THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 583-2005

WINNIPEG WATER TREATMENT PROGRAM – WATER TREATMENT PLANT FOUNDATIONS AND CONCRETE STRUCTURES

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02223	EXCAVATION AND BACKFILLING FOR STRUCTURES
02451	PILE FOUNDATIONS, GENERAL
02468	PRECAST CONCRETE PILES
02620	SUB-DRAINAGE
03100	CONCRETE FORMWORK
03200	CONCRETE REINFORCEMENT
03250	CONCRETE ACCESSORIES
03300	CAST-IN-PLACE CONCRETE
03412	PRECAST CONCRETE ROOF PANELS
05500	MISCELLANEOUS STEEL FABRICATIONS
05530	ALUMINUM FABRICATIONS
07550	EPDM WATERPROOF MEMBRANE
09870	COATING SYSTEMS FOR STEEL TANKS AND PIPES
15010	GENERAL MECHANICAL PROVISIONS
15100-00	PLUMBING PIPING
15100-01	DATA SHEET- POLYVINYL CHLORIDE DRAIN WASTE AND VENT(PVC-DWV) PIPE AND FITTINGS
15100-02	DATA SHEET – CAST IRON SOIL PIPE(CISP) AND FITTINGS
15100-03	DATA SHEET - COPPER DRAINAGE AND VENT PIPE AND FITTINGS
15100-10	DATA SHEET - GALVANIZED STEEL DRAIN AND VENT PIPE AND FITTINGS
15200-000	PROCESS PIPING
15200-00L	PIPING SERVICE LEGEND
15200-00S	PIPING SCHEDULE
15200-03	DATA SHEET - CARBON STEEL PIPE AND FITTINGS – GENERAL SERVICE
15200-04	DATA SHEET - CARBON STEEL PIPE AND FITTINGS – LARGE DIAMETER
15200-07	DATA SHEET - GALVANIZED STEEL PIPE AND FITTINGS – GENERAL SERVICE
15200-08	DATA SHEET - STAINLESS STEEL PIPE AND FITTINGS – GENERAL SERVICE
15200-09	DATA SHEET - STAINLESS STEEL PIPE AND FITTINGS – SPECIAL SERVICE 1
15200-10	DATA SHEET- POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS
15200-12	DATA SHEET- FIBREGLASS REINFORCED PLASTIC (FRP) PIPE AND FITTINGS
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15200-19	DATA SHEET- STAINLESS STEEL PIPE AND FITTINGS – SPECIAL SERVICE 2
15200-20	DATA SHEET- STAINLESS STEEL PIPE AND FITTINGS – SPECIAL SERVICE 3
15410	PLUMBING FIXTURES

Appendix A – Forms

Form 103 – Certificate of Equipment Satisfactory Performance

Appendix B – Embedment and Blockout List

PART B - BIDDING PROCEDURES

B1. PROJECT TITLE

B1.1 WINNIPEG WATER TREATMENT PROGRAM – WATER TREATMENT PLANT FOUNDATIONS AND CONCRETE STRUCTURES

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, March 10, 2006.

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

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

B3. SITE INVESTIGATION

B3.1 Further to GC:3.1, the Contract Administrator or an authorized representative will be available at the Site from 11:00 a.m. to 12:00 noon on February 20, 2006 to provide Bidders access to the Site.

B3.2 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B4. ENQUIRIES

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

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

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

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

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

B5. ADDENDA

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

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

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

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

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

B6. SUBSTITUTES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

B7. BID SUBMISSION

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

(a) Form A: Bid;

(b) Form B: Prices; and

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

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

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

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

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

B7.5 Bid Submissions shall be submitted to:

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

B8. BID

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

B9. PRICES

B9.1 The Bidder shall state the lump sum price in Canadian funds for the Work on Form B: Prices.

B10. QUALIFICATION

B10.1 The Bidder shall:

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

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

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

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

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

(f) employ only Subcontractors who:

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

(ii) have successfully carried out work similar in nature, scope and value to the portion of the Work proposed to be subcontracted to them, and are fully capable of performing the Work required to be done in accordance with the terms of the Contract;

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

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

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

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

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

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

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

B11. BID SECURITY

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

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

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

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

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

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

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

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

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

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

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

B12.1.1 Bidders or their representatives may attend.

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

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

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

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

B13. IRREVOCABLE BID

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

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

B14. WITHDRAWAL OF BIDS

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

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

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

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

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

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

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

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

B15. EVALUATION OF BIDS

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

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

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

(c) Total Bid Price;

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

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

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

B15.4 Further to B15.1(c), the Total Bid Price shall be the lump sum price shown on Form B: Prices.

B15.4.1 If there is any discrepancy between the lump sum price written in figures and the lump sum price written in words, the price written in words shall take precedence.

B16. AWARD OF CONTRACT

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

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

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

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

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

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

(d) only one Bid is received; or

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

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

PART C - GENERAL CONDITIONS

C1. GENERAL CONDITIONS

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

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

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

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

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

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

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

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of construction of a reinforced concrete water treatment plant structure and chlorine contact tank effluent conduit and three (3) permanent bridges.

D2.1.1 Certain works have been or will be constructed by others and includes bulk excavation to grades as shown on drawing WM-C0165 and other contracts specified in D22.

D2.2 The major components of the Work are:

(a) Excavation and backfilling except as noted in D2.1.1.

(b) Construction of cast-in-place concrete components as specified in the Contract Documents including footings, foundations, slabs, walls, pits, pads and concrete pipe supports and fill concrete. Grouting between pipes, pipe supports will be supplied and installed by the pipe Supply Contractor.

(c) Construction of foundation drainage around the perimeter including manholes.

(d) Supply and installation of all dampproofing, EPDM membrane, insulation and protection board as specified in Section 07550.

(e) Supply, delivery and installation of all precast concrete piles shown on the drawings and not otherwise specified in D2.2(g)(i).

(f) Performance Verification of water retaining structures.

(g) City Supplied Equipment:

(i) Precast concrete piles: The Contractor shall pick up and deliver to the Site and install one thousand five hundred fifty (1,550) City supplied 400mm precast concrete piles 13m to 18m in length. The fabrication of these City supplied piles is specified in City of Winnipeg Bid Opportunity 378-2005 and City of Winnipeg Bid Opportunity 694-2005 and shall be installed in the Filtration Area 1, Filtration Area 2, Ozonation Area and Residuals Handling Area. This City Supplied Equipment will be located at 185 Dawson Road, Winnipeg, Manitoba.

(ii) Mechanical wall embeds and sleeves: Mechanical wall embeds and sleeves will be supplied by a Supply Contractor for installation by the Contractor.

(iii) Mechanical and electrical slab embeds and sleeves: Mechanical and electrical slab embeds and sleeves will be supplied and installed by the Supply Contractors.

(iv) The location of all mechanical and electrical embeds shall be generally as shown on the Drawings, however, final locations of all mechanical and electrical embeds shall be determined based on pipe placement shop drawings prepared by the Supply Contractors. The Contractor shall identify in the Contract Work Schedule each concrete placement that requires pipe placement shop drawings and the Contract Administrator will provide the necessary pipe placement shop drawings a minimum of five (5) Business Days prior to each such concrete placement so identified in the Contract Work Schedule.

(v) Embedments in cast-in-place concrete required for the future installation of precast roof members, monorails and cranes will be supplied by the City and shall be installed by the Contractor. The precast roof members will be supplied and installed by others.

(vi) A Supply Contractor will supply and install fifteen (15) sluice gates and three (3) flap gates. The Contractor shall provide the required openings and prepare concrete surfaces as specified herein.

(h) Supply and installation of all blockouts (including removal as applicable) including blockouts for door frames, louvers, piping and all other penetrations through walls and slabs as shown on the drawings.

(i) Unless otherwise specified in D2.2(g), all embedments in cast-in-place concrete shall be supplied and installed by the Contractor. This includes, but is not limited to, lifting eyes and dowels for CMU.

(j) Supply and installation of aluminum and steel fabrications as specified in Section 05500 and 05530

(k) Construction of three (3) permanent bridges and associated work as specified in Part E.

D2.3 The scope of the specifications in Part E are as follows:

(a) Articles E1 to E16 (inclusive) apply to the Work,

(b) Articles E17 to E30 (inclusive) apply only to the construction of the three permanent bridges and road construction. This construction is shown on the drawings with the WN suffix in the Consultant Drawing No. in E1.2.

(c) Divisions 2, 3, 5 and 7 apply to the Work except as specified in D2.3(b) and D2.2.

(d) Products specified in Divisions 9 and 15 are supplied by others. The Contractor shall install and handle City Supplied Equipment supplied pursuant to these two Divisions in accordance with the provision of the applicable Sections in these Division and D2.2.

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

(a) **ANSI** means American National Standards Institute

(b) **ASME** means American Society of Mechanical Engineers

(c) **ASTM** means American Society for Testing and Materials

(d) **AWWA** means American Water Works Association

(e) **CSA** means Canadian Standards Association

(f) **DAF** means Dissolved Air Flotation

(g) **DBPS** means Deacon Booster Pumping Station

(h) **EPDM** means Ethylene Propylene Diene Monomer

(i) **GWWD** means Greater Winnipeg Water District

(j) **HDPE** means High Density Polyethylene

(k) **IEC** means International Electrotechnical Commission

(l) **ISO** means International Organization for Standardization

(m) **NACE** means National Association of Corrosion Engineers

(n) **NEMA** means National Electrical Manufacturers Association

(o) **NSF** means National Sanitation Foundation, and

(p) **SAE** means Society of Automotive Engineer

(q) **SSPC** means Steel Structures Painting Council

(r) **RWPS** means Raw Water Pumping Station

(s) **TGS** means Manitoba Transportation and Government Services

(t) **CMU** means concrete masonry unit fabricated to CAN3-A165 also known as concrete block.

(u) **Manufacturer** means the person, partnership or corporation responsible for the manufacture and fabrication of equipment supplied by the Contractor for the completion of the Work.

(v) **Manufacturer's Representative** means a trained serviceman empowered by the Manufacturer to provide installation, testing, and commissioning assistance to the Contractor in his performance of those functions.

(w) **Supply Contractor** means a contractor retained by the City under a separate contract to supply City Supplied Equipment installed under this Contract.

(x) **City Supplied Equipment** means equipment purchased by the City under a separate contract which is supplied into the care of the Contractor for installation under this Contract.

(y) **IEEE** means Institute of Electrical and Electronics Engineers

(z) **NEMA** means National Electrical Manufacturer's Association

(aa) **ISA** means the Instrumentation Systems and Automation Society

(bb) **API** means American Petroleum Institute

(cc) **Contract Work Schedule** means a Gantt Charter developed by the Contractor developed using the critical path method which shows the proposed progress of the major items of work which are to be performed under this Contract

(dd) **Project Master Schedule** means a schedule developed by the Contract Administrator which includes and coordinates the Contract Work Schedules of several City contracts, including this Contract

(ee) **Professional Engineer** means a professional engineer registered in the Province of Manitoba.

(ff) **Performance Verification** means all factory and field tests, demonstrations and other activities required from the Contractor to complete Form 103 – Certificate of Equipment Satisfactory Performance and to demonstrate to the Contract Administrator's satisfaction that the equipment supplied under this Contract is performing as specified herein.

(gg) **Acceptable Shop Drawings** means all required Shop Drawings have been reviewed by the Contract Administrator and have been annotated and stamped as "reviewed" or "reviewed as modified" in accordance with E11.

(hh) **SCADA** means supervisor control and data acquisition

(ii) **WTP** means the Winnipeg Water Treatment Plant and includes the structure and all equipment and materials supplied and installed into the building, under multiple construction contracts, including the Work provided under this Contract.

(jj) **City Warehouse** means the enclosed and heated City owned warehouse located at 1500 Plessis Road, Winnipeg, Manitoba.

(kk) **Record Drawings** means a minimum of one (1) complete set of Contract Documents and Shop Drawings maintained at the Contractor's Site office on which the Contractor clearly shall clearly record in red pencil all Addenda, Change Orders, Field Instructions, and other revisions or as-built conditions which deviate from the original Contract Documents or Acceptable Shop Drawings.

(ll) **Floculation/DAF Area 1** means all building areas within the Floculation/DAF Area 1 of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140.

(mm) **Floculation/DAF Area 2** means all building areas within the Floculation/DAF Area 2 of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140.

