

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>
LD-3034	Bishop Grandin LDS Boulevard Outfall Gate Chamber - Site Plan
LD-3035	Bishop Grandin Boulevard LDS Outfall Gate Chamber - Concrete Details
LD-3036	Bishop Grandin Boulevard LDS Outfall Gate Chamber - Reinforcing Details
LD-3037	Rice Road LDS Outfall Gate Chamber - Site Plan
LD-3038	Rice Road LDS Outfall Gate Chamber - Concrete Layout
LD-3039	(i) Rice Road LDS Outfall Gate Chamber - Concrete Details
LD-3040	(j) Rice Road LDS Outfall Gate Chamber - Reinforcing Layout 1 of 2
LD-3041	(k) Rice Road LDS Outfall Gate Chamber - Reinforcing Layout 2 of 2
LD-3042	Stormont Drive LDS Outfall Gate Chamber - Site Plan
LD-3043	Stormont Drive LDS Outfall Gate Chamber - Details
LD-3044	Bishop Grandin and Rice Road Gate Chambers - Hatch details
LD-3045	Bishop Grandin and Rice Road Gate Chambers - Miscellaneous Metal Details

E2. SOILS INVESTIGATION REPORT

- E2.1 Further to GC:3.1, of the General Conditions, a geotechnical soils investigation has been done in the vicinity of the proposed works to determine the character of the subsurface soil to facilitate the design of the Work. The information is considered accurate at the locations indicated and at the time of the investigation. However, considerable variations in the soil conditions may exist between test holes and fluctuations in ground water levels can be expected seasonally. Test hole logs are included.
- E2.2 Bidders are responsible for any interpretation they place on the supplied information and are expected to make such additional investigation of the soil as they feel necessary to satisfy themselves.
- E2.3 Any test borings made by the bidder shall be done in accordance with the requirements of the appropriate authority of the City of Winnipeg. Bidders shall notify the contract Administrator prior to starting any soil boring operation.

E3. OFFICE FACILITIES

- E3.1 The Contractor shall supply office facilities for the Contract Administrator's use meeting the following requirements.

- (a) Locate at a site near the Work and approved by the Contract Administrator. Relocate the office to a suitable site as work progresses as directed by the Contract Administrator.
- (b) A minimum floor area of 20 square metres, window area of 3 square metres and a door entrance with suitable lock satisfactory to the Contract Administrator.
- (c) Be suitable for all-weather use capable of maintaining a temperature range between 16°C and 25°C.
- (d) Supplied with adequate lighting and 120 volt power supply.
- (e) Furnished with one desk, one drafting table, one filing cabinet and six chairs, all satisfactory to the Contract Administrator.
- (f) Separate toilet with door lock.
- (g) Cleaned weekly immediately prior to the Job Sit Meetings to the satisfaction of the Contract Administrator.
- (h) Temporary structures provided for this project shall be stabilized in a sufficient manner to prevent the structure from being overturned by wind forces as defined in the National Building Code. The stabilization method shall be designed by a Professional Engineer registered in the Province of Manitoba and experienced in this type of design. Design notes and drawings for the stabilization works signed and sealed by the Engineer shall be provided to the Contract Administrator for review.

E3.2 Provision of the field office shall include maintenance and removal of the office, operating costs and service installation costs.

E3.3 Costs for provision of office facilities for the Contract Administrator's use will be included in mobilization and demobilization.

E4. DANGEROUS WORK CONDITIONS

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

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

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

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

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

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

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

E5. MOBILIZATION AND DEMOBILIZATION

- E5.1 Mobilization and demobilization will include but not be limited to start-up costs, equipment set-up and removal, field office and storage facilities set-up and removal and site cleanup.
- E5.2 Mobilization and demobilization will be measured on a unit basis and paid for at the Contract Unit Price for "Mobilization and Demobilization" in accordance with this specification, accepted and measured by the Contract Administrator.
- E5.3 50% of the Mobilization and Demobilization unit price will be paid on the first progress payment.
- E5.4 The remaining 50% of the Mobilization and Demobilization unit price will be paid subsequent to the completion of the work and restoration and clean up of all sites.

E6. PROTECTION OF EXISTING TREES

- E6.1 Do not remove existing trees and take the following precautionary steps to avoid damage from construction activities to existing boulevard trees within the limits of the construction area.
- E6.1.1 Do not stockpile materials and soil or park vehicles and equipment on boulevards within 2 metres of trees.
- E6.1.2 Strap mature tree trunks with 25 x 150 x 2400 wood planks. Smaller trees shall be similarly protected using appropriately sized wood planks.
- E6.1.3 Excavations shall be carried out in a manner to minimize damage to existing root systems. Where roots must be cut to facilitate an excavation they shall be neatly pruned at the face of the excavation.
- E6.1.4 Work on site shall be carried out in a manner to minimize damage to existing tree branches. Where damage to tree branches does occur, the Contractor shall neatly prune the damaged branch.
- E6.1.5 American elm trees shall not be pruned between April 1st and August 1st and Siberian elm trees between April 1st and July 1st of any year under provisions of The Dutch Elm Disease Act.
- E6.2 All damage to existing trees due to construction activities shall be repaired to the requirements and satisfaction of the City of Winnipeg, Parks and Recreation Department, Forestry Branch at the Contractor's expense.
- E6.3 Costs for protection of trees will be included in gate chamber construction.

E7. WATERWAY BY-LAW

- E7.1 The Contractor shall note that all works within 107 metres (350 feet) of a riverbank are within the jurisdiction of the Waterway By-law. The Contract Administrator will apply and pay for required Waterway Permits for the project. The Contractor shall adhere to restrictions imposed by the permit.
- E7.2 Under no circumstances will stockpiling of any material be permitted on within 107 metres of a riverbank or dyke.

