported to the site.

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

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

MSDS for all materials shall be used which are manufactured from or contain toluene diisocyanate (TDI), toluene, acetone or methyl ethyl ketone.

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

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

### E10.3 Construction Methods

#### E10.3.1 Hazard Assessment

- (a) In conjunction with securing of the site and obtaining underground clearances, the Contractor shall conduct a hazard assessment for each site requiring a man entry stabilization repair or entry into any confined work space as required to complete the work. The assessment shall identify and evaluate the hazards, including but not be limited to review of the following as it pertains to the work to be performed:
  - (i) nature of the defect;
  - (ii) location of the defect in the sewer/manhole;
  - (iii) structural condition and amount of debris in the remaining sewer/manhole;
  - (iv) condition of the manholes up and downstream of the required repair;
  - (v) atmospheric conditions in the manholes up and downstream of the required repair;
  - (vi) condition of adjacent downstream sewers;
  - (vii) flow in the sewer.
- (b) The hazard assessment shall be based on the Contractors review of video for the sewer(s) and site inspection of the manholes, sewers and external conditions. Prior to the inspection, the Contractor shall conduct the necessary atmospheric monitoring of the affected manholes and sewers to establish acceptable entry conditions.
- (c) The Contractor shall prepare a safe work plan in accordance with E10.3.2 complete with the necessary controls and procedures required to maintain a safe working environment for the repair. Provide plan to contract administrator.

### E10.3.2 Safe Work Plan

- (a) Subsequent to performing a hazard assessment a safe work plan shall be developed to address the potential hazards associated with each site. In addition to addressing the potential hazards the safe work plan shall address but not be limited to the following:
- (i) guidelines for confined space entry work established by The Manitoba Workplace Safety and Health Act;
  - (ii) provision for emergency response;
  - (iii) training and duties for entry personnel;
  - (iv) rescue and emergency services;
  - (v) requirement for purging, ingesting, flushing and/or continuous ventilation to eliminate or control atmospheric hazards;
  - (vi) requirement for and provision of supplied air;
  - (vii) communication between members of the repair crew in the pipe and on the ground's surface;
  - (viii) current and forecasted weather conditions;
  - (ix) isolating the workspace by plugging of upstream sewers and monitoring of upstream flow levels;
  - (x) provision of back-up equipment;
  - (xi) method of ingress into the sewer;
  - (xii) method of egress out of the sewer – forward and backwards.
- (b) The Contractor shall not enter the sewer or manholes to begin the work until they have completed a hazard assessment and safe work plan for the specific repair and reviewed said plans with their designated safety officer for acceptance. The safe work plan procedures and practices shall conform to all federal, provincial and municipal codes, regulations and guidelines including Manitoba Labour "Guidelines for Confined Space Entry".

### E10.3.3 Equipment Set Up

In accordance with the safe work plan for the repair, the Contractor shall set up the required safety equipment and controls to safely perform the work.

Specialized equipment to perform the repair work, such as lights, pressure washers, drills and chipping hammers shall in no way adversely affect the operation of the safety equipment required to perform the work.

Subsequent to completion of the repairs the Contractor shall remove all equipment from the sewers and manholes.

### E10.3.4 Enter the Manhole and Sewer

The Contractor shall enter the manhole/sewer and complete the work in accordance with their safe work plan and requirements for the repair contained herein.

If at any time during the repair the attendant and/or Contractor believes he cannot safely perform the work they shall immediately stop the work and evacuate the sewer and manholes. The Contractor shall re-assess their safe work plan considering the reason for the work stoppage. The work shall only be resumed when the Contractor has deemed it safe to return by completing a reassessment and safe work plan revision, where necessary.

### E10.3.5 Sewer Repairs

#### (a) General

The Contractor shall repair the sewer fabric to restore the structural integrity of the sewer and provide a smooth flow surface conforming to the adjacent sewer/manhole cross-section and materials. Prior to carrying out any sewer repairs. The Contractor shall clean the sewer to remove all sediment and debris as required by the Contract Administrator. The cleaned surface is to be suitable to inspect the pipe for Damage and for layout of areas to be repaired. The Contractor will review the repair requirements with the Contract Administrator to determine the type and limit of the repair sections.