(nn) **Administration Area** means all building areas within the Administration Area of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140.

(oo) **Ozonation Area** means all building areas within the Ozonation Area of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140.

(pp) **Residuals Handling Area** means all building areas within the Residuals Handling Area of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140.

(qq) **Chemical Systems Area** means all building areas within the Chemical Systems Area of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140.

(rr) **Filtration Area 1** means all building areas within the Filtration Area 1 of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140, including the attached flap gate chamber.

(ss) **Filtration Area 2** means all building areas within the Filtration Area 2 of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140.

(tt) **Electrical Area** means all building areas within Electrical of the WTP as shown on the structural key plans WB-S0100, WB-S0110, WB-S0115,WB-S0120, WB-S0130 and WB-S0140 including the attached flap gate chamber.

D3.2 The definitions of technical terms, abbreviations, and symbols will be those of the American Society for Testing and Materials, Canadian Standards Association and the applicable Codes and Standards. In the event of a dispute, the Contract Administrator's decision will be final.

D3.3 The Manufacturer and Manufacturer's Representative are not parties to this Contract. All work required from the Manufacturer and Manufacturer's Representative shall be provided and coordinated by the Contractor.

D3.4 The technical terms related to coating systems shall be as defined in clause 1.2 of Section 09870.

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is UMA Projects (CM) Ltd., represented by:

Bill Richert, P. Eng.
Deacon Reservoir WTP Project Offices
RM of Springfield

Telephone No. (204) 986-6053
Facsimile No. (204) 986-8393

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

D5. CONTRACTOR'S SUPERVISOR

D5.1 At the pre-construction meeting, the Contractor shall identify his designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D6. NOTICES

D6.1 Except as provided for in GC:23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

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

D6.3 All notices of appeal to the Chief Administrative Officer shall be sent to the following address or facsimile number:

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

Facsimile No.: (204) 949-1174

D6.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

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

Facsimile No.: (204) 947-9155

D7. FURNISHING OF DOCUMENTS

D7.1 Upon award of the Contract, the Contractor will be provided with six (6) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

SUBMISSIONS

D8. SAFE WORK PLAN

D8.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D8.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt

D9. INSURANCE

D9.1 The City will provide and maintain the following Project Insurance Coverages:

(a) Builder's Risk Insurance in the amount of one hundred percent (100%) of the total project cost.

(i) The Contractor shall be responsible for deductibles up to $10,000.00 maximum of any one loss.

(b) Wrap-Up Liability Insurance in an amount of no less than 10 million dollars ($10,000,000.00)

(i) The Contractor shall be responsible for deductibles up to $10,000.00 maximum of any one loss..

(c) The City of Winnipeg will carry such insurance to cover all parties engaged in the Work in this Contract. Provision of this insurance by the City of Winnipeg is not intended in any way to relieve the Contractor from his obligations under the terms of the Contract. Specifically, losses relating to deductibles for insurance, as well as losses in excess of limits of coverage and any risk of loss that is not covered under the terms of the insurance provided by the City of Winnipeg remains with the Contractor.

D9.2 The Contractor shall provide and maintain the following insurance coverage at all times during the performance of the Work:

(a) Automobile liability insurance for owned and non-owned automobiles used for or in connection with the work in the amount of at least two million dollars ($2,000,000.00).

(i) Deductibles shall be borne by the Contractor;

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

(iii) The Contractor shall provide the Contract Administrator with evidence of insurance of the policy at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than seven (7) Calendar Days from notification of the award of Contract.

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

D10. PERFORMANCE SECURITY

D10.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

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

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

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

D10.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D10.2 If the bid security provided in his Bid Submission was not a certified cheque or draft pursuant to B11.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D11. DETAILED PRICES

D11.1 The Contractor shall provide the Contract Administrator with a detailed price breakdown in a format acceptable to the Contract Administrator at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D11.2 Detailed Prices shall include the following unit prices:

(a) Ten thousand dollars ($10,000) for the successful water tightness testing of each water retaining structure in accordance with clause 3.16 of Section 03300 (46 units in total).

D12. SUBCONTRACTOR LIST

D12.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D13. DETAILED WORK SCHEDULE

D13.1 The Contract Administrator has developed a Project Master Schedule for the project. This schedule will be available in the offices of the Contract Administrator and will be updated as required as the work progresses.

D13.2 The Contractor shall prepare a detailed Contract Work Schedule for his work based on a critical path method (CPM) approach and provide this Contract Work Schedule at least two (2) Business Days prior to beginning any work on Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D13.3 The schedule shall conform to the Project Master Schedule and show, in a clear graphical manner, through the use of Gantt charts, in a maximum of weekly stages, the proposed progress of the main items, structures and subtrades of the contract and indicate the labour, construction crews, plant and equipment to be employed. Indicate the delivery date of major pieces of equipment to be supplied. The schedule shall be predicated on the completion of all work on or before the date of Substantial Performance.

D13.3.1 The Contract Work Schedule shall include, but is not limited to, the detailed concrete placement schedule required to coordinate the preparation of pipe placement shop drawings as specified in D2.2(g), the Shop Drawing submission schedule and the water tightness testing schedule, by area.

D13.4 Upon acceptance by the Contract Administrator, distribute copies of the revised schedule to Subcontractors and other concerned parties.

D13.5 The Contract Work Schedule shall be updated as the work requires and submitted to the Contract Administrator.

D13.6 The Contractor shall instruct recipients to report to the Contractor immediately any problems anticipated by the timetable shown in the Contract Work Schedule.

D13.7 While it is intended that the Contractor shall be allowed, in general, to carry on the Contract in accordance with such general plans as may appear to him to be most desirable, the Contract Administrator, at his discretion, may direct the order in which, and points at which, the work shall be undertaken.

D13.8 This control shall be exercised in the interests of the City so that the work or other Contractors who may be working on the site may be coordinated with the work on this Contract. A program of work will be drawn up and agreed to before the commencement of the Contract.

D13.9 The Contract Administrator shall be notified immediately when the work under the Contract Work Schedule will adversely affect the work of other Contractors and the critical path of the Project Master Schedule as the work under the Contractor's Contract Work Schedule is an integral part of the Project Master Schedule..

SCHEDULE OF WORK

D14. COMMENCEMENT

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

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

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

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

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

(iii) the Safe Work Plan specified in D8;

(iv) evidence of the insurance specified in D9;

(v) the performance security specified in D10;

(vi) the detailed prices specified in D11;

(vii) the Subcontractor list specified in D12; and

(viii) the Contract Work Schedule specified in D13.

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

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

D15. SCHEDULE RESTRICTIONS

D15.1 The intent of this contract is to complete the various areas of the Work such that the work under the Water Treatment Plant (WTP) exterior envelope contract can start as early as possible in 2006. To accomplish this it is expected that the Work of this contract will be carried out in an orderly manner so as to allow exterior envelope work to proceed progressively from area to area. The Contractor is required to complete the construction of specific areas in accordance as noted in D16. Critical Stages.

D15.2 The Raw Water Pumping Station (RWPS) Contract 650-2005 will be underway during the initial period of this Contract work. Access through and around the RWPS area at the S-W corner of the WTP will be restricted during the RWPS construction period. This Contractor shall cooperate with the RWPS contractor in the interests of both parties but this Contractor should expect that access into the WTP excavation from the south may not always be available.

D15.3 The existing 230 kV Manitoba Hydro transmission line shown immediately north of the A Section Aqueduct on drawing CM-G001 is scheduled to be relocated during June 2006.

D16. CRITICAL STAGES

D16.1 The Contractor shall achieve Critical Stages of the Work in accordance with the following requirements:

(a) August 15, 2006: Complete all components of the Work related to construction of the chlorine contact effluent conduit.

(b) October 31, 2006: Completion of all components of the Work related to the construction of the two most easterly bridges.

(c) November 30, 2006: Complete all components of the Work related to construction of the Filtration Area 1 and Filtration Area 2 to an elevation of 334.4, including backfilling.

(d) January 31, 2007: Complete all components of the Work related to construction of the Administration Area up to an elevation of 345.0 metres.

(e) June 30, 2007: Complete all components of the Work related to construction of Filtration Area 1, Filtration Area 2, Residuals Handling Area and Ozonation Area.

(f) October 17, 2007: Complete all components of the Work related to construction of the Chemical Systems Area.

(g) March 31, 2008. Complete all components of the Work related to construction of the Flocculation/DAF Area 1, Flocculation/DAF Area 2, Electrical Area and the completion of the Administration Area.

D17. SUBSTANTIAL PERFORMANCE

D17.1 The Contractor shall achieve Substantial Performance by March 31, 2008.

D17.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted

during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

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

D18. TOTAL PERFORMANCE

D18.1 The Contractor shall achieve Total Performance by May 31, 2008.

D18.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D18.3 The date on which the Work has been certified by the Contract Administrator as being totally performed to the requirements of the Contract through the issue of a certificate of Total Performance is the date on which Total Performance has been achieved.

D19. LIQUIDATED DAMAGES

D19.1 If the Contractor fails to achieve Critical Stages, Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for same, the Contractor shall pay the City the following amounts per Calandar Day for each and every Calandar Day following the days fixed herein for same during which such failure continues:

(a) Critical Stages specified in D16.1(c) - two thousand, six hundred dollars ($2,600);

(b) Critical Stages specified in D16.1(g) and Substantial Performance - two thousand, six hundred dollars ($2,600); and

(c) Total Performance – six hundred dollars ($600).

D19.2 The amounts specified for liquidated damages in D19.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve critical stages, Substantial Performance or Total Performance by the days fixed herein for same.

D19.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

CONTROL OF WORK

D20. JOB MEETINGS

D20.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

D20.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D21. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D21.1 Further to GC:6.26, UMA Projects (CM) Ltd. shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

D21.2 As Prime Contractor, UMA Projects (CM) Ltd. will administer a Safety and Health Management Plan. Compliance with this Plan will be mandatory for all personnel on the construction site and orientation of all staff by the Prime Contractor's Safety Officer will be required. Further to GC:6.26, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

D21.3 The Water Treatment Program Project Safety and Health Management Plan is available on the City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt/projects

D22. COOPERATION WITH OTHERS

D22.1 The Contractor shall note that several other contracts will be underway at the time of construction, including, but not limited to;

(a) Bid Opportunity 153-2005 Winnipeg Water Treatment Program – Yard Piping and Valve Chambers. Expected completion date: May 30, 2006.

(b) Bid Opportunity 166-2005 Winnipeg Water Treatment Program – Clearwell Construction. Expected completion date: August 31, 2006.

(c) Bid Opportunity 650-2005 Winnipeg Water Treatment Program – Raw Water Pumping Station Construction. Expected completion date: September 15, 2006.

(d) Bid Opportunity 378-2005 Winnipeg Water Treatment Program - Water Treatment Plant Piling Supply. Fabrication of 699 piles has been completed.

(e) Bid Opportunity 694-2005 Water Treatment Program - Supply and Delivery of Precast Piles for the Water Treatment Plant. Including the fabrication of 12,500 metres of precast concrete piles, expected to be completed April 15, 2006.

(f) Bid Opportunity 743-2005 Winnipeg Water Treatment Program – Water Treatment Plant Building Envelope. Expected period of construction: December 1, 2006 – April 30, 2008.

(g) Bid Opportunity 742-2005 Winnipeg Water Treatment Program – Process Mechanical and Electrical Installation. Expected period of construction: September 1, 2006 – June 30, 2008.

(h) Ancillary Building Construction. Expected period of construction: December 1, 2006 – August 30, 2007.

D22.2 Bid Opportunities for D22.1(a), D22.1(b), D22.1(c), D22.1(d) and D22.1(e) are available at the City of Winnipeg Materials Management website at http://www.winnipeg.ca/matmgt/bidopp.asp.

D22.3 The Bid Opportunities for D22.1(f), D22.1(g) and D22.1(h) have not yet been issued for tender, and are not available at the City of Winnipeg Materials Management website.

D22.4 The ancillary buildings noted in D22.1(h) are three building located north of the WTP and clearwell and south of the GWWD rail spur.

D22.5 The Contractor will not have exclusive use of the Site. The Contractor shall coordinate activities with others and minimize disruptions to others, where possible.

D22.6 Where site access requires relocation for installation of works, the Contractor shall construct suitable, all-weather detours, as required.