E8. CONFLICT WITH EXISTING UTILITIES

E8.1 Further to Clause 3.4 of CW 1120, the City will arrange and pay for the MTS and gas utilities to be relocated on Kilkenny Drive in the vicinity of the Rice Road Gate Chamber as shown on Drawing LD-3037 before construction starts.

E9. SHOP DRAWINGS

E9.1 Description

- (a) This Specification shall revise, amend and supplement the requirements of CW 1100.
 - (i) The term 'shop drawings' means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, including site erection drawings which are to be provided by the Contractor to illustrate details of a portion of the work.
 - (ii) The Contractor shall submit specified shop drawings to the Contract Administrator for review. All submissions must be in metric units. Where data is in imperial units, the correct metric equivalent shall also be show on all submissions for Engineering review.
- (b) Shop Drawings
 - (i) Original drawings are to be prepared by Contractor, Subcontractor, Supplier, Distributor, or Manufacturer, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate sections.
 - (ii) Shop drawings for the following structural components shall bear the seal of a registered Engineer of Manitoba.
 - (l)(a) Shoring.
 - (m) (b) Reinforcing steel.
 - (n) (c) Metal Fabrications.
- (c) Contractor's Responsibilities
 - (i) Review shop drawings, product data and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.
 - (ii) Verify:
 - (a) Field measurements
 - (b) Field construction criteria
 - (c) Catalogue numbers and similar data
 - (iii) Coordinate each submission with requirements of work and Contract Documents. Individual shop drawings will not be reviewed until all related drawings are available.
 - (iv) Notify Contract Administrator, in writing at time of submission, of deviations from requirements of Contract Documents.
 - (v) Responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator's review of submission, unless Contract Administrator gives written acceptance of specified deviations.
 - (vi) Responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
 - (vii) The Contractor shall make any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.
 - (viii) After Contract Administrator's review and return of copies, distribute copies to sub-trades as appropriate.

- (ix) Maintain one (1) complete set of reviewed shop drawings, filed by Specification Section Number, at the site of the work for use and reference of the Contract Administrator and Subcontractors.
- (d) Submission Requirements
 - (i) Schedule submissions at least 14 Calendar days before dates reviewed submissions will be needed, and allow for a 14 Calendar day period for review by the Contract Administrator of each individual submission and re-submission, unless noted otherwise in the Contract Documents.
 - (ii) Submit five (5) paper prints of shop drawings. The Contractor is advised that the Contract Administrator will retain three (3) copies of all submittals and return two (2) copies to the Contractor.
 - (iii) Accompany submissions with transmittal letter, containing:
 - (a) Date
 - (b) Project title and Bid Opportunity number
 - (c) Contractor's name and address
 - (d) Number of each shop drawing, product data and sample submitted
 - (e) Specification Section, Title, Number and Clause
 - (f) Drawing Number and Detail/Section Number
 - (g) Other pertinent data
 - (iv) Submissions shall include:
 - (a) Date and revision dates.
 - (b) Project title and Bid Opportunity number.
 - (c) Name of:
 - (i) Contractor
 - (ii) Subcontractor
 - (iii) Supplier
 - (iv) Manufacturer
 - (v) Separate detailer when pertinent
 - (d) Identification of product of material.
 - (e) Relation to adjacent structure or materials.
 - (f) Field dimensions, clearly identified as such.
 - (g) Specification section name, number and clause number or drawing number and detail/section number.
 - (h) Applicable standards, such as CSA or CGSB numbers.
 - (i) Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.
- (e) Other Considerations
 - (i) Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.
 - (ii) Material and equipment delivered to the site of the works will not be paid for at least until pertinent shop drawings have been submitted and reviewed.
 - (iii) Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.
 - (iv) No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions and review of shop drawings.

E9.2 Measurement and Payment

- (i) Preparation and submittal of Shop Drawings will be included in gate chamber construction.

E10. FLOW CONTROL

- E10.1 During winter months land drainage and storm relief sewers can receive flow of an undetermined amount from groundwater infiltration, watermain breaks, snow melt and other unforeseen sources.
- E10.2 Provide flow control measures to contend with and maintain flow in the land drainage and storm relief sewers that are directed to the location where gate chambers are being constructed. Flow control measures shall include but not be limited to diversions, flumes and by-pass pumping.
- E10.3 Discharge hoses for by-pass pumping shall not be laid across vehicle or pedestrian traffic areas and must be protected from freezing during winter months. Pumping equipment if used, shall be set-up in a location and in such a way to not be a noise problem for nearby residences
- E10.4 Provide a flow control plan for each gate chamber location to the Contract Administrator for review before removing any existing sewer pipe.
- E10.5 Costs for flow control will be included in gate chamber construction.

E11. CAST-IN-PLACE CONCRETE GATE CHAMBER CONSTRUCTION

- E11.1 Description
- E11.2 General
- (a) This specification shall cover construction of cast-in-place concrete gate chambers and shall supplement, revise and amend CW 2160.
- E11.3 Materials
- (a) Concrete Mix Design
- (i) Concrete mix design shall be as indicated in the Construction Notes on the Drawings.
- (b) Lean-Mix Concrete Design
- (i) Proportioning of fine aggregate, coarse aggregate, cement, and water for lean mix concrete shall be as follows:
- (a) Cement: Type 50
- (b) Minimum Compressive Strength @ 28 days: 15 MPa
- (e) Slump: 80 mm
- (f) Air Content: nil
- (g) Minimum Cement Content = 240 kg/m³
- (h) Maximum Water/Cement Ratio = 0.49
- (c) Grout
- (i) Grout shall be Sika Grout 212 or approved equal.
- (d) Reinforcing Steel
- (i) Bar accessories:
- (a) To be made from a non-corroding material.
- (b) Shall not stain, blemish or spall the concrete surface for the life of the concrete.
- (c) Shall be approved by the Contract Administrator.
- (d) Bar chairs shall be PVC.
- (e) Bonding Agent
- (i) Bonding agent shall be ACRYL-STIX or approved equal.
- (f) Waterproofing
- (i) Waterproofing shall be in accordance with E15 of this specification.