#### (b) Spalling and Eroded Pipe Repairs

Large concrete repairs where existing concrete is missing, severely deteriorated or there is exposed soil a reasonable and limited level of surface preparation is required, including removal of unsound material and cleaning of edges of the repair area, and setting of the required formwork and bracing. Concrete placement and finishing shall be done in accordance with CW 2160-R6. All formwork and bracing shall be removed from the sewer/manhole at the completion of the work. The Contractor is to remove all loose material and replace the concrete using reinforcement to secure the concrete repair to an acceptable existing concrete edge. Where the extent or edge of the repair meets with acceptable concrete, this edge shall be jack hammered to a depth of 75mm to allow for placement of 15M deformed tie bars. These bars shall be placed every 300mm along the repair edge. The thickness of the new concrete within the repair section shall not be less than 75 mm where reinforcing steel is required. The Contractor will review and determine the repair requirements and limits with the Contract Administrator prior to carrying out the repairs.

#### (c) Surface Grouting

Patching and grouting of small repairs up to 50mm in thickness shall include a reasonable and limited level of surface preparation, including removal of unsound material and cleaning of the edges of the repair area. The Contractor shall apply the patching material in accordance with the manufacturer's printed instructions.

#### (d) Void Filling

Small voids in the backfill around the exterior of the pipe shall be completely filled with concrete from the inside of the sewer prior to repairing the sewer fabric.

#### (e) Cementitious Crack Injection

Pressure injection grouting of cracks shall be done in accordance with the manufacturer's printed instructions.

### E10.3.6 Quality Assurance

The applicator shall have a minimum of 3 years of experience performing similar work and be authorized by the suppliers for performing injection of the nature specified, using the product specified or approved.

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

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

#### E10.3.7 Repair Acceptance

Upon completion of the designated repair the Contractor shall clean and perform the Inspection.

Acceptance testing shall conform to CW 2130 except that no deflection testing will be required and obstruction testing will only be carried out at the discretion of the Contract Administrator.

The Contractor shall not be responsible for defects in existing unrepaired sewer lines unless those defects are a direct result of the Contractor's operation.

#### E10.3.8 Submittals

The Contractor shall submit to the Contract Administrator one (1) week prior to the start of work, a statement of qualifications of the applicator of the grout. The statement must identify the years of experience of the individuals responsible for the mix design, grout preparation and installation. Proof must be given that the applicator has experience with work of similar nature and scope.

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

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

- (i) Grout port types and dimensions, configuration along the axis of the pipe, and longitudinal spacing.
- (ii) Grouting application rates and anticipated hydrostatic pressure on the pipe.
- (iii) Method for repairing grout ports.
- (iv) Method for handling wastewater from grouting operations.

#### E10.3.9 Records

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

#### E10.3.10 Protection to Work and Cleanup

The Contractor will be required to furnish such pumps as may be necessary to care for wastewater and grout from his operations. No wastes from the grouting operations are to be allowed to enter the river system. The Contractor shall, upon completion of his operations, clean up all waste resulting from his operations that is unsightly or would interfere with the efficient operation of the project as anticipated by the original design.

#### E10.3.11 Supervision of Grouting Operations

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

### E10.3.12 Execution

Contractor shall evaluate, select and submit for review and approval the injection grouting material, method, and pertinent data to the Contract Administrator for each condition and type of joint, or void identified and deemed by the Contractor as requiring treatment at least one (1) week prior to the commencement of injection grouting.

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

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

### E10.3.13 Cementitious Grout Injection Preparation and Installation

Grouting shall be performed in conjunction with E15 Cold Weather Requirements.

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

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

Injection ports shall be installed in holes drilled through the pipe. The Contract Administrator shall approve the spacing between ports. The Contractor shall submit a plan for the injection port distribution which shall include the configuration and distribution of injection ports, the port size, the number of ports per location, and the number of locations at least one (1) week prior to the commencement of injection grouting. All injection ports shall be flushed clean prior to grouting, and repaired to the satisfaction of the Contract administrator once grouting operations are complete.

Grout shall be placed from the bottom of the cavity to the top of the cavity in a uniform and continuous procedure. During grouting, adjacent ungrouted ports shall be left open to permit the flow or escape of air, water, or flushed-out grout. When required, cap or seal adjacent ports or vent holes once clean consistent grout is observed flowing from vent or port. At all times, a minimum of one vent hole or port shall be maintained open and monitored for grout level. The Contractor shall submit the proposed grouting procedure at least one (1) week prior to the commencement of injection grouting.

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

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

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

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

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

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

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

Upon completion of the work, remove all injection-related materials from the work area, and remove all debris from the site.