D22.7 The Contractor shall note that the Deacon Booster Pumping Station and surrounding compound will be in use during the construction period. The Contractor shall maintain reasonable access to all existing plant, valve chambers, rail, mechanical and electrical facilities at all times. The Contractor shall provide all reasonable assistance to Operations personnel to provide safe, secure access to operational facilities.

D23. PARTNERING

D23.1 In order to effectively and efficiently accomplish the Work of this Contract, The City of Winnipeg, Water and Waste Department is encouraging the formation of a cohesive, mutually beneficial working relationship with the Contractor, his Subcontractors and representatives from the successful bidder for Bid Opportunity 583-2005 Winnipeg Water Treatment Program – WTP Foundations and Concrete Structures as well as other contractors on site. This working relationship will endeavour to draw on individual and corporate and community strengths, skills and knowledge to achieve a quality project to the benefit of all participants. The objective of Partnering is to build co-operative relationships, avoid or minimize disputes and actively pursue the attainment of common goals. Success will depend upon teamwork with open and effective communication while adhering to the highest professional standards. Participation in Partnering will not in any way affect the application or legal obligation of the Contract. The Partnering Initiation Workshop is typically a one and one-half (1 ½) day session for a project of this magnitude, which may be held in conjunction with the pre-construction meeting. The Partnering Initiation Workshop will be scheduled for a date immediately following award of this contract.

D23.2 Participation in the Partnering Initiation Workshop shall be carried out at no cost to the Contractor nor shall any payment be made for time and travel expenses incurred by the Contractor associated with participation in the Partnering Initiation Workshop. It shall be considered incidental to the Work included in this project.

D24. VALUE ENGINEERING

D24.1 General:

D24.1.1 Following the award of the Contract, and further to GC:4.06, the City will entertain value engineering proposals from the Contractor, with the intention of sharing any cost savings generated by such proposals. The purpose is to encourage the use of the Contractor's ingenuity and experience at arriving at a lower cost construction than reflected in the Contract Documents by sharing of the savings resulting therefrom.

D24.1.2 The Contractor is cautioned not to base any Bid prices on the anticipates approval of the value engineering proposal and to recognize that such proposal may be rejected and that he will be required to complete the Contract in accordance with the Drawings and Specifications at the Bid price.

D24.2 Value engineering proposals:

D24.2.1 All proposals, whether or not approved by the Contract Administrator for use in this Contract, apply only to this Contract and become property of the City and shall contain no restrictions imposed by the Contractor on their use of disclosure. The City retains the right to use, duplicate and disclose in whole or in part any data necessary for the utilization of the proposal. The City retains the right to utilize any accepted proposal or part thereof on any other or subsequent project without any obligation to the Contractor submitting same.

D24.2.2 As a minimum, the following materials and information shall be submitted with each proposal, plus any additional information requested by the Contract Administrator:

(a) A statement that the proposal is submitted as a value engineering proposal.

(b) A description of the differences between the existing Contract requirements and the proposed change, and the comparative advantages and disadvantages of each, including considerations of service life, economy of operation, ease of maintenance and safety.

(c) Complete plans and specifications sealed by a Professional Engineer, showing the proposed revisions which incorporate the same design criteria and restrictions relative to the original Contract features and requirements. Also to be submitted is a statement that items such as substructure and foundation design and erection systems were considered in arriving at the proposal.

(d) A complete cost analysis indicating the final change in Contract value and, where applicable, the quantities to be replaced by the proposal, the new costs and quantities generated by the proposal, and the cost effects of the proposed changes of operations, maintenance and other considerations.

(e) A statement of the time in which the proposal must be executed so as to obtain the maximum cost reduction. This date must be selected so as to allow the Contract Administrator ample time for the review and processing. Should the Contract Administrator find that insufficient time is available for review and processing, the proposal may be rejected solely on this basis. If the Contract Administrator fails to respond to the proposal by the date specified, the Contractor shall consider the proposal rejected and shall have no claims against the City as a result thereof.

(f) A statement as to the effect the proposal will have on the time for completion of the Contract.

D24.3 Value engineering proposal evaluation:

D24.3.1 The Contract Administrator will be the sole judge as to whether a proposal is qualified for consideration and evaluation. The Contract Administrator may reject any proposal that requires excessive time or cost for review, evaluation and/or investigation, or which is not consistent with the City's design policies and basic design criteria for the Work.

D24.3.2 The Contractor shall have no claim against the City for any costs or delays due to the Contract Administrator's rejection of a value engineering proposal, including but not limited to development costs, anticipated profits or increased material or labour costs resulting from delays in the review of such proposal.

D24.3.3 The proposal shall not be experimental in nature but shall have been proven to the Contract Administrator's satisfaction under similar or acceptable conditions on another City project or another location acceptable to the Contract Administrator.

D24.3.4 The savings generated by the proposal must be of sufficient significance, in the sole judgement of the Contract Administrator, to warrant review and processing. All costs resulting from the review and processing of a proposal will be borne by the Contractor.

D24.3.5 Design proposals shall conform to the accepted design standards identified by the City.

D24.3.6 If additional information is needed to evaluate proposals, this information must be provided by the Contractor in a timely manner. Failure to do so will result in the rejection of the proposal. Such additional information may include, where design changes are proposed, results of field investigations and surveys, design computations, and field change sheets.

D24.4 Changes:

D24.4.1 The Contract Administrator may reject all or any portion of the work performed pursuant to an approved value engineering proposal if he determines that unsatisfactory results are being obtained. The Contract Administrator may direct the removal of such rejected work and require the Contractor to proceed in accordance with the original Contract

requirements without reimbursement for any work performed under the proposal or for its removal. Where modifications to the value engineering proposal are approved in order to adjust field or other conditions, reimbursement will be limited to the total amount payable for the work at the Contract Bid prices as if it were constructed in accordance with the original Contract requirements. Such rejection or limitation of reimbursement shall not constitute the basis of any claim against the City for delay or for any other costs.

D24.5 Measurement and payment for accepted value engineering proposals:

D24.5.1 If a value engineering proposal is accepted, a change to the Work will be issued in accordance with GC:7.3.

D24.5.2 The cost of the revised work as determined from the aforementioned change in quantities or new items will be paid directly. In addition to such payment, the City will pay the Contractor, via a separate item, fifty (50) percent of the savings to the City, as reflected by the difference between the above payment and the cost of the related construction required by the original Contract Drawings and Specifications computed at the Contract Bid prices, less the amount due to the City for the cost to review and process the proposal.

D24.5.3 The Contractor's cost for development, design and preparation of the value engineering proposal are not eligible for reimbursement.

MEASUREMENT AND PAYMENT

D25. PAYMENT SCHEDULE

D25.1 Further to GC:12, payment shall be in accordance with the following payment schedule:

(a) The Lump Sum Price listed in Form B: Prices will be paid on the basis of monthly progress estimates in accordance with GC:12 and the detailed price breakdown prepared pursuant to D11.

(b) Ten thousand dollars ($10,000) of the Lump Sum Price will be paid on the basis of the satisfactory completion of water tightness tests as specified in Section 03300 for each of the following forty six (46) water retaining structures, including completion of Form 103: Certificate of Equipment Satisfactory Performance:

(i) Floc Tanks 1-8;
(ii) DAF Basins 1-8 ;
(iii) DAF Effluent Channel #1 and #2;
(iv) Backwash Supply Tanks #1 and #2;
(v) Ozone Contactors #1 and #2;
(vi) Ozone Discharge Chamber;
(vii) Filter Tanks 1-8;
(viii) Overflow Channel;
(ix) Ten Residuals Handling Area Tanks;
(x) Upper Filter Channel;
(xi) Lower Filter Channel;
(xii) Common Filter Effluent Channel.
(xiii) Chlorine Contact Chamber Effluent Conduit.

D25.2 All signatures are required on each Form 103 in order for the form to be considered satisfactorily completed for the purposes of payments made pursuant to D25.1(b).

D25.3 Where completion of a Form 103 is required for payment, one such form shall be completed for each unit.

D26. WARRANTY

D26.1 Notwithstanding GC:13.2, the Contractor shall warrant the membrane system as stated in Form W1: Manufacturer Guarantee Agreement and Form W2: Subcontractor Guarantee Agreement, included in Section 07550.

D26.1.1 For the purposes of Performance Security, the warranty specified in D26.1 shall be one (1) year from Total Performance.

D26.2 The Warranty for the installation of City Supplied Equipment, installed by the Contractor, shall be the responsibility of the Contractor. Warranty for the proper operation of properly installed City Supplied Equipment is the responsibility of the Supply Contractor.

FORM H1: PERFORMANCE BOND
(See D10)

KNOW ALL MEN BY THESE PRESENTS THAT

_____
(hereinafter called the "Principal"), and

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

_____

_____ dollars ($_____.____)

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

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

_____ day of _____ , 20____ , for:

BID OPPORTUNITY NO. 583-2005

WINNIPEG WATER TREATMENT PROGRAM – WATER TREATMENT PLANT FOUNDATIONS AND CONCRETE STRUCTURES

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

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

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

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

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

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

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)
(See D10)

_____
(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 583-2005

WINNIPEG WATER TREATMENT PROGRAM – WATER TREATMENT PLANT FOUNDATIONS AND CONCRETE STRUCTURES

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

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

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

_____

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

_____
(Address)

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

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

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

_____ .
(Date)

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

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

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

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM J: SUBCONTRACTOR LIST
(See D12)

WINNIPEG WATER TREATMENT PROGRAM – WATER TREATMENT PLANT FOUNDATIONS AND CONCRETE STRUCTURES

Name	Address

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

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

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

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

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

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

CONSULTANT DRAWING NO.	CITY DRAWING NO.	TITLE
CM-G001		WATER TREATMENT PLANT – CONSTRUCTION SITE LAYOUT
WB-M0151		WATER TREATMENT PLANT MAIN BUILDING – PROCESS – SLUICE GATE LOCATION PLAN
WM-G9001	1-0601M-G-G9001-001-00D	GENERAL MAIN PROCESS - HYDRAULIC PROFILE
WM-C0165		CIVIL - EXISTING SITE PLAN AND SURVEY PLAN
WA-S0101	1-0601A-A-S0101-001-00D	STRUCTURAL-ADMINISTRATION AREA - LOWER LEVEL PLAN
WA-S0111	1-0601A-A-S0111-001-00D	STRUCTURAL-ADMINISTRATION AREA - FIRST FLOOR PLAN
WA-S0121	1-0601A-A-S0121-001-00D	STRUCTURAL-ADMINISTRATION AREA - SECOND FLOOR PLAN
WA-S0131	1-0601A-A-S0131-001-00D	STRUCTURAL-ADMINISTRATION AREA - THIRD FLOOR PLAN
WA-S0141	1-0601A-A-S0141-001-00D	STRUCTURAL-ADMINISTRATION AREA - ROOF FRAMING PLAN
WA-S0146	1-0601A-A-S0146-001-00D	STRUCTURAL-ADMINISTRATION AREA - ROOF PLAN
WA-S0201	1-0601A-A-S0201-001-00D	STRUCTURAL-ADMINISTRATION AREA - SECTIONS
WA-S0202	1-0601A-A-S0202-001-00D	STRUCTURAL-ADMINISTRATION AREA - SECTION
WA-S0203	1-0601A-A-S0203-001-00D	STRUCTURAL-ADMINISTRATION AREA - SECTIONS
WA-S0204	1-0601A-A-S0204-001-00D	STRUCTURAL-ADMINISTRATION AREA - SECTION
WA-S0205	1-0601A-A-S0205-001-00D	STRUCTURAL-ADMINISTRATION AREA - SECTION
WA-S0206	1-0601A-A-S0206-001-00D	STRUCTURAL-ADMINISTRATION AREA - SECTION
WA-S0401	1-0601A-A-S0401-001-00D	STRUCTURAL-ADMINISTRATION AREA - DETAILS
WA-F0105	1-0601A-B-F0105-001-00D	STRUCTURAL-ADMINISTRATION AREA - PILING PLAN
WA-S0505	1-0601A-D-S0505-001-00D	STRUCTURAL-ADMINISTRATION AREA - PILING SCHEDULE
WA-S0515	1-0601A-D-S0515-001-00D	STRUCTURAL-ADMINISTRATION AREA - COLUMN AND BEAM SCHEDULES
WB-S0100	1-0601B-A-S0100-001-00D	STRUCTURAL-LOWER LEVEL KEY PLAN
WB-S0110	1-0601B-A-S0110-001-00D	STRUCTURAL-FIRST FLOOR KEY PLAN
WB-S0115	1-0601B-A-S0115-001-00D	STRUCTURAL-LOWER CHANNEL KEY PLAN
WB-S0120	1-0601B-A-S0120-001-00D	STRUCTURAL-UPPER CHANNEL KEY PLAN
WB-S0130	1-0601B-A-S0130-001-00D	STRUCTURAL-THIRD FLOOR KEY PLAN