- (g) Cast Iron Sluice Gates
 - (i) Cast iron sluice gates, wall thimbles, mechanical lift operator, stems and accessories shall be in accordance with E13 of this specification.
- (h) Cast Iron Flap Gates
 - (i) Cast iron flap gates and wall thimbles shall be in accordance with E14 of this specification.
- (i) Miscellaneous Metals and Accessories
 - (i) In accordance with E16 of this specification and as shown on the Drawings.
- (j) Shop Drawings
 - (i) Provide shop drawings in accordance with E9 of this specification.
 - (ii) Submit shop drawings for reinforcing steel a minimum of two (2) weeks prior to the fabrication of any reinforcing steel.
- (k) Backfill
 - (i) In accordance with CW 2030. Class of backfill to be as shown on the Drawings.

E11.4 Construction Methods

- (a) Construction Method Submission
 - (i) No work shall commence on construction of cast-in-place gate chambers until after the Contract Administrator's review of the Contractor's Construction Method submission.
 - (ii) The Contractor shall prepare for the Contract Administrator's review a Construction Method submission detailing:
 - (i) Construction sequence to be followed including all methods to be employed to ensure no damage occurs to existing structures or adjacent properties within or adjacent to an excavation.
 - (ii) Shoring system to be used.
 - (iii) Proposed method of chamber construction.
 - (iv) Specialized equipment to be used.
 - (v) Any design revisions proposed to accommodate the Contractor's proposed construction method.
 - (vi) Water control considerations including details on the Contractor's proposed method of groundwater and surface runoff control.
 - (iii) The Contractor shall respond to any concerns that may be raised by the Contract Administrator after review of Construction Method submission.
- (b) Excavation
 - (i) Remove excavated material from the site immediately. Excavated material shall not be stockpiled on-site unless it will be used as backfill the same day it is excavated.
 - (ii) Place a minimum 75 millimetre thick lean mix concrete slab in the bottom of the excavation to provide a clean working base upon completion of the excavation to the required limits. Allow the concrete to set for twenty-four (24) hours before setting up forms or placing reinforcing steel.
 - (iii) Lean mix concrete shall be well-tamped and screed to give a level working platform for setting up forms and placing reinforcing steel. Allow the concrete to set for twenty-four (24) hours before setting up forms or placing reinforcing steel.
 - (iv) Supply and place lean mix concrete, as directed by the Contract Administrator, as backfill for any portions of the excavation, carried beyond the required limits of excavation. The limits of excavation shall be considered to be the inside face of the shoring system and the underside of the working base slab.

- (v) All working areas below grade shall be kept adequately and securely supported during and after excavation until the shoring and bracing is in place to prevent loss of ground or injury to any person from falling material.
- (c) Excavation Security Fence
 - (i) Further to Clause 3.1 of CW 1130, completely cover the excavation and provide a security fence to completely surround the excavation when unattended generally in accordance with the following.
 - (ii) Security fence shall be chain link fence or approved equal, a minimum 1.80 metres high with metal support posts embedded far enough into the ground and spaced close enough together so the fence will not sag or collapse.
 - (iii) Attach fencing securely to posts.
 - (iv) Secure the gate or end of the fencing to a post with chain and a padlock.
 - (v) Provide alternate security fence proposal to Contract Administrator for approval.
- (d) Shoring
 - (i) The type, strength, and amount of shoring and bracing shall be such as the nature of the ground and attendance conditions may require, taking into account property lines, existing slopes, utilities and roadways.
 - (ii) Shoring and bracing shall be so spaced and dimensioned as to prevent caving, loss of ground, surface settlement, or squeezing of the soil beyond the neat lines of excavation. It shall be free from defects that might impair its strength or suitability for the work. Sheeting/shoring and bracing shall conform to the latest revisions of the "Construction Safety Act" of the Department of Labour of the Government of Manitoba.
 - (iii) Supporting design calculations as required to facilitate review of the submission for conformance with the Contract Documents.
 - (iv) Submit Shop Drawings and design calculations for the shoring/excavation system designed and sealed by a Professional Engineer registered or licensed to practice in the Province of Manitoba and experienced in the structural design of shoring systems. The designer of the shoring system shall inspect the system during construction and certify, in writing to the Contract Administrator, that construction is in conformance with the approved design.
 - (v) Shoring and bracing shall be installed such that the structure size and wall thickness shown on the drawings can be obtained subsequent to installation of the shoring system.
 - (vi) Shoring and bracing shall remain in place until concrete has attained 75% of the design strength.
- (e) Cast in place Concrete Chamber Construction
 - (i) Construct cast in place concrete chambers in accordance with CW 2160, except as supplemented, revised or amended in this specification and as indicated in the construction notes on the Drawings.
 - (ii) Adjust the location of reinforcing steel adjacent to openings to frame those openings in accordance with good practice, and maintain the bar spacing intent.
 - (iii) Do not use welded splices for reinforcing steel.
 - (iv) Order all wall reinforcing steel in lengths to best suit the spacing of walers so that reinforcing bars will not be bent or misformed in order to remove the walers.
 - (v) Install foundation waterproofing in accordance with E15 of this Specification.
- (f) Backfill
 - (i) Place and compact backfill material as indicated on the Drawings in accordance with CW 2030. Do not place backfill material in a frozen state. Supply heating and