#### E10.3.14 Correction of Deficiencies

If deficiencies are found in the repaired section the Contractor shall bear all costs of correcting the deficiencies including the cost of re-inspection to confirm that the deficiencies are rectified in accordance with these specifications.

### E10.4 Basis of Measurement and Payment

#### E10.4.1 Grouting

- (a) Injection grouting of cracks will be measured and paid for on a linear basis. The length to be paid for shall be the total length (in meters) as measured by the Contract Administrator.
- (b) Spalling and eroded pipe repairs will be measured and paid for on a square meter basis as measured by the Contract Administrator.
- (c) Surface grouting and all other grouting repairs will be measured and paid for on a square meter basis as measured by the Contract Administrator.

#### E10.4.2 Void Filling

The supply and installation of void filling will be measured on a volume basis and paid for at the Contract Unit Price for "Void Filling". The volume to be paid for will be the total number of cubic meters of concrete installed in accordance with this specification, accepted and measured by the Contract Administrator.

## E11. CHANNEL PROTECTION

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

## E12. TOPSOIL AND SODDING

Topsoil and sod to be installed in accordance with CW 3510. A limited amount of topsoil and sod has to be included in the Contract for the restoration above the overflow pipe. All other areas to be restored to existing condition or better. No payment will be made for topsoil and sod outside of the limit for the overflow easement.

### **E13. PROTECTION OF EXISTING TREES**

- E13.1 The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing trees within the limits of the construction area:
- (a) The Contractor shall not stockpile materials and soil or park vehicles and equipment on boulevards within 2 meters of trees.
  - (b) Trees identified to be at risk by the Contract Administrator are to be strapped with 25 x 100 x 2400 mm wood planks, or suitably protected as approved by the Contract Administrator.
  - (c) Excavation shall be performed in a manner that minimizes damage to the existing root systems. Where possible, excavation shall be carried out such that the edge of the excavation shall be a minimum of 1.5 times the diameter (measured in inches), with the outcome read in feet, from the closest edge of the truck. Where roots must be cut to facilitate excavation, they shall be pruned neatly at the face of excavation.
  - (d) Operation of equipment within the dripline of the trees shall be kept to the minimum required to perform the work required. Equipment shall not be parked, repaired, refuelled; construction materials shall not be stored, and earth materials shall not be stockpiled within the driplines of trees. The dripline of a tree shall be considered to be the ground surface directly beneath the tips of its outermost branches. The Contractor shall ensure that the operations do not cause flooding or sediment deposition on areas where trees are located.
  - (e) Work on-site shall be carried out in such a manner so as to minimize damage to existing tree branches. Where damage to branches does occur, they shall be neatly pruned.
- E13.2 All damage to existing trees caused by the Contractors activities shall be repaired to the requirements and satisfaction of the Contract Administrator and the City Forester or his designate.
- E13.3 No separate measurement or payment will be made for the protection of trees.
- E13.4 Elm trees cannot be trimmed between April 1 and July 31, inclusive.

### **E14. AUTHORIZED WORK ON PRIVATE PROPERTY**

- E14.1 Further to GC 6.28, the Contractor shall confine his works to the right-of-way or easements. Where Work is required to be done on private property the Contract Administrator will authorize such work in writing after the Contractor has provided in writing to the Contract Administrator the permission of the property owner.

### **E15. COLD WEATHER REQUIREMENTS**

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

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

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

- (i) Before any concrete is placed, all ice, snow, and frost shall be completely removed from all formwork, and other surfaces against which concrete temperatures of such surfaces raised above 7°C for twenty-four (24) hours

- minimum prior to concreting. Where concrete work is to come in contact with the earth, the surface of the earth shall be completely free of frost when concrete is placed thereon.
- (ii) Concrete aggregates and water shall be heated to not over 80°C. Concrete shall be not less than 20°C or more than 30°C in temperature when deposited. Concrete when placed during freezing weather, or if freezing is anticipated during curing period, shall be fully enclosed and the temperature of same maintained at not less than 20°C for five (5) days nor less than 5°C for an additional five (5) days.
  - (iii) Heating enclosures shall be strong and wind-proof, well ventilated with heating units so located as to prevent local overheating or drying of the concrete or damage from combustion gases. Only indirect fired heaters will be accepted. Units must be vented outside the enclosure. No direct fired units will be accepted.
  - (iv) The Contractor shall inform the Contract Administrator well in advance as to the methods of enclosure and frost protection he proposes to employ.