CONSULTANT DRAWING NO.	CITY DRAWING NO.	TITLE
WB-S0140	1-0601B-A-S0140-001-00D	STRUCTURAL-ROOF FRAMING KEY PLAN
WB-S0145	1-0601B-A-S0145-001-00D	STRUCTURAL-ROOF KEY PLAN
WB-S0451	1-0601B-A-S0451-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0452	1-0601B-A-S0452-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0453	1-0601B-A-S0453-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0454	1-0601B-A-S0454-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0455	1-0601B-A-S0455-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0456	1-0601B-A-S0456-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0457	1-0601B-A-S0457-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0458	1-0601B-A-S0458-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0459	1-0601B-A-S0459-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0460	1-0601B-A-S0460-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0461	1-0601B-A-S0461-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0462	1-0601B-A-S0462-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0464	1-0601B-A-S0464-001-00D	STRUCTURAL-STANDARD DETAILS
WB-S0472	1-0601B-A-S0472-001-00D	STRUCTURAL-STANDARD DETAILS
WB-F0105	1-0601B-B-F0105-001-00D	STRUCTURAL-PILING KEY PLAN
WB-S0501	1-0601B-P-S0501-001-00D	STRUCTURAL-WATERSTOP ISOMETRIC
WC-S0111	1-0601C-A-S0111-001-00D	STRUCTURAL-CHEMICAL AREA - FIRST FLOOR PLAN
WC-S0121	1-0601C-A-S0121-001-00D	STRUCTURAL-INSTRUMENT ROOM AREA - UPPER PLAN
WC-S0131	1-0601C-A-S0131-001-00D	STRUCTURAL-ELECTRICAL AND MECHANICAL ROOM AREA - THIRD FLOOR PLAN
WC-S0141	1-0601C-A-S0141-001-00D	STRUCTURAL-CHEMICAL AREA - ROOF FRAMING PLAN
WC-S0146	1-0601C-A-S0146-001-00D	STRUCTURAL-CHEMICAL AREA - ROOF PLAN
WC-S0201	1-0601C-A-S0201-001-00D	STRUCTURAL-CHEMICAL AREA - SECTION
WC-S0202	1-0601C-A-S0202-001-00D	STRUCTURAL-CHEMICAL AREA - SECTION
WC-S0203	1-0601C-A-S0203-001-00D	STRUCTURAL-CHEMICAL AREA - SECTION
WC-S0204	1-0601C-A-S0204-001-00D	STRUCTURAL-CHEMICAL AREA - SECTION
WC-S0205	1-0601C-A-S0205-001-00D	STRUCTURAL-CHEMICAL AREA - SECTION
WC-S0206	1-0601C-A-S0206-001-00D	STRUCTURAL-CHEMICAL AREA - SECTION
WC-S0207	1-0601C-A-S0207-001-00D	STRUCTURAL-CHEMICAL AREA - SECTION
WC-S0451	1-0601C-A-S0451-001-00D	STRUCTURAL-CHEMICAL AREA - DETAILS OF PILE CAP
WC-F0105	1-0601C-B-F0105-001-00D	STRUCTURAL-CHEMICAL AREA - PILING PLAN
WC-S0505	1-0601C-D-S0505-001-00D	STRUCTURAL-CHEMICAL AREA - PILING SCHEDULE
WC-S0515	1-0601C-D-S0515-001-00D	STRUCTURAL-CHEMICAL AREA - COLUMN AND BEAM SCHEDULES
WF-S0101	1-0601F-A-S0101-001-00D	STRUCTURAL-FILTRATION AREA 1 - LOWER LEVEL PLAN
WF-S0102	1-0601F-A-S0102-001-00D	STRUCTURAL-FILTRATION AREA 2 - LOWER LEVEL PLAN
WF-S0105	1-0601F-A-S0105-001-00D	STRUCTURAL-FILTRATION AREA 1 - LOWER LEVEL REINFORCING PLAN
WF-S0106	1-0601F-A-S0106-001-00D	STRUCTURAL-FILTRATION AREA 2 - LOWER LEVEL REINFORCING PLAN
WF-S0111	1-0601F-A-S0111-001-00D	STRUCTURAL-FILTRATION AREA 1 - FIRST FLOOR PLAN
WF-S0112	1-0601F-A-S0112-001-00D	STRUCTURAL-FILTRATION AREA 2 - FIRST FLOOR PLAN
WF-S0115	1-0601F-A-S0115-001-00D	STRUCTURAL-FILTRATION AREA 1 - FIRST FLOOR REINFORCING PLAN
WF-S0116	1-0601F-A-S0116-001-00D	STRUCTURAL-FILTRATION AREA 2 - FIRST FLOOR REINFORCING PLAN
WF-S0117	1-0601F-A-S0117-001-00D	STRUCTURAL-FILTRATION AREA 1 - LOWER CHANNEL PLAN

CONSULTANT DRAWING NO.	CITY DRAWING NO.	TITLE
WF-S0118	1-0601F-A-S0118-001-00D	STRUCTURAL-FILTRATION AREA 2 - LOWER CHANNEL PLAN
WF-S0121	1-0601F-A-S0121-001-00D	STRUCTURAL-FILTRATION AREA 1 - UPPER CHANNEL PLAN
WF-S0122	1-0601F-A-S0122-001-00D	STRUCTURAL-FILTRATION AREA 2 - UPPER CHANNEL PLAN
WF-S0125	1-0601F-A-S0125-001-00D	STRUCTURAL-FILTRATION AREA 1 - UPPER CHANNEL REINFORCING PLAN
WF-S0131	1-0601F-A-S0131-001-00D	STRUCTURAL-FILTRATION AREA 1 - THIRD FLOOR PLAN
WF-S0132	1-0601F-A-S0132-001-00D	STRUCTURAL-FILTRATION AREA 2 - THIRD FLOOR PLAN
WF-S0135	1-0601F-A-S0135-001-00D	STRUCTURAL-FILTRATION AREA 1 - THIRD FLOOR REINFORCING PLAN
WF-S0136	1-0601F-A-S0136-001-00D	STRUCTURAL-FILTRATION AREA 2 - THIRD FLOOR REINFORCING PLAN
WF-S0141	1-0601F-A-S0141-001-00D	STRUCTURAL-FILTRATION AREA 1 - ROOF FRAMING PLAN
WF-S0142	1-0601F-A-S0142-001-00D	STRUCTURAL-FILTRATION AREA 2 - ROOF FRAMING PLAN
WF-S0146	1-0601F-A-S0146-001-00D	STRUCTURAL-FILTRATION AREA 1 - ROOF PLAN
WF-S0147	1-0601F-A-S0147-001-00D	STRUCTURAL-FILTRATION AREA 2 - ROOF PLAN
WF-S0201	1-0601F-A-S0201-001-00D	STRUCTURAL-FILTRATION AREA - SECTION
WF-S0202	1-0601F-A-S0202-001-00D	STRUCTURAL-FILTRATION AREA - SECTION
WF-S0203	1-0601F-A-S0203-001-00D	STRUCTURAL-FILTRATION AREA - SECTIONS
WF-S0204	1-0601F-A-S0204-001-00D	STRUCTURAL-FILTRATION AREA - SECTIONS
WF-S0205	1-0601F-A-S0205-001-00D	STRUCTURAL-FILTRATION AREA - SECTION
WF-S0206	1-0601F-A-S0206-001-00D	STRUCTURAL-FILTRATION AREA - SECTIONS
WF-S0207	1-0601F-A-S0207-001-00D	STRUCTURAL-FILTRATION AREA - SECTION
WF-S0208	1-0601F-A-S0208-001-00D	STRUCTURAL-FILTRATION AREA - SECTIONS
WF-S0209	1-0601F-A-S0209-001-00D	STRUCTURAL-FILTRATION AREA - SECTIONS
WF-S0401	1-0601F-A-S0401-001-00D	STRUCTURAL-FILTRATION AREA - DETAILS
WF-S0402	1-0601F-A-S0402-001-00D	STRUCTURAL-FILTRATION AREA - DETAILS
WF-S0403	1-0601F-A-S0403-001-00D	STRUCTURAL-FILTRATION AREA - DETAILS
WF-S0404	1-0601F-A-S0404-001-00D	STRUCTURAL-FILTRATION AREA - DETAILS
WF-S0405	1-0601F-A-S0405-001-00D	STRUCTURAL-FILTRATION AREA - DETAILS
WF-S0406	1-0601F-A-S0406-001-00D	STRUCTURAL-FILTRATION AREA - DETAILS
WF-F0105	1-0601F-B-F0105-001-00D	STRUCTURAL-FILTRATION AREA 1 - PILING PLAN
WF-F0106	1-0601F-B-F0106-001-00D	STRUCTURAL-FILTRATION AREA 2 - PILING PLAN
WF-S0505	1-0601F-D-S0505-001-00D	STRUCTURAL-FILTRATION AREA - PILING SCHEDULE
WF-S0506	1-0601F-D-S0506-001-00D	STRUCTURAL-FILTRATION AREA - PILING SCHEDULE
WF-S0507	1-0601F-D-S0507-001-00D	STRUCTURAL-FILTRATION AREA - PILING SCHEDULE
WF-S0515	1-0601F-D-S0515-001-00D	STRUCTURAL-FILTRATION AREA - COLUMN AND BEAM SCHEDULES
WI-S0146	1-0601I-A-S0146-001-00D	STRUCTURAL-RAW WATER PUMP STATION AREA - ROOF PLAN
WI-S0201	1-0601I-A-S0201-001-04D	STRUCTURAL-RAW WATER PUMP STATION AREA - SECTION (NIC)
WI-S0202	1-0601I-A-S0202-001-02D	STRUCTURAL-RAW WATER PUMP STATION AREA - SECTION (NIC)
WM-S0111	1-0601M-A-S0111-001-00D	STRUCTURAL-ELECTRICAL ROOM - FIRST FLOOR PLAN
WM-S0141	1-0601M-A-S0141-001-00D	STRUCTURAL-ELECTRICAL ROOM - ROOF FRAMING PLAN
WM-S0146	1-0601M-A-S0146-001-00D	STRUCTURAL-ELECTRICAL ROOM - ROOF PLAN
WM-S0201	1-0601M-A-S0201-001-00D	STRUCTURAL-ELECTRICAL ROOM - SECTION
WM-S0202	1-0601M-A-S0202-001-00D	STRUCTURAL-ELECTRICAL ROOM - SECTION
WM-S0203	1-0601M-A-S0203-001-00D	STRUCTURAL-ELECTRICAL ROOM - SECTION