- hoarding in accordance with CW 2160 if required to ensure material does not freeze before compaction is complete.
- (ii) Notify the Contract Administrator at least one (1) full working day in advance of any backfilling operation. No Backfill shall be placed against concrete until approved by the Contract Administrator and in no case before field cured test cylinders show the concrete strength to be 75% of that specified.
- (g) Grout
 - (i) Mix and apply grout in accordance with the manufacturers instructions. Consistency to be suitable for the intended application.
 - (h) Sluice Gate Installation
 - (i) Install sluice gates, wall thimbles, mechanical lift operator, stem and accessories as shown on the Drawings and in accordance with E13 of this specification.
 - (ii) Sluice gates shall be left in the open position at all times except when on site working on the gate.
 - (i) Flap Gate Installation
 - (i) Install flap gates, wall thimbles and lifting cable as shown on the Drawings and in accordance with E14 of this specification.
 - (j) Miscellaneous Metal Fabrications
 - (i) Install miscellaneous metal fabrications as shown on the Drawings and in accordance with E16 of this specification.
 - (k) Bollards
 - (i) Install removable steel bollards at the locations shown and as detailed on the Drawings.

E12. PRE-CAST CONCRETE GATE CHAMBER CONSTRUCTION

E12.1 Description

- (a) General
- (b) This specification shall cover construction of cast-in-place concrete gate chambers.

E12.2 Materials

- (a) Pre-cast concrete manhole sections used for gate chambers shall be in accordance with section 2.7 of CW 2130.
- (b) Flexible Transition Pipe Couplings
 - (i) Flexible transition pipe couplings shall be in accordance with Clause 2.1 and 2.6 of CW 2130.
- (c) Manhole Frames and Covers
 - (i) Cover: Unmarked Titan TF-114 cast iron solid cover.
 - (ii) Frame: 225 millimetre high cast iron frame.
- (d) Cast Iron Flap Gates
 - (i) Cast iron flap gates and wall thimbles shall be in accordance with E14 of this specification.
- (e) Cast Iron Gate Valves
 - (i) Gate Valves shall be bronze mounted, cast iron body with flanged ends equipped with:
 - a) outside rising stem, screw and yoke
 - b) bronze trimmed cast iron wedge

- c) bronze stem
- d) double O-ring stem seals
- (ii) Flanges shall conform in dimension and drilling to ANSI/ASME B15.1, Class 150.
- (iii) Direction of opening shall be counter clockwise and shall be clearly stamped or indicated with raised letters and arrow.
- (iv) Manufacturer's nameplate shall be attached to the valve body with stainless steel fasteners.
- (v) Gate valves shall be as manufactured by Crane, Jenkins, Kennedy, Mueller, Clow or approved equal.
- (vi) Submit shop drawings of gate valves in accordance with E9 of this specification.
- (f) Gate Valve Stem Extension
 - (i) Gate valve stem extension shall be 38 millimetre diameter ASTM A276 Type 304 stainless steel, schedule 40 pipe with a 50 mm square operating nut.
 - (ii) Submit shop drawings of the valve stem extension in accordance with E9 of this specification.
- (g) Stem Extension Guide and Wall Brackets
 - (i) Stem extension guide and wall brackets to be ASTM A276, Type 304 stainless steel suitable for keeping the stem extension plumb and centered in the valve box while not interfering with the operation of the valve stem.
 - (ii) Submit shop drawings of the stem extension guides and wall brackets in accordance with E9 of this specification.
- (h) Flange Adapter
 - (i) Vanstone Flange or approved equal.
- (i) Miscellaneous Metals and Accessories
 - (i) In accordance with E16 of this specification and as shown on the Drawings.

E12.3 Construction Methods

- (a) Install pre-cast concrete gate chambers as shown on the Drawings in accordance with Clause 3.8 and 3.9 of CW 2130.
- (b) Gate Valve Installation
 - (i) Install gate valves, flange adapters and valve stems as shown on the Drawings.
 - (ii) Gate valves shall be left in the open position at all times except when on site working on the valve.
- (c) Flap Gate Installation
 - (i) Install flap gates and wall thimbles as shown on the Drawings and in accordance with E of this specification.
- (d) Miscellaneous Metal Fabrications
 - (i) Install miscellaneous metal fabrications as shown on the Drawings and in accordance with E16 of this specification.

E12.4 Measurement and Payment

- (a) Construction of pre-cast concrete gate chambers will be measured on a unit basis and paid for at the Contract Unit Price for "Pre-cast Concrete Gate Chamber". The number of units to be paid for will be the total number of pre-cast concrete gate chambers constructed in accordance with this specification, accepted and measured by the Contract Administrator.

E13. CAST IRON SLUICE GATES

E13.1 Description

(a) General

- (i) This Specification shall cover the supply, delivery, installation and testing of cast iron sluice gates, wall thimbles, mechanical lift operator, stems, wall brackets and accessories.

(b) General Design:

- (i) Specification Standard: AWWA C560
- (ii) Type: Rising stem with stop nut, flange back with standard bottom closure.
- (iii) Mounting: Type F wall thimble
- (iv) Seating Head: Maximum design seating head for all sluice gates will be from centreline of the gate to the top of the gate chamber unless noted otherwise on the Drawings.
- (v) Operator and Lift: Enclosed gear lift with pedestal.
Operator to be finished with a 50 millimetre x 50 millimetre square nut suitable for attachment of an electric portable drill for opening.
Operator shall turn counter clock wise to open.
- (vi) Stem Cover: Gear lift to be complete with stem cover with acrylic window with gradations in suitable increments for the entire range of gate operation.
- (vii) Stem Guides: Adjustable in both the horizontal and vertical directions.