Cold weather requirements shall be considered incidental to the Works of this Contract and no measurement or payment will be made for this item.

## **E16. CRITICAL STAGES**

- E16.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:
- (a) The rockfilled columns at Valhalla Drive Outfall shall be completed prior to the replacement of CSP.

## **E17. SILT FENCE**

### **E17.1 Description**

- E17.1.1 This specification covers the erection of temporary silt fencing, which shall be installed and maintained at the locations shown on the drawings to control runoff and minimize the release of detrimental silt loading to watercourses.
- E17.1.2 The scope work included in this specification is as follows:
- (a) Supply and Install temporary silt fencing at locations as indicated, in accordance with the detailed drawing provided, prior to undertaking any other activities on the site where silt fencing is required.
  - (b) Maintain the silt fencing in serviceable condition throughout the entire duration of activities at the site where silt fencing is required, including final restoration and cleanup of the construction site.
  - (c) Remove the silt fencing and restore the area where the fencing was installed, without further disturbing the area and without releasing any deleterious substances to the adjacent watercourse.

### **E17.2 Materials**

#### **E17.2.1 Fences Posts**

- (a) Fence posts shall be 100 mm untreated wood posts or 50 mm steel posts, minimum length of 1.1 m.

**E17.2.2 Filter Fabric**

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

<b>Property</b>	<b>Test Method</b>	<b>Value</b>
Grab Tensile Strength	ASTM D 4632	0.55 kN
Grab Tensile Elongation	ASTM D 4632	15%
Mullen Burst	ASTM D 4786	2060 kPa
Puncture	ASTM D 4833	0.285 kN
Trapezoid Tear	ASTM D 4533	0.285 kN
UV Resistance	ASTM D 4355	80 % @ 500 hrs
Apparent Opening Size (AOS)	ASTM D 4751	0.60 mm
Flow Rate	ASTM D 4491	405 l/min/m <sup>2</sup>

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

**E17.2.3 Wire Mesh**

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

**E17.2.4 Fencing Material Fasteners**

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

**E17.3 Construction Methods**

**E17.3.1** Ensure that no deleterious substances are discharged into the adjacent watercourse at any time during construction activities.

**E17.3.2 Silt Fence Installation**

- (a) Excavate 150 x 150 anchor trench along alignment of silt fence as indicated.
- (b) Install fence posts as indicated. Ensure that fence posts are firmly driven into undisturbed soil, or are completely and firmly backfilled if installed via auger methods. Attach wire mesh as support backing for silt fence filter fabric with fasteners as specified in E17.2.4. Attach silt fence filter fabric on top of wire mesh in similar fashion. Overlap any fence seams (wire mesh or filter fabric) by 450 mm minimum. Ensure that wire mesh and filter fabric are installed on the upslope side of the post and are fully laid in anchor trench as shown.
- (c) Install and compact impermeable excavated materials into anchor trench and slope as indicated. Compact to 95% of maximum dry density (ASTM D-698).

**E17.3.3 Silt Fence Maintenance**

- (a) Inspect silt fence daily, prior to starting any other construction activities. If fence posts are found loose or not upright, repair in accordance with installation procedure as specified in E17.3.2. If silt fence is found to be loose or torn, repair or replace as necessary to comply with E17.3.2.
- (b) If silt deposition at the fence is 300 mm or more in depth, carefully remove and dispose of silt offsite without disturbing silt fence.

#### E17.3.4 Silt Fence Removal

- (a) Following completion of all site construction activities (including final restoration and cleanup), remove all fence posts, wire mesh, fabric and fasteners from site.
- (b) Restore areas disturbed in accordance with E4, without releasing any deleterious substances to the adjacent watercourse.

#### E17.4 Method of Measurement and Basis of Payment

##### Supply and Install Silt Fence

A limited amount of silt fence has been included in the contract for the control of runoff. All other areas effected by the contractor will be at the contractors own cost. No payments will be made for additional sediment and erosion control outside of the quantities provided for in the contract.

- (a) Supply, installation, maintenance and removal of temporary silt fencing for control of runoff and deleterious material discharge to adjacent water courses shall be measured on a linear basis. The length to be paid for shall be the total number of lineal meters of silt fencing acceptably supplied, installed, maintained and removed.
- (b) Payment shall be made at the Contract unit price bid for "Supply and Install Silt Fence", which shall be payment in full for supplying, installing, maintaining and removing the silt fence, and all other items incidental to the work covered under this specification.