CONSULTANT DRAWING NO.	CITY DRAWING NO.	TITLE
WM-S0204	1-0601M-A-S0204-001-00D	STRUCTURAL-ELECTRICAL ROOM - SECTION
WM-S0205	1-0601M-A-S0205-001-00D	STRUCTURAL-ELECTRICAL ROOM - SECTION
WM-F0105	1-0601M-B-F0105-001-00D	STRUCTURAL-ELECTRICAL ROOM - PILING PLAN
WM-S0515	1-0601M-D-S0515-001-00D	STRUCTURAL-ELECTRICAL ROOM - COLUMN AND BEAM SCHEDULES
WM-S9002	1-0601M-D-S9002-001-00D	STRUCTURAL-GENERAL NOTES, AND ABBREVIATIONS
WO-S0101	1-0601O-A-S0101-001-00D	STRUCTURAL-OZONATION AREA - LOWER LEVEL PLAN
WO-S0111	1-0601O-A-S0111-001-00D	STRUCTURAL-OZONATION AREA - FIRST FLOOR PLAN
WO-S0121	1-0601O-A-S0121-001-00D	STRUCTURAL-OZONATION AREA - SECOND FLOOR PLAN
WO-S0131	1-0601O-A-S0131-001-00D	STRUCTURAL-OZONATION AREA - THIRD FLOOR PLAN
WO-S0141	1-0601O-A-S0141-001-00D	STRUCTURAL-OZONATION AREA - ROOF FRAMING PLAN
WO-S0146	1-0601O-A-S0146-001-00D	STRUCTURAL-OZONATION AREA - ROOF PLAN
WO-S0201	1-0601O-A-S0201-001-00D	STRUCTURAL-OZONATION AREA - SECTION
WO-S0202	1-0601O-A-S0202-001-00D	STRUCTURAL-OZONATION AREA - SECTION
WO-S0203	1-0601O-A-S0203-001-00D	STRUCTURAL-OZONATION AREA - SECTION
WO-S0204	1-0601O-A-S0204-001-00D	STRUCTURAL-OZONATION AREA - SECTION
WO-S0205	1-0601O-A-S0205-001-00D	STRUCTURAL-OZONATION AREA - SECTION
WO-S0206	1-0601O-A-S0206-001-00D	STRUCTURAL-OZONATION AREA - SECTION
WO-S0207	1-0601O-A-S0207-001-00D	STRUCTURAL-OZONATION AREA - SECTION
WO-F0105	1-0601O-B-F0105-001-00D	STRUCTURAL-OZONATION AREA - PILING PLAN
WO-S0505	1-0601O-D-S0505-001-00D	STRUCTURAL-OZONATION AREA - PILING SCHEDULE
WO-S0506	1-0601O-D-S0506-001-00D	STRUCTURAL-OZONATION AREA - PILING SCHEDULE
WO-S0515	1-0601O-D-S0515-001-00D	STRUCTURAL-OZONATION AREA - COLUMN AND BEAM SCHEDULES
WP-S0111	1-0601P-A-S0111-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - FIRST FLOOR PLAN
WP-S0112	1-0601P-A-S0112-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - FIRST FLOOR PLAN
WP-S0121	1-0601P-A-S0121-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - CHANNEL FLOOR PLAN
WP-S0122	1-0601P-A-S0122-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - CHANNEL FLOOR PLAN
WP-S0131	1-0601P-A-S0131-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - THIRD FLOOR PLAN
WP-S0132	1-0601P-A-S0132-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - THIRD FLOOR PLAN
WP-S0141	1-0601P-A-S0141-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - ROOF FRAMING PLAN
WP-S0142	1-0601P-A-S0142-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - ROOF FRAMING PLAN
WP-S0146	1-0601P-A-S0146-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - ROOF PLAN
WP-S0147	1-0601P-A-S0147-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - ROOF PLAN
WP-S0201	1-0601P-A-S0201-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - SECTION
WP-S0202	1-0601P-A-S0202-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - SECTION
WP-S0203	1-0601P-A-S0203-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - SECTION
WP-S0204	1-0601P-A-S0204-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - SECTION
WP-S0205	1-0601P-A-S0205-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - SECTION
WP-S0206	1-0601P-A-S0206-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - SECTION
WP-S0207	1-0601P-A-S0207-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - SECTION
WP-S0208	1-0601P-A-S0208-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - SECTION
WP-S0209	1-0601P-A-S0209-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - SECTION
WP-S0210	1-0601P-A-S0210-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - SECTION
WP-S0211	1-0601P-A-S0211-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - SECTION

CONSULTANT DRAWING NO.	CITY DRAWING NO.	TITLE
WP-S0212	1-0601P-A-S0212-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - SECTION
WP-S0213	1-0601P-A-S0213-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - SECTION
WP-S0214	1-0601P-A-S0214-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - SECTION
WP-S0215	1-0601P-A-S0215-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - SECTION
WP-S0216	1-0601P-A-S0216-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - SECTION
WP-S0401	1-0601P-A-S0401-001-00D	STRUCTURAL-FLOC / DAF AREA - DETAILS
WP-F0105	1-0601P-B-F0105-001-00D	STRUCTURAL-FLOC / DAF AREA 1 - PILING PLAN
WP-F0106	1-0601P-B-F0106-001-00D	STRUCTURAL-FLOC / DAF AREA 2 - PILING PLAN
WP-S0505	1-0601P-D-S0505-001-00D	STRUCTURAL-FLOC / DAF AREA - PILING SCHEDULE
WP-S0506	1-0601P-D-S0506-001-00D	STRUCTURAL-FLOC / DAF AREA - PILING SCHEDULE
WP-S0507	1-0601P-D-S0507-001-00D	STRUCTURAL-FLOC / DAF AREA - PILING SCHEDULE
WP-S0515	1-0601P-D-S0515-001-00D	STRUCTURAL-FLOC / DAF AREAS - COLUMN AND BEAM SCHEDULES
WR-S0101	1-0601R-A-S0101-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - LOWER LEVEL PLAN
WR-S0111	1-0601R-A-S0111-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - FIRST FLOOR PLAN
WR-S0121	1-0601R-A-S0121-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECOND FLOOR PLAN
WR-S0131	1-0601R-A-S0131-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - THIRD FLOOR PLAN
WR-S0141	1-0601R-A-S0141-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - ROOF FRAMING PLAN
WR-S0146	1-0601R-A-S0146-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - ROOF PLAN
WR-S0201	1-0601R-A-S0201-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTION
WR-S0202	1-0601R-A-S0202-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTION
WR-S0203	1-0601R-A-S0203-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTION
WR-S0204	1-0601R-A-S0204-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTION
WR-S0205	1-0601R-A-S0205-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTION
WR-S0206	1-0601R-A-S0206-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTION
WR-S0207	1-0601R-A-S0207-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTION
WR-S0208	1-0601R-A-S0208-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTION
WR-S0209	1-0601R-A-S0209-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - SECTIONS
WR-F0105	1-0601R-B-F0105-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - PILING PLAN
WR-S0505	1-0601R-D-S0505-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - PILING SCHEDULE
WR-S0506	1-0601R-D-S0506-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - PILING SCHEDULE
WR-S0515	1-0601R-D-S0515-001-00D	STRUCTURAL-RESIDUALS HANDLING AREA - COLUMN AND BEAM SCHEDULES
WT-S041	1-0601T-B-S0041-001-00D	STRUCTURAL-CCT EFFLUENT CONDUIT PILING PLAN, FOUNDATION PLAN AND SCHEDULE
WT-S042	1-0601T-D-S0042-001-00D	STRUCTURAL-CCT EFFLUENT CONDUIT SECTIONS AND DETAILS
WY-S0101	1-0601Y-A-S0101-001-00D	STRUCTURAL-FLAP GATES - PLANS
WY-S0201	1-0601Y-A-S0201-001-00D	STRUCTURAL-FLAP GATES - SECTIONS AND DETAILS
WY-F0101	1-0601Y-B-F0101-001-00D	STRUCTURAL-FLAP GATES - PILING PLANS
WB-M9451	1-0601B-A-M9451-001-00D	PROCESS MECHANICAL-STANDARD DETAILS
WB-M9452	1-0601B-A-M9452-001-00D	PROCESS MECHANICAL-STANDARD DETAILS
WB-M9453	1-0601B-A-M9453-001-00D	PROCESS MECHANICAL-STANDARD DETAILS
WB-M9454	1-0601B-A-M9454-001-00D	PROCESS MECHANICAL-STANDARD DETAILS
WC-M9111	1-0601C-A-M9111-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - CHEMICAL

CONSULTANT DRAWING NO.	CITY DRAWING NO.	TITLE
		AREA PLAN
WC-M9201	1-0601C-A-M9201-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - CHEMICAL AREA SECTIONS
WC-M9401	1-0601C-A-M9401-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - POLYMER AREA FIRST FLOOR PLAN DETAIL
WC-M9402	1-0601C-A-M9402-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - POLYMER AREA SECOND FLOOR PLAN DETAIL
WC-M9403	1-0601C-A-M9403-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - SBS AND PEROXIDE AREA PLAN DETAILS
WF-M9101	1-0601F-A-M9101-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA 1 LOWER PLAN
WF-M9102	1-0601F-A-M9102-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA 2 LOWER PLAN
WF-M9103	1-0601F-A-M9103-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA 3 LOWER PLAN
WF-M9121	1-0601F-A-M9121-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA 1 UPPER CHANNEL LEVEL PLAN
WF-M9122	1-0601F-A-M9122-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA 2 UPPER CHANNEL LEVEL PLAN
WF-M9131	1-0601F-A-M9131-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA 1 THIRD FLOOR PLAN
WF-M9132	1-0601F-A-M9132-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA 2 THIRD FLOOR PLAN
WF-M9201	1-0601F-A-M9201-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA SECTION
WF-M9205	1-0601F-A-M9205-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA SECTION
WF-M9206	1-0601F-A-M9206-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA SECTION
WF-M9207	1-0601F-A-M9207-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA SECTION
WF-M9208	1-0601F-A-M9208-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA SECTION
WF-M9209	1-0601F-A-M9209-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - FILTRATION AREA SECTION
WO-M9121	1-0601O-A-M9121-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - OZONE CONTACTORS UPPER PLAN
WO-M9131	1-0601O-A-M9131-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - OZONE GENERATION ROOM THIRD FLOOR PLAN
WO-M9201	1-0601O-A-M9201-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - SECTION
WO-M9202	1-0601O-A-M9202-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - SECTION DETAILS
WO-M9203	1-0601O-A-M9203-001-00D	PROCESS MECHANICAL-PIPE EMBEDS - SECTION DETAILS
WA-H9102	1-0601A-A-H9102-001-00D	PLUMBING-PIPE EMBEDS - ADMINISTRATION AREA LOWER LEVEL PLAN
WA-H9122	1-0601A-A-H9122-001-00D	PLUMBING-PIPE EMBEDS - ADMINISTRATION AREA SECOND FLOOR PLAN
WA-H9132	1-0601A-A-H9132-001-00D	PLUMBING-PIPE EMBEDS - ADMINISTRATION AREA THIRD FLOOR PLAN
WB-H9101	1-0601B-A-H9101-001-00D	PLUMBING-PIPE EMBEDS - OVERALL LOWER LEVEL PLAN
WB-H9111	1-0601B-A-H9111-001-00D	PLUMBING-PIPE EMBEDS - OVERALL FIRST FLOOR PLAN
WB-H9121	1-0601B-A-H9121-001-00D	PLUMBING-PIPE EMBEDS - OVERALL SECOND FLOOR PLAN
WB-H9131	1-0601B-A-H9131-001-00D	PLUMBING-PIPE EMBEDS - OVERALL THIRD FLOOR PLAN
WB-H9451	1-0601B-A-H9451-001-00D	PLUMBING-STANDARD DETAILS
WB-H9452	1-0601B-A-H9452-001-00D	PLUMBING-STANDARD DETAILS
WC-H9112	1-0601C-A-H9112-001-00D	PLUMBING-PIPE EMBEDS - CHEMICAL AREA FIRST FLOOR PLAN
WC-H9122	1-0601C-A-H9122-001-00D	PLUMBING-PIPE EMBEDS - CHEMICAL AREA SECOND