E13.2 Materials

- (a) Frame, Slide, guides and yoke ASTM A48 Cast Iron, Class 30
- (b) Seating Faces ASTM B21 Naval Bronze, Alloy 482
- (c) Wall Thimble ASTM A48 Cast Iron, Class 30
- (d) Wedges ASTM B564 Manganese Bronze, Alloy 865
- (e) Wedge Blocks ASTM A48 Cast Iron, Class 30
- (f) Fasteners & Anchors ASTM A276 Type 316 Stainless Steel
- (g) Stem ASTM A276 Type 304 Stainless Steel
- (h) Stem Couplings ASTM A276 Type 304 Stainless Steel
- (i) Stem Guide ASTM A48 Cast iron, Class 30 with Bronze bushings
- (j) Operator Pedestal ASTM A48 Cast Iron, Class 30 or Steel
- (k) Stem cover Aluminium or galvanized steel
- (l) Shop Drawings
 - (i) Submit shop drawings of cast iron sluice gates, wall thimbles, mechanical lift operator, stems, wall brackets and accessories in accordance with E9 of this specification.
 - (ii) Submit a shop drawing of the stem coupling in accordance with E9 of this specification for the stem extension at the Dunham Road Gate Chamber.
- (m) Operating and Maintenance Manuals
 - (i) Provide five (5) copies of all the manufacturer's brochures and technical literature detailing correct installation procedure and recommended operating and maintenance instructions. Manuals shall be bound with the project title and gate

description identified on the front cover. One set of manuals shall be provided for each size of gate. Final payment for sluice gates will not be made until the above information has been provided to the Contract Administrator.

- (n) Delivery and Shipping
 - (i) The Contract Administrator will examine the sluice gate assemblies, thimbles, frames, stems, operators and accessories upon delivery and will reject any equipment that is found to be damaged to the extent that, in the Contract Administrator's opinion, it cannot be put to the use for which it was intended. The Contractor shall arrange with the gate supplier to repair any superficially damaged equipment to the satisfaction of the Contract Administrator.
 - (ii) It shall be the responsibility of the Contractor to negotiate any claims for damage with the carrier and to make arrangements to have any rejected equipment replaced as soon as possible at no extra expense to the City.

E13.3 Construction Methods

- (a) Installation
 - (i) Install cast iron sluice gates, wall thimbles, mechanical lift operator, stems, wall brackets and accessories as shown on the drawings and in accordance with the manufacturer's recommendations.
 - (ii) Make arrangements to have a qualified field representative of the sluice gate supplier/manufacturer inspect the installation during and after completion and provide a Certificate of Satisfactory Installation to the Contract Administrator.
 - (iii)
- (b) Removal and Relocation of Existing Mechanical Lift Operator and Stem Extension at Dunham Road Gate Chamber
 - (i) Secure the sluice gate in the open position before removing the mechanical lift operator and pedestal. The gate should be secured in such a way that it can be closed if need be.
 - (ii) Neatly disconnect the existing mechanical lift operator from the gate stem, unbolt from the existing concrete slab, and store in a secure location where the operator will not be damaged.
 - (iii) Make required measurements of the existing stem for the required coupling to join the existing stem to the stem extension.
- (c) Shop Testing
 - (i) The fully assembled gate shall be shop inspected, adjusted and tested for operation and leakage at the design head before shipping.
 - (ii) Provide the following information to the Contract Administrator prior to delivery of sluice gate and operator assemblies:
 - (i) A certified copy of the Chemical and Physical Analysis on all materials used in the manufacture of the sluice gate, wall thimble, stems, operator and accessories or certification that the materials used are in strict accordance with this specification.
 - (ii) Copies of the test reports for Performance and Leakage tests. Included on the report shall be the signature of the official who is responsible for the gate assembly and testing.
- (d) Field Testing
 - (i) Perform leakage tests in the Contract Administrator's presence once sluice gates have been installed to ensure compliance with the allowable leakage rate indicated in AWWA C561.

- (ii) Arrange for a qualified field representative of the sluice gate supplier/manufacturer to be present during field testing.
- (iii) Generally, the test for seating head will be performed by closing the gate against high river levels in the spring and measuring the leakage rate through the gate.
- (iv) If it is not possible to use high river level, install an inflatable plug in the outfall, fill the chamber with water to the specified head and measure the leakage rate through the gate. Inflatable plug shall be inflated from, anchored to and removable from the ground surface.
- (v) The test for the unseating head will be performed by closing the sluice gate and flap gate, filling the chamber between the gates with water to the specified head and measuring the leakage rate through the gates.
- (vi) The Contractor will be responsible to pump river water or supply water from a hydrant into the chamber for testing purposes.
- (vii) If a gate fails the field leakage test, the Contractor shall undertake adjustments, replacements or other modifications recommended by the sluice gate supplier/manufacturer's field representative and repeat the test. The sequence shall be repeated until the gate passes the allowable leakage rate.

E13.4 Measurement and Payment

- (a) Supply, installation and testing of cast iron sluice gates, wall thimbles, mechanical lift operator, stems, wall brackets and accessories will be included in gate chamber construction.
- (b) Removal and relocation of existing mechanical lift operator and stem extension at Dunham Road Gate Chamber will be included in gate chamber construction.

E14. CAST IRON FLAP GATES

E14.1 Description

- (a) General
 - (i) This Specification shall cover the supply, delivery, installation and testing of cast iron flap gates and wall thimbles.
- (b) General Design:
 - (i) Leakage rate Specification Standard: AWWA C560
 - (ii) Type: Flange Back for mounting on a wall thimble or flat concrete wall.
 - (iii) Mounting: Type F wall thimble
 - (iv) Seating Head: Maximum design seating head for all flap gates will be from centreline of the gate to the top of the gate chamber unless noted otherwise on the Drawings.
 - (v) Cover: One piece cast iron with lifting eye for manual operation
 - (vi) Seat: One piece cast iron, raised surface and inclined to assure positive closure.
 - (vii) Links: Complete with grease nipples at pivot pints and adjusting screws to align seating faces.
 - (viii) Pivot Lugs: One piece cast iron adjustable in the horizontal plane without removal of cover, complete with grease nipples.
 - (ix) Stem Guides: Adjustable in both the horizontal and vertical directions.

E14.2 Materials

- (a) Cast Iron pieces: ASTM A48 Cast Iron, Class 30

- (b) Seating Faces: ASTM B21 Bronze, Alloy 482
- (c) Links: Cast iron or high tensile Bronze B584 – C865
- (d) Bushings: Bronze B21, Alloy 482
- (e) Hinge Pins: ASTM A276, Type 316 stainless steel or silicon Bronze B98-CA655
- (f) Fasteners: ASTM A276, Type 316 stainless steel
- (g) Shop Drawings
 - (i) Submit shop drawings of cast iron flap gates and wall thimbles in accordance with E9 of this specification.
- (h) Operating and Maintenance Manuals
 - (i) Provide five (5) copies of all the manufacturer's brochures and technical literature detailing correct installation procedure and recommended operating and maintenance instructions. Manuals shall be bound with the project title and gate description identified on the front cover. One set of manuals shall be provided for each size of gate. Final payment for flap gates will not be made until the above information has been provided to the Contract Administrator.

E14.3 Construction Methods

- (a) Installation
 - (i) Install cast iron flap gates and wall thimbles as shown on the drawings and in accordance with the manufacturer's recommendations.
 - (ii) Make arrangements to have a qualified field representative of the flap gate supplier/manufacturer inspect the installation during and after completion and provide a Certificate of Satisfactory Installation to the Contract Administrator
- (b) Delivery and Shipping
 - (i) The Contract Administrator will examine the flap gate assemblies and wall thimbles upon delivery and will reject any equipment that is found to be damaged to the extent that, in the Contract Administrator's opinion, it cannot be put to the use for which it was intended. The Contractor shall arrange with the gate supplier to repair any superficially damaged equipment to the satisfaction of the Contract Administrator.
 - (ii) It shall be the responsibility of the Contractor to negotiate any claims for damage with the carrier and to make arrangements to have any rejected equipment replaced as soon as possible at no extra expense to the City.
- (c) Shop Testing
 - (i) The fully assembled gate shall be shop inspected, adjusted and tested for operation and leakage at the design head before shipping.
 - (ii) Provide the following information to the Contract Administrator prior to delivery of flap gate and wall thimble:
 - (i) A certified copy of the Chemical and Physical Analysis on all materials used in the manufacture of the flap gate and wall thimble or certification that the materials used are in strict accordance with this specification.
 - (ii) Copies of the test reports for Performance and Leakage tests. Included on the report shall be the signature of the official who is responsible for the gate assembly and testing.
- (d) Field Testing
 - (i) Perform leakage tests in the Contract Administrator's presence once flap gates have been installed to ensure compliance with the allowable leakage rate indicated in AWWA C561.

- (ii) Arrange for a qualified field representative of the flap gate supplier/manufacturer to be present during field testing.
- (iii) The test for seating head will be performed by closing the flap gate and sluice gate, filling the chamber between the gates with water to the specified head and measuring the leakage rate through the gates.
- (iv) The Contractor will be responsible to pump river water or supply water from a hydrant into the chamber for testing purposes.
- (v) If a gate fails the field leakage test, the Contractor shall undertake adjustments, replacements or other modifications recommended by the flap gate supplier/manufacturer's field representative and repeat the test. The sequence shall be repeated until the gate passes the allowable leakage rate.

E14.4 Measurement and Payment

- (a) Supply, installation and testing of cast iron flap gates and wall thimbles will be included in gate chamber construction.

E15. FOUNDATION WATERPROOFING

E15.1 Description

(a) General

- (i) This Specification shall cover the supply and placement of underground concrete gate chamber foundation waterproofing.

E15.2 Materials

- (a) Waterproofing membrane: Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, reinforced with non-woven polyester weighing 180 g/m². Top surface polyethylene film. Bottom surface: thermofusible plastic film. Acceptable material: Soprema Sopralene Flam 180, IKO Aquabarrier TG.
- (b) Primes, mastic sealant and accessories: as recommended by membrane manufacturer, applicable for substrate.
- (c) Protection board: insulating fibreboard to CAN/CSA-A247, Type II, 12 millimetres thick.

E15.3 Construction Methods

(a) Quality Assurance

- (i) Installation of waterproofing membrane shall be performed by workers approved and trained by manufacturer for application of its products. Applicators must have minimum 5 years proven experience. If requested, submit proof of experience, in writing, from manufacturer.

(b) Warranty

- (i) Provide written warranty, signed and issued in the name of the Owner stating that the waterproofing is guaranteed against leaking, loss of adhesion, for a period of five (5) years from the date of acceptance

(c) Environmental Requirements

- (i) Maintain air temperature and structural base temperature at installation area above membrane manufacturer's recommendations before, during and 72 hours after installation.
- (ii) For applications in freezing weather do not commence application until authorized by membrane manufacturer.
- (iii) For enclosed applications ensure adequate forced air circulation during curing period.