CONSULTANT DRAWING NO.	CITY DRAWING NO.	TITLE
		FLOOR PLAN
WC-H9132	1-0601C-A-H9132-001-00D	PLUMBING-PIPE EMBEDS - CHEMICAL AREA THIRD FLOOR PLAN
WF-H9104	1-0601F-A-H9104-001-00D	PLUMBING-PIPE EMBEDS - FILTRATION AREA 1 LOWER LEVEL PLAN
WF-H9105	1-0601F-A-H9105-001-00D	PLUMBING-PIPE EMBEDS - FILTRATION AREA 2 LOWER LEVEL PLAN
WF-H9106	1-0601F-A-H9106-001-00D	PLUMBING-PIPE EMBEDS - BACKWASH PUMP ROOM LOWER LEVEL PLAN
WF-H9133	1-0601F-A-H9133-001-00D	PLUMBING-PIPE EMBEDS - FILTRATION AREA 1 THIRD FLOOR PLAN
WF-H9134	1-0601F-A-H9134-001-00D	PLUMBING-PIPE EMBEDS - FILTRATION AREA 2 THIRD FLOOR PLAN
WM-H9112	1-0601M-A-H9112-001-00D	PLUMBING-PIPE EMBEDS - FIRE PUMP AND ELECTRICAL ROOM FIRST FLOOR PLAN
WO-H9112	1-0601O-A-H9112-001-00D	PLUMBING-PIPE EMBEDS - OZONATION AREA FIRST FLOOR PLAN
WO-H9132	1-0601O-A-H9132-001-00D	PLUMBING-PIPE EMBEDS - OZONATION AREA THIRD FLOOR PLAN
WP-H9113	1-0601P-A-H9113-001-00D	PLUMBING-PIPE EMBEDS - FLOC / DAF AREA 1 FIRST FLOOR PLAN
WP-H9114	1-0601P-A-H9114-001-00D	PLUMBING-PIPE EMBEDS - FLOC / DAF AREA 2 FIRST FLOOR PLAN
WP-H9133	1-0601P-A-H9133-001-00D	PLUMBING-PIPE EMBEDS - FLOC / DAF AREA 1 THIRD FLOOR PLAN
WP-H9134	1-0601P-A-H9134-001-00D	PLUMBING-PIPE EMBEDS - FLOC / DAF AREA 2 THIRD FLOOR PLAN
WR-H9112	1-0601R-A-H9112-001-00D	PLUMBING-PIPE EMBEDS - RESIDUALS AREA FIRST FLOOR PLAN
WR-H9122	1-0601R-A-H9122-001-00D	PLUMBING-PIPE EMBEDS - RESIDUALS AREA SECOND FLOOR PLAN
WR-H9132	1-0601R-A-H9132-001-00D	PLUMBING-PIPE EMBEDS - RESIDUALS AREA THIRD FLOOR PLAN
WP-M9101	1-0601P-A-M9101-001-00D	PIPE EMBEDS – PLAN AT EL. 244.400 AND SECTIONS FLOCCULATION AND DAF TANKS
WP-M9102	1-0601P-A-M9102-001-00D	PIPE EMBEDS – FIRST FLOOR PLAN AND SECTIONS FLOAT COLLECTION SUMPS
WP-M9103	1-0601P-A-M9103-001-00D	PIPE EMBEDS – THIRD FLOOR PLAN AND SECTIONS CLARIFIED RAW WATER
WP-M9104	1-0601P-A-M9104-001-00D	PIPE EMBEDS – SECOND FLOOR PLAN MUD VALVE DRAIN LINES
WP-M9105	1-0601P-A-M9105-001-00D	PIPE EMBEDS – THIRD FLOOR PLAN AND SECTIONS OZONE COOLING WATER RETURN
WP-M9106	1-0601P-A-M9106-001-00D	PIPE EMBEDS – FIRST FLOOR PLAN AND SECTIONS SUPERNATANT AND SLUDGE LINES
WP-M9107	1-0601P-A-M9107-001-00D	PIPE EMBEDS – FIRST FLOOR PLAN AND SECTIONS RAW WATER SUMP DISCHARGE PIPING
WP-M9108	1-0601P-A-M9108-001-00D	PIPE EMBEDS – FIRST FLOOR PLAN AND SECTIONS OZONE CONTACTOR DRAIN
WR-M9112	1-0601R-A-M9112-001-00D	PIPE EMBEDS – INLET CHANNEL PLAN VIEWS
WR-M9113	1-0601R-A-M9113-001-00D	PIPE EMBEDS – WASHWATER RECOVERY TANKS PROCESS PIPING PLAN
WR-M9123	1-0601R-A-M9123-001-00D	PIPE EMBEDS – THICKENED SLUDGE EQUALIZATION TANKS PLAN VIEWS
WR-M9124	1-0601R-A-M9124-001-00D	PIPE EMBEDS – FLOCCULATION CHAMBER PLAN VIEWS
WR-M9201	1-0601R-A-M9201-001-00D	PIPE EMBEDS – SECTIONS
WR-M9202	1-0601R-A-M9202-001-00D	PIPE EMBEDS – SECTION
WR-M9206	1-0601R-A-M9206-001-00D	PIPE EMBEDS – FLOCCULATION CHAMBER SECTIONS
WR-M9208	1-0601R-A-M9208-001-00D	PIPE EMBEDS – THICKENED SLUDGE EXTRACTION PIPE SECTION

CONSULTANT DRAWING NO.	CITY DRAWING NO.	TITLE
WN-S0170	1-0601N-A-S0170-001-00D	STRUCTURAL-WESTERN BRIDGE LAYOUT AND ELEVATION
WN-S0171	1-0601M-D-S0171-001-00D	STRUCTURAL-WESTERN BRIDGE BORING LOGS
WN-S0470	1-0601N-A-S0470-001-00D	STRUCTURAL-WESTERN BRIDGE ABUTMENT CONCRETE DETAILS
WN-S0471	1-0601N-A-S0471-001-00D	STRUCTURAL- WESTERN BRIDGE ABUTMENT REINFORCING DETAILS
WN-S0472	1-0601N-A-S0472-001-00D	STRUCTURAL- WESTERN BRIDGE DECK SLAB DETAILS
WN-S0473	1-0601N-A-S0473-001-00D	STRUCTURAL- WESTERN BRIDGE APPROACH SLAB DETAILS
WN-S0474	1-0601N-A-S0474-001-00D	STRUCTURAL- WESTERN BRIDGE APPROACH SLAB DETAILS
WN-S0180	1-0601N-A-S0180-001-00D	STRUCTURAL-MIDDLE BRIDGE LAYOUT AND ELEVATION
WN-S0480	1-0601N-A-S0480-001-00D	STRUCTURAL- MIDDLE BRIDGE ABUTMENT CONCRETE DETAILS
WN-S0481	1-0601N-A-S0481-001-00D	STRUCTURAL- MIDDLE BRIDGE ABUTMENT REINFORCING DETAILS
WN-S0482	1-0601N-A-S0482-001-00D	STRUCTURAL- MIDDLE BRIDGE DECK SLAB DETAILS
WN-S0483	1-0601N-A-S0483-001-00D	STRUCTURAL- MIDDLE BRIDGE APPROACH SLAB DETAILS
WN-S0484	1-0601N-A-S0484-001-00D	STRUCTURAL- MIDDLE BRIDGE APPROACH SLAB DETAILS
WN-S0190	1-0601N-A-S0190-001-00D	STRUCTURAL-EASTERN BRIDGE LAYOUT AND ELEVATION
WN-S0191	1-0601M-D-S0191-001-00D	STRUCTURAL-EASTERN BRIDGE BORING LOGS
WN-S0490	1-0601N-A-S0490-001-00D	STRUCTURAL- EASTERN BRIDGE ABUTMENT CONCRETE DETAILS
WN-S0491	1-0601N-A-S0491-001-00D	STRUCTURAL- EASTERN BRIDGE ABUTMENT REINFORCING DETAILS
WN-S0492	1-0601N-A-S0492-001-00D	STRUCTURAL- EASTERN BRIDGE DECK SLAB DETAILS
WN-S0493	1-0601N-A-S0493-001-00D	STRUCTURAL- EASTERN BRIDGE APPROACH SLAB DETAILS
WN-S0494	1-0601N-A-S0494-001-00D	STRUCTURAL- EASTERN BRIDGE APPROACH SLAB DETAILS
WN-C0161	1-0601N-A-C0161-001-00D	CIVIL-ROADWORKS AND WEST BRIDGE PLAN - PROFILE
WN-C0162	1-0601N-A-C0162-001-00D	CIVIL-ROADWORKS AND MIDDLE BRIDGE PLAN - PROFILE
WN-C0163	1-0601N-A-C0163-001-00D	CIVIL-ROADWORKS AND EAST BRIDGE PLAN - PROFILE

E1.3 The following Manitoba Transportation and Government Services Specifications are applicable to the bridge road construction work specified in E17-E30:

SPECIFICATION No	TITLE	DATE
200	Traffic Control	March 2002
500	Grading	March 2002
1000 M	Excavation for Structures	May 1984
1002 M	Supplying and Placing Granular Backfill	February 1982
1016 M	Driving Precast Concrete Piles	May 1984
1030 M	Reinforced Concrete	May 1984
1031M	Ready-Mixed Concrete	January 1981

SPECIFICATION No	TITLE	DATE
200	Traffic Control	March 2002
1032 M	Reinforced Concrete Deck Slabs, Approach Slabs, Rigid Frames, End Newel Posts, Curbs, Sidewalks, and Medians	May 1984
1052 M	Asphalt Paving on Bridges	May 1984
1055 M	Hot Poured Rubber Asphalt Waterproofing	May 1984
1062 M	Placing Miscellaneous Metal	May 1984
1064 M	Placing Steel Beam Guard Railing	January 1981

E1.3.1 The specifications referenced in E1.3 are available at the following internet website: http://www.gov.mb.ca/tgs/contracts/specmanual/index.html.

E1.4 The following Specifications are applicable to the WTP and chlorine contact conduit construction components of the Work:

SPECIFICATION No.	TITLE
02223	EXCAVATION AND BACKFILLING FOR STRUCTURES
02451	PILE FOUNDATIONS, GENERAL
02468	PRECAST CONCRETE PILES
02620	SUB-DRAINAGE
03100	CONCRETE FORMWORK
03200	CONCRETE REINFORCEMENT
03250	CONCRETE ACCESSORIES
03300	CAST-IN-PLACE CONCRETE
03412	PRECAST CONCRETE ROOF PANELS
05500	MISCELLANEOUS STEEL FABRICATIONS
05530	ALUMINUM FABRICATIONS
07550	EPDM WATERPROOF MEMBRANE
09870	COATING SYSTEMS FOR STEEL TANKS AND PIPES
15010	GENERAL MECHANICAL PROVISIONS
15100-00	PLUMBING PIPING
15100-01	DATA SHEET- POLYVINYL CHLORIDE DRAIN WASTE AND VENT(PVC-DWV) PIPE AND FITTINGS
15100-02	DATA SHEET – CAST IRON SOIL PIPE(CISP) AND FITTINGS
15100-03	DATA SHEET - COPPER DRAINAGE AND VENT PIPE AND FITTINGS
15100-10	DATA SHEET - GALVANIZED STEEL DRAIN AND VENT PIPE AND FITTINGS
15200-000	PROCESS PIPING

SPECIFICATION No.	TITLE
15200-00L	PIPING SERVICE LEGEND
15200-00S	PIPING SCHEDULE
15200-03	DATA SHEET - CARBON STEEL PIPE AND FITTINGS – GENERAL SERVICE
15200-04	DATA SHEET - CARBON STEEL PIPE AND FITTINGS – LARGE DIAMETER
15200-07	DATA SHEET - GALVANIZED STEEL PIPE AND FITTINGS – GENERAL SERVICE
15200-08	DATA SHEET - STAINLESS STEEL PIPE AND FITTINGS – GENERAL SERVICE
15200-09	DATA SHEET - STAINLESS STEEL PIPE AND FITTINGS – SPECIAL SERVICE 1
15200-10	DATA SHEET- POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS
15200-12	DATA SHEET- FIBREGLASS REINFORCED PLASTIC (FRP) PIPE AND FITTINGS
15200-13	DATA SHEET- COPPER AND COPPER ALLOY PIPE, TUBING AND FITTINGS
15200-19	DATA SHEET- STAINLESS STEEL PIPE AND FITTINGS – SPECIAL SERVICE 2
15200-20	DATA SHEET- STAINLESS STEEL PIPE AND FITTINGS – SPECIAL SERVICE 3
15410	PLUMBING FIXTURES

E2. SOILS INVESTIGATION REPORT

E2.1 Further to GC:3.1, a copy of the geotechnical information is available on the Winnipeg Water Treatment Program – Project Site Information page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt/projects

E2.2 Test Hole Logs

E2.2.1 Geotechnical information has been compiled from various sources to summarize subsurface conditions within the work area. Test_Hole_Logs-Set1.pdf at the aforementioned internet site.

(a) By UMA Engineering

(i) TH's 04-01 to 04-10, 04-12 to 04-24, 04-31, and 04-33 to 04-50 (2004)

(ii) TH's 1 to 3 (1996)

(b) By Others

(i) TH A13 by KGS Group (1991)

(ii) TH's 3 to 6 by RM Hardy & Associates (1977)

(iii) TH 1 and 2 by Dyregrov Consultants (1993)

(c) The Figure attached with the Water Treatment Plant Test Pile Program in Appendix B of these Specifications illustrates the test pile locations in relation to the work area.

(d) Within the City of Winnipeg Water Treatment Plant Preliminary Design Report – Section 14 Geotechnical Investigation (2005), UMA Test Hole information is considered accurate at the locations drilled and at the time of the investigations.

The inclusion of test hole data recorded by others does not represent any guarantees to the accuracy of this data.

(e) Test hole information is provided to assist in the Bidder's evaluation of subsurface conditions and the Bidder shall solely be responsible for any interpretation that they make from this information. Variations in soil conditions may exist between test holes and fluctuations in groundwater levels can be expected seasonally and may occur as a result of construction activities or operation of the Floodway.

E2.3 Test Pile Driving Records

E2.3.1 Test_Pile_Driving_Records-Set1.pdf at the internet site identified in E2.2. shows data recorded by UMA Engineering Ltd. during driving of ten (10) test piles at the site in March, 2005.

E2.4 Reports

E2.4.1 Additional reports and geotechnical information listed as follows are available for viewing at the offices of Earth Tech Canada Inc., 850 Pembina Highway, Winnipeg, Manitoba.

(a) The City of Winnipeg Water Treatment Plant Preliminary Design Report – Section 14 Geotechnical Investigation (2005)

(b) Water Impounding Reservoir - Cell #2 and Booster Pumping Station Deacon Manitoba by RM Hardy & Associates Ltd. (1977)

(c) Proposed Venturi Chambers Deacon Reservoir by Dyregrov Consultants (1993)

(d) Deacon Reservoir Expansion Proposed Groundwater Monitoring Program by KGS Group (1993)

(e) Shoal Lake Aqueduct Program 5 – Deacon Drainage Improvements by UMA Engineering Ltd. (1996)

(f) Pile Driving records from Deacon Booster Pumping Station by RM Hardy and Associates (1979).

(g) Pile Driving records for the Clearwell construction Bid Opportunity 166-2005 by Earth Tech (Canada) Inc. (2005).

Information in these reports has been provided to assist in the Bidder's evaluation of subsurface conditions and the Bidder shall solely be responsible for any interpretation that they make from this information.

GENERAL REQUIREMENTS

E3. OFFICE AND SITE FACILITIES

E3.1 The Contractor shall supply office facilities for his own use and also for Concrete Quality Testing. The facilities shall be situated at the area designated on the drawings.

(a) Facilities for Concrete Quality Testing:

(i) The minimum facility floor area shall be 10 square metres

(ii) The facility shall have a door with lockable hardware

(iii) The facility shall have heating and cooling provisions to maintain a temperature between 15C and 25C

(iv) The facility shall be set up so that it is vibration free

(v) The facility shall be accessible seven (7) days a week for test sample pickup

E3.2 With reference to drawing CM-G001, the City will provide to the Contractor without cost:

(a) Granular pad for office location

(b) A 100A two pole breaker in Distribution A to serve office lighting, receptacles and convenience power (electric space heating equipment is not allowed)

(c) Communications connections for four telephone and internet (high speed equivalent). The Contractor shall supply and install the telephone service from the City's existing telephone service pedestal that is located in the contractor's office area.

(d) Onsite washroom and toilet facility with non-potable water supply.

(e) Power for construction purposes:

(i) The City will provide space in each of the Temporary Power Supply panel and Distribution B for one 225A, 600V, 3 pole breaker to serve tower cranes.

(ii) The City will provide and energize two portable distribution panels (Distribution 4 and Distribution 5) as shown on CM-G001 for the Contractor's use. These distribution panels will include a 45kVA transformer (600V:208V, 3 phase)and 125A, 120/208V, 3 phase panelboard with space for 10 circuits each.

(iii) Unless otherwise specified, all required over-current protection, portable distribution panels and transformations, cables, conductors, grounding and other materials required to provide construction power for the Work shall be supplied and installed by the Contractor.

(iv) Distributions 1, 2 and 3 as shown on CM-G001 are not available for the Contractor's use.

(v) Manitoba Hydro utility charges for electrical power used by the Contractor for construction purposes will be paid by the City.

(vi) Power required for on-site welding shall be provided by the Contractor.

E3.2.1 The Contractor may arrange for additional facilities with the approval of the Contract Administrator and at the Contractor's cost.

E4. SITE ROADS AND WORK SITE ACCESS

E4.1 The Contractor shall have access to the Site on Business Days between 07:00 and 18:00 unless otherwise approved by the Contract Administrator.

E4.2 Access to the work site is restricted and cooperation with other contractors on site is necessary in the best interest of all parties.

E4.3 The Site is located on Provincial Road 207, 3.2 km north of Highway 1 in Dugald, Manitoba.

E4.3.1 The Site address is PR 207, Lot 57082, Dugald, Manitoba.

E4.3.2 Provincial Road 207 is a Class B1 road and is subject to load restrictions which will affect the maximum weight of individual deliveries. However, The City of Winnipeg and Manitoba Transportation and Government Services (TGS) have reached the following agreement to facilitate construction of the Winnipeg Water Treatment Program:

(a) The approximately 3.2 km of PR 207 between the entrance to the Site and Highway 1 will be designated as an TAC Route for construction of the Winnipeg Water Treatment Program effective January 1, 2006 until TGS imposes Spring Restrictions.

(b) During the TGS imposed Spring Restriction period, normal (non Spring Restriction) Class B1 highway loadings will be allowed on PR 207 between the entrance to the Site and Highway 1. The Spring Restriction period is normally in place from March

23 to May 26, but it is subject to change due to weather conditions as assessed by TGS. Upon removal of the Spring Restriction, normal Class B1 will continue to be allowed.

(c) The portion of PR 207 between the entrance to the Site and Highway 1 will be upgraded during 2006 to a TAC Route. PR 207 will remain open during the upgrading process but users will be subjected to intermittent delays due to road construction.

(d) TGS permits will be required for each construction vehicle in excess of Class BI highway loading from January 1, 2006 until the upgrade of PR 207 has been completed:

(i) The Contract Administrator will provide permit forms to the Contractor.

(ii) The Contractor shall complete a permit form for each company retained to transport materials to the Site and shall return them to the Contract Administrator who will submit the permit forms to TGS for processing.

(iii) The Contract Administrator will return the completed permit forms to the Contractor and the Contractor shall ensure that each vehicle carries a photocopy of the permit.

(iv) The permit fee will be paid directly to TGS by the City of Winnipeg. The Contractor will not be charged for the permit fees.

(v) The permit will be good for 1 year from issue.

(vi) The Contract Administrator will establish a process to record the date, company name and commodity of each vehicle entering the Site.

(vii) TGS will make random permit checks of vehicles using PR 207.

E4.4 Access to the Site is generally limited to

(a) A temporary bridge over the Aqueduct adjacent to the Project offices. Use of this bridge has restrictions for the period of time that the yard piping and Raw Water Pumping Station construction is under way (see D15 – Schedule Restrictions) – this bridge is scheduled to be removed October 31/06

(b) A temporary bridge over the Aqueduct east of the Manitoba Hydro tower– this bridge is scheduled to be removed October 31/06. The permanent bridge adjacent to this bridge shall be constructed during the summer of 2006 and shall be available for use by the City and other contractors upon completion.

(c) Access from west of the Clearwell. Use of this access is subject to completion of clearwell backfill expected to be complete mid summer 2006.

E4.5 On site access roads will be installed by others as follows:

(a) From temporary bridge noted in E4.4(a) above to a location adjacent to the RWPS.

(b) From temporary / permanent bridge noted in E4.4(b) above to a location adjacent to the RWPS at approximately elevation 234.0.

E4.6 Maintenance and upkeep of the noted roads is the shared responsibility of all contractors who use the roads, including the Contractor.

E4.7 Construction and removal, if necessary, of any additional access roads is the responsibility of the Contractor.

E4.8 The Contractor may use of the north portion of the Muster Area #2, as noted on drawing CM-G001, as a lay down area for staging the Work until December 31, 2007. Any levelling of the earth in the Contractor’s lay down area shall be done at the Contractor’s cost.

E5. FIELD ENGINEERING

E5.1 The Contractor shall engage a qualified surveyor to layout the works and record as-constructed measurements for Record Drawings.

E5.2 The surveyor shall be a registered Manitoba Land Surveyor, or an instrumentman or surveying firm experienced in layout of similar projects, subject to the approval of the Contract Administrator.

E5.3 Survey reference points for horizontal and vertical control are indicated on the drawings. The Contractor shall locate, confirm and preserve the reference points during construction.

E6. SITE DRAINAGE

E6.1 The Contractor shall be responsible for drainage of all excavations associated with the Work from Award until Total Performance.

E6.2 Provision of adequate site drainage during the performance of the Contract shall be the Contractor's responsibility. The Contractor shall maintain site grading as necessary to provide for proper drainage away from the excavated areas. This water is to be re-directed into ditches outside of the site. Silt fences shall be properly erected and keyed into the primary ditches to prevent eroded materials from leaving the site. No extra payment or time extension will be granted as a result of difficulties associated with site access resulting from poor site drainage during any part of the performance of the Work.

E7. WASTE CONTAINER

E7.1 A waste container to dispose of garbage produced from the site shall be provided by the Contractor. It shall be located in a safe, convenient location, and be emptied as necessary by the Contractor. The provision, maintenance and removal of a waste container shall be considered a subsidiary obligation of the Contractor.

E8. SANITATION FACILITY

E8.1 Portable toilets may be provided by the Contractor. Any portable toilet shall be cleaned on a weekly basis and provided with regular maintenance as required to ensure proper operation.

E8.2 Portable toilets shall be located in an area acceptable to the Contract Administrator.

E9. CONDITION, PROTECTION OF, AND ACCESS TO THE AQUEDUCT

E9.1 Condition of the Aqueduct

E9.1.1 The Aqueduct is constructed of reinforced concrete and in some areas, contains numerous cracks. The Aqueduct, therefore, shall be considered as a fragile structure. All work procedures conducted by the Contractor on and/or near the Aqueduct shall be well planned and executed to ensure that the Aqueduct is not subjected to construction related loads, including excessive vibrations and concentrated or asymmetrical lateral loads.

E9.2 Protection of the Aqueduct

E9.2.1 Contractors working in the vicinity of the aqueduct shall ensure that:

(a) Equipment shall only be permitted to cross the Aqueduct at designated bridge crossing locations and shall come to a complete stop before crossing.

(b) Granular material, construction material, soil or other material shall not be stockpiled on the Aqueduct or within 10 metres of the Aqueduct centreline.

(c) Construction practices shall not subject the Aqueduct arch to asymmetrical loading at any time.

(d) Construction practices or procedures at or near the Aqueduct shall not impart excessive vibration loads on the Aqueduct and/or cause settlement of the subgrade below the Aqueduct.

E9.2.2 It is the Contractors' responsibility to ensure that all work crew members understand, observe, and work to the requirements of Specifications.

E9.3 Equipment Restrictions

E9.3.1 Equipment must cross the Aqueduct in a responsible and careful manner (i.e. slowly).

E10. ENVIRONMENTAL PROTECTION

E10.1 The Contractor shall be aware that the Aqueduct is for potable water supply and no contamination by fuel, chemicals, etc. shall be permitted at any time. Fuels or chemicals shall not be stored within 30 metres of the Aqueduct.

E10.2 The Contractor shall plan and implement the Work of this Contract strictly in accordance with the requirements of the environmental protection measures as herein specified.

E10.3 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

E10.3.1 Federal

(a) Canadian Environmental Protection Act (CEPA) c.16

(b) Transportation of Dangerous Goods Act and Regulations c.34

E10.3.2 Provincial

(a) The Dangerous Goods Handling and Transportation Act D12

(b) The Endangered Species Act E111

(c) The Environment Act c.E125

(d) The Fire Prevention Act F80

(e) The Manitoba Nuisance Act N120

(f) The Public Health Act c.P210

(g) The Workplace Safety and Health Act W120

(h) Current applicable associated regulations.

(i) The Fisheries Act

(j) The Migratory Birds Act

(k) The Historic Resources Act

(l) Drinking Water Safety Act

E10.3.3 The Contractor is advised that the following environmental protection measures apply to the Work.

E10.3.4 Materials Handling and Storage

(a) Construction materials shall not be stored within ten (10) metres of the Aqueduct centerline without the approval of the Contract Administrator.