- (iv) Install membrane on dry substrates, free of snow and ice. Use only dry materials and apply only during weather that will not introduce moisture beneath waterproofing membrane.
- (d) Preparation
 - (i) Examine substrates and site conditions to ensure acceptability for application of waterproofing membranes. Notify Contract Administrator, in writing, of unsuitable surfaces or working conditions.
 - (ii) Do not commence application until all other work that will penetrate membrane is complete.
 - (iii) Clean substrates of all snow, ice, loose particles, oil, grease, dirt, curing compounds, or other foreign matter detrimental to application of primers and waterproofing membranes.
 - (iv) Ensure concrete surfaces are fully cured and dry using test methods recommended by membrane manufacture.
 - (v) Repair defects in concrete surfaces such as spalled or poorly consolidated concrete. Remove sharp protrusions, sharp edges and form lines.
 - (vi) Patch rough areas with a weld-adhered parge coat to provide smooth surface. Allow to fully cure and dry.
- (e) Priming
 - (i) Apply primer in accordance with manufacturer's instructions at recommended rate of application.
 - (ii) Do not apply primer to frozen or damp surfaces.
 - (iii) Apply primer only when air and surface temperatures are within manufacturer's recommended limits.
 - (iv) Avoid pooling of primer and allow to cure until tack-free.
 - (v) Prime only the area to be covered with membrane in a working day. Re-prime areas not covered with waterproofing within 24 hours of application of primer.
- (f) Membrane Application
 - (i) Apply membrane in accordance with manufacturer's instructions and with good construction practice to maintain continuity of waterproofing over building elements below finished grade elevation.
 - (ii) Place membrane in position without stretching, taking care to avoid trapped air, creases or fish mouths.
 - (iii) Ensure membrane is totally bonded to substrate.
 - (iv) Apply membrane vertically in longest possible lengths to reduce number of end joints.
 - (v) Overlap side laps minimum 75 millimetres and end laps minimum 150 millimetres. Stagger end laps minimum 300 millimetres in adjacent rows.
 - (vi) Seal horizontal and vertical terminations by applying heavy pressure to edges with a roller to ensure positive bond. Apply a continuous bead of mastic sealant to all terminations. Make watertight. Seal daily terminations with mastic sealant.
 - (vii) Terminate membrane 300 millimetres below finished grade.
- (g) Membrane Application at Corners
 - (i) Remove sharp or protruding edges from external corners prior to application of membrane.
 - (ii) Reinforce external corners with cushion strip of membrane minimum 300 mm wide at each corner. Install cushion strip below main membrane.
- (h) Membrane Application Over Protrusions and Penetrations

- (i) Apply two layers of membrane flashing around protrusions, and extend at least 150 millimetres in all directions. Cut and fit membrane neatly and snug fitting, leave no gaps. Seal all terminations with mastic sealant. Flash protrusions with liquid mastic extending 150 millimetres along pipe or conduit.
 - (ii) Seal with liquid mastic all protrusions or difficult detail areas which do not allow easy installation of membrane. Make watertight.
- (i) Inspection and Repair
- (i) Inspect membrane thoroughly before covering and make corrections immediately.
 - (ii) Patch and repair misaligned or inadequately lapped seams, tears, punctures or fishmouths.
 - (iii) Patch with piece of waterproofing membrane and extend minimum 150 millimetres in all directions from fault and seal edges with mastic sealant.
- (j) Protection Board
- (i) Install protection board against all waterproofing membranes to protect against backfilling operations.
 - (ii) Install boards vertically without fasteners or adhesives.
 - (iii) Install protection board during backfilling operations to allow backfill materials to hold protection board tight to waterproofing membrane.
 - (iv) Terminate protection board 600 millimetres below grade.

E15.4 Measurement and Payment

- (a) Supply and installation of waterproofing membrane and protection board will be included in gate chamber construction.

E16. METAL FABRICATIONS

E16.1 Description

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

E16.2 Materials

- (a) All materials shall be of a type acceptable to the Contract Administrator, and shall be subject to inspection and testing by the Contractor Administrator.
- (b) Material intended for use in the various assemblies shall be new, straight, clean, with sharply defined profiles.
- (c) Steel Sections and Plates: to CAN/CSA G40.20/G40.21, Grade 300 W, except W, HP and HSS sections, which shall be Grade 350 W.
- (d) Steel Pipe: to ASTM A53/A53M, seamless, galvanized, as specified by item.
- (e) Welding materials: to CSA W59.
- (f) Hot dipped galvanized steel repair material: Galvalloy and Gal-Viz
- (g) Stud Anchors: to ASTM A108, Grade 1020.
- (h) Aluminum: to CAN/CSA S157 and the Aluminum Association 'Specifications for Aluminum Structures'. Aluminum for plates shall be Type 6061-T651. Aluminium plate shall have an approved raised oval or multi-grip pattern.
- (i) Isolating sleeves shall be "Nylite" – headed sleeve as manufactured by SPAE-Naur of Kitchener, Ontario, or approved equal.

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

E16.3 Construction Methods

(a) Submittals

- (i) The Contractor shall submit the qualifications of the fabricator and welders to the Contractor Administrator for acceptance.
- (ii) Submit shop drawings in accordance with E9 clearly indicating materials, core thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and, accessories. Indicate field measurements on shop drawings.

(b) Fabrication

- (i) Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured. Assemble work in such a way that no disfigurements will show in the finished work, or impair the strength.
- (ii) Confirm measurements for all fabrications before fabricating.
- (iii) Cut aluminium plate with edges straight and true, and as far as practical, maintain continuity of the pattern at abutting edges.
- (iv) Pieces shall be of the sizes indicated on the Drawings and shall not be built up from scrap pieces. Confirm sizes with field measurements.
- (v) Where possible, fit work and shop assemble, ready for erection.
- (vi) Angle frames shall be of the same material as the cover plate, and cover plates shall be hinged and be supplied with lifting handles, as shown on the Drawings. Exterior covers shall be supplied with a hasp for a padlock.
- (vii) Remove and grind smooth burrs, filings, sharp protrusions, and projections from metal fabrications to prevent possible injury. Correct any dangerous or potentially harmful installations as directed by Contract Administrator.
- (viii) All steel welding shall conform to CSA Standard W.59. Fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with CSA Standard W.47.1. Welding shall be done by currently licensed welders only.
- (ix) All aluminium welding shall conform to Welding shall be in accordance with the requirements of CSA W59.2. The fabricator shall be fully certified in conformance with CSA Standard W47.2. All welding shall be done in a licensed welding shop, and no field welding will be permitted unless approved in writing, in advance, by the Contract Administrator.
- (x) Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- (xi) All steel shall be hot-dip galvanizing after fabrication, in accordance with CAN/CSA-G164, to a minimum net retention of 600 gm/m².
- (xii) Seal exterior steel fabrications to provide corrosion protection in accordance with CAN3-S16.1.
- (xiii) Use self-tapping shake-proof flat-headed screws on items requiring assembly by screws.

(c) Erection

- (i) Do steel welding work in accordance with CSA W59 and aluminium welding work in accordance with CSA W59.2
- (ii) Erect metalwork in accordance with reviewed shop drawings, square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

- (iii) Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles where not specifically indicated on the Drawings.
- (iv) Provide components for building in accordance with shop drawings and schedule.
- (v) Make field connections with bolts to CAN/CSA-S16, or weld.
- (vi) Touch-up rivets, bolts and burnt or scratched surfaces that are to receive paint finish, with zinc primer after completion of erection.
- (vii) Repair damaged galvanized surfaces and field welds with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780, Repair of Damaged Hot Dip Galvanizing Coatings. The general procedure shall be to allow a small amount of the repair alloy to flow then spread by brushing briskly with a wire brush. Brushing shall be sufficient to obtain a bright finish. Repeat process three times to ensure a proper thickness is achieved. Temperatures shall be kept below 177°C (350°F) at all times. All heating of structural steelwork shall be done in the presence of the Contract Administrator.
- (viii) Install access hatch frames square and level at the locations show on the Drawings. Embed anchors in concrete as shown on the Drawings. Install covers and adjust hardware to proper function.
- (ix) All aluminium surfaces in contact with concrete shall be isolated using alkali-resistant bituminous paint meeting the requirements of CGSB 31-GP-3M.
- (x) Install electrochemical isolation gaskets and sleeves to electrically isolate dissimilar metals.

E16.4 Measurement and Payment

- (a) Supply, fabrication, transportation, handling, delivery and placement of metal fabrications will be included in gate chamber construction.

E17. TEMPORARY SURFACE RESTORATION AND MAINTENANCE

E17.1 Further to CW 1130, if the Contractor fails to maintain disturbed surfaces as directed and within the time period given by the Contract Administrator, the City or its designate may perform the work required and the cost may be deducted from payments owed.

E17.2 Costs for temporary restoration and maintenance of disturbed surfaces will be included in gate chamber construction.

E18. SURFACE RESTORATION

E18.1 Restoration of all existing surface areas disturbed by construction activities including but not limited to areas disturbed by; construction equipment, placement of field office or equipment trailer, snow clearing and where construction materials were stockpiled, shall be restored as follows.

- (a) Grassed areas: sodding using imported topsoil in accordance with CW 3510.
- (b) Gravel surfaces: in accordance with CW 3150.
- (c) Asphalt surfaces: match existing base course and asphalt thickness or a minimum of 150 millimetres of base course and 75 millimetres of Type 1A Asphaltic concrete whichever is greater, in accordance with CW 3410.
- (d) Pavement slabs (including private approaches): in accordance with CW 3230.
- (e) Miscellaneous concrete slabs (median slab, sidewalk, bullnose: in accordance with CW3235
- (f) Concrete curb and gutter: in accordance with CW 3240.

(g) Interlocking pavement stones: CW 3330.

E18.2 Restore berms constructed around finished gate chambers with sod using imported topsoil in accordance with CW 3510. Berm areas indicated on the Drawings to have "Turfstone" shall be in accordance with E19 of this specification.

E18.3 Costs for permanent surface restoration will be included in gate chamber construction.

E19. INTERLOCKING CONCRETE SURFACING

E19.1 Description

(a) General

(i) This specification shall cover the supply and installation of interlocking concrete surfacing on berms constructed around gate chambers.

E19.2 Materials

(a) Interlocking Concrete Surfacing

(i) "Turfstone" Interlocking Concrete Surfacing by Barkman Concrete Ltd. or approved equal. Provide samples to the Contract Administrator for approval prior to delivery and installation.

(ii) Length and width of concrete surfacing units not to vary more than 2 millimetres from approved samples.

(iii) Height of concrete surfacing units not to vary by more than 3 millimetres from approved samples.

(b) Granular Base Material

(i) Granular base course shall be crushed limestone in accordance with CW 3110.

(c) Topsoil

(i) Topsoil shall be in accordance with CW 3540.

(d) Seed Mix

(i) Seed mix shall be in accordance with CW 3520 for general park areas, boulevards and medians.

E19.3 Construction Methods

(a) Construct berm to required elevation and excavate to required depth for interlocking concrete surfacing and base course. Excavation to be in accordance with CW 3110. Excavation shall not extend more than 150 millimetres beyond the required limits of the interlocking concrete surfacing.

(b) Construct a 150 millimetre thick compacted granular base course in accordance with CW 3110.

(c) Install interlocking concrete surfacing units onto compacted base course in a pattern acceptable to the Contract Administrator. Fit interlocking concrete surfacing units hand-tight to each other.

(d) Ensure pattern is straight and true and does not wander.

(e) Make required cuts to interlocking concrete surfacing with a masonry saw to leave neat clean edges free from chips.

(f) Finished top height of interlocking concrete surfacing shall be 10 millimetres higher than the finished sod height surrounding the interlocking concrete surfacing.

(g) Fill openings in interlocking concrete surfacing with topsoil and add seed in accordance with CW 3520.

E19.4 Measurement and Payment

- (a) Supply and installation of interlocking concrete surfacing will be included in gate chamber construction.