E10.3.5 Fuel Handling and Storage

(a) The Contractor shall abide by the requirements of Manitoba Conservation storage and handling of Petroleum Products and Allied Products Regulations for handling and storage of fuel products.

(b) All fuel handling and storage facilities shall comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.

(c) Fuels, lubricants, and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act shall be stored and handled within the approved storage areas.

(d) The Contractor shall ensure that all fuel storage containers are inspected daily for leaks and spillage.

(e) Products transferred from the fuel storage area(s) to specific work sites shall not exceed the daily usage requirement.

(f) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size shall be spread on the ground to catch the fluid in the event of a leak or spill. No repairs within 30 m of aqueduct or watercourse will be permitted.

(g) Refuelling of mobile equipment and vehicles shall take place at least 30 m from a watercourse.

(h) The area around storage sites and fuel lines shall be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.

(i) A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills shall be stored nearby on-site. The Contractor shall ensure that additional material can be made available on short notice. All refuelling vehicles shall be equipped with a spill response kit.

E10.3.6 Waste Handling and Disposal

(a) The construction area shall be kept clean and orderly at all times during and at completion of construction.

(b) At no time during construction shall personal or construction waste be permitted to accumulate for more than one day at any location on the construction site, other than at a dedicated storage area as may be approved by the Contract Administrator.

(c) Indiscriminate dumping, littering, or abandonment shall not take place.

(d) No on-site burning of waste is permitted.

(e) Equipment shall not be cleaned within 30 m of watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.

E10.3.7 Dangerous Goods/Hazardous Waste Handling and Disposal

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

(b) The Contractor shall be familiar with The Dangerous Goods Handling and Transportation Act and Regulations and meet training requirements for these Regulations.

E10.3.8 Emergency Spill Response

(a) The Contractor shall ensure that due care and caution is taken to prevent spills.

(b) The Contractor shall report all major spills of petroleum products or other hazardous substances with the potential for impacting the environment and threat to human health and safety to the Contract Administrator and Manitoba Conservation, immediately after occurrence of the environmental accident, by calling the 24-hour emergency telephone phone number (204) 945-4888.

(c) The Contractor shall designate a qualified supervisor as the on-site emergency response coordinator for the project. The emergency response coordinator shall have the authority to redirect manpower in order to respond in the event of a spill. (Should include reference to a site-specific Emergency Response Plan and Environmental Protection Plan.)

(d) The following actions shall be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on-site emergency response coordinator:

(i) Notify emergency-response coordinator of the accident:

- identify exact location and time of accident
- indicate injuries, if any
- request assistance as required by magnitude of accident Manitoba Conservation 24-hour Spill Response Line (204) 945-4888, RCMP (Oakbank Detachment) (911), City of Winnipeg Fire Department (911), Springfield Ambulance (911), company backup, contact Contract Administrator.

(ii) Assess situation and gather information on the status of the situation, noting:

- personnel on site
- cause and effect of spill
- estimated extent of damage
- amount and type of material involved
- proximity to waterways and the Aqueduct

(iii) If safe to do so, try to stop the dispersion or flow of spill material:

- approach from upwind
- stop or reduce leak if safe to do so
- dyke spill material with dry, inert sorbent material or dry clay soil or sand
- prevent spill material from entering waterways and utilities by dyking
- prevent spill material from entering Aqueduct manholes and other openings by covering with rubber spill mats or dyking

(iv) Resume any effective action to contain, clean up, or stop the flow of the spilled product.

The emergency response coordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to the Manitoba Conservation according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.

E11. SHOP DRAWINGS AND PRODUCT DATA

E11.1 Arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles

or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator in writing of any deviations in Shop Drawings from the requirements of the Contract Documents.

E11.2 Shop Drawings shall be submitted with a copy of the associated Specification. For each Specification clause, note compliance or deviation from Specification. Provide full explanation for any deviation. Shop Drawings submitted without the associated Specification Sections will be returned to the Contractor as “Rejected”.

E11.3 Examine all Shop Drawings prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of the Work and the Contract Documents. Examination of each Shop Drawing shall be indicated by stamp, date and signature of a responsible person of the Subcontractor for supplied items and of the General Contractor for fabricated items. Shop Drawings not stamped, signed and dated will be returned without being reviewed and stamped Re-submit".

E11.4 Submit Shop Drawings with reasonable promptness and in an orderly sequence so as to cause no delay in the Work. Failure to submit Shop Drawings in ample time is not to be considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed. Jointly prepare a schedule fixing the dates for submission and return of Shop Drawings.

E11.5 The Contract Administrator will review and return Shop Drawings in accordance with the schedule agreed upon or otherwise with reasonable promptness so as to cause no delay in the Work.

E11.6 Submit six (6) copies of white prints, plus one (1) copy of reproducibles, and six (6) copies of all fixture cuts and brochures.

E11.7 Shop Drawing review by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.

E11.8 Review by the Contract Administrator shall not relieve the Contractor of his responsibility for errors or omissions in Shop Drawings or for proper completion of the Work in accordance with the Contract Documents.

E11.9 Responsibility for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation and coordination of all parts of the Work rests with the Contractor.

E11.10 Shop Drawings will be returned to the Contractor with one of the following notations:

E11.10.1 When stamped "REVIEWED" or "NO EXCEPTIONS TAKEN", distribute additional copies as required for execution of the Work.

E11.10.2 When stamped "REVIEWED AS MODIFIED" or "MAKE NOTED CORRECTIONS", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".

E11.10.3 When stamped "REVISE & RESUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.

E11.10.4 When stamped "NOT REVIEWED" or "REJECTED", submit other Drawings, brochures, etc. for review consistent with the Contract Documents.

E11.10.5 Only Shop Drawings bearing "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS", or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.

E11.11 After submittals are stamped "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.

E11.12 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.

E11.13 Make changes in Shop Drawings, which the Contract Administrator may require, consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

E11.14 Shop Drawings indicating design requirements not included in the Contract Documents require the seal of a qualified Professional Engineer, registered in the province of the place of the Project. Consulting calculations shall be submitted for review, if requested, and sealed by a qualified Professional Engineer.

E11.15 Only two (2) reviews of shop drawings will be made by the contract administrator at no cost. Each additional review will be charged to the contractor at the contract administrator's scheduled rates. The contract administrator's charges for the additional work will be deducted from the contractor's progress certificates.

E12. SITE RESTORATION

E12.1 The Contractor shall remove the temporary Site office and storage facilities prior to Total Performance being issued.

E12.2 The Contractor shall be responsible for ground restoration, as determined necessary by the Contract Administrator.

E12.3 The Contractor shall be responsible for any damage caused by his forces on roadways or accesses.

E13. FORMS

E13.1 The following forms will be used on this Contract:

Form 103 Certificate of Equipment Satisfactory Performance

E13.2 A Sample of this form is found in Appendix A – Forms.

E14. RECORD DRAWINGS

E14.1 The Contractor shall keep one (1) complete set of white prints at their Site office, including all Addenda, Change Orders, Field Instructions, and other revisions for the purposes of Record Drawings. As the Work proceeds, the Contractor shall clearly record in red pencil all as-built conditions which deviate from the original Contract documents.

E14.2 The Record Drawings shall be available for review by the Contract Administrator upon request at any time during the performance of the Work.

E14.3 Prior to achieving Total Performance, the Contractor shall submit the Record Drawings prepared pursuant to E15.1 to the Contract Administrator for his review and use. If, in the opinion of the Contract Administrator, the Record Drawings are incomplete or inaccurate, the Record Drawings will be returned to the Contractor and the Contractor shall revise and resubmit the Record Drawings at his cost.

E14.4 Total Performance cannot be achieved without the submission of Record Drawings as specified in E15.1 and that are acceptable to the Contract Administrator.

E15. NOT USED

E16. PIPE EMBEDS AND BLOCKOUTS

E16.1 The Drawings do not show the locations of all mechanical, electrical and other embedments. Additional embedments and blockouts required shall be provided as indicated in Appendix B.

E16.2 Further to Appendix B: all embed types identified as “conduit embed” or “conduit sleeve” are electrical embeds and will be supplied and installed by a Supply Contractor. All other items specified in Appendix B shall be installed or supplied and installed by the Contractor as specified in D2.2.

SPECIFICATIONS FOR THE CONSTRUCTION OF THREE BRIDGES

E17. TRAFFIC CONTROL

E17.1.1 Further to clause 3.7 of CW 1130-R1, the Contractor shall maintain safe traffic movement along the main access road servicing Deacon Booster Pumping Station including, but not limited to erecting appropriate roadway signing. The Contractor shall erect barricades for the duration of construction at the south limit of construction, keeping non-construction-related traffic from entering the site and potentially crossing the unprotect Aqueduct.

E18. REMOVE AND INSTALL CHAIN LINK FENCE

E18.1 Description

E18.1.1 Remove and Install Chain Link Fence shall be in accordance with Specification CW 3550-R2, ”Chain Link Fencing” except where noted, revised, or supplemented in this Specification.

E18.2 Materials

E18.2.1 The Contractor shall utilize the existing chain link fence material that encloses the Aqueduct to reconfigure the fence geometry as indicated on the drawings. Any excess material shall be neatly rolled and disposed of in accordance with GC:9.

E18.3 Construction Methods

E18.3.1 The Contractor shall remove the fence to the limits as indicated on the drawings.

E18.3.2 After completion of the bridge construction the Contractor shall install the fence to 1 m outside the top of the backslope and close off access to the Aqueduct.

E19. EXCAVATION

E19.1 Description

E19.1.1 Excavation shall be in accordance with Specification CW 3170-R3, "Earthwork and Grading" except where noted, revised, or supplemented in this Specification.

E19.2 Construction Methods:

E19.2.1 The Contractor shall utilize Stockpile No. 1, as illustrated on the drawings, beginning at the west tip and working in an easterly direction to construct the earth embankment on the north side of the Aqueduct. The Contractor shall also utilize this stockpile to regrade the ditches as indicated on the drawings. If there is excess material from Stockpile No. 1 that lies within the roadway cross section (after constructing the road embankment and regrading the ditches), the Contractor shall excavate, haul, and place this material along the southwest face of Stockpile No. 2. The material placed in the ditches shall be compacted to a minimum of ninety (90) percent of Standard Proctor Density.

E20. GWWD RAILWAY EMBANKMENT CULVERT INSTALLATION

E20.1 Description

E20.1.1 Culvert Installation shall be in accordance with Specification CW 3170-R3, "Installation of Culverts" except where noted, revised, or supplemented in this Specification.

E20.2 Materials

E20.2.1 The Contractor shall supply railway ballast in accordance with the requirements hereinafter specified.

E20.2.2 Railway ballast shall be composed of hard, strong and durable particles, clean and free from injurious amounts of deleterious substances and conforming to the following requirements of this Specification.

(a) The limits for deleterious substances are as follows:

(i)	Soft and friable pieces	5.0%
(ii)	Material finer than No. 200 Sieve	2.0%
(iii)	Clay lumps	0.5%

E20.2.3 The percentage of wear shall be less than 32%, as determined by the LA Abrasion Test, ASTM Designation C131.

E20.2.4 The soundness loss shall be less than 13.0%, as determined by the magnesium sulphate soundness test for coarse aggregate, ASTM Designation C88.

E20.2.5 The railway ballast shall contain less than 25% by mass of flat pieces. In case of dispute, the test method "Determination of Flakiness Index", British Standard B12, shall be used.

E20.2.6 The minimum bulk specific gravity shall be 2.60, ASTM Designation C127.

E20.2.7 At least 60% of the railway ballast shall have 2 or more fractured faces.

E20.2.8 Railway ballast shall conform to the following gradation in accordance with ASTM Designation C136 and C117:

Sieve Opening Size	Permissible Range (% by Weight Passing)
2 inch	100
1½ inch	90 – 100

1 inch	20 – 55
¾ inch	0 – 15
¾ inch	0 – 5
No. 200	0 - 2

E20.3 Construction Methods

E20.3.1 The City of Winnipeg will be responsible for removing and re-installing the ties and rail. At least five (5) Business Days notice shall be given to the Contract Administrator.

E20.3.2 The Contractor shall complete the excavating, culvert installation, and backfilling within a 24 hour period following removal of the ties of and rail.

E20.3.3 The Contractor shall excavate to the lines and grades as specified by the Contract Administrator and install the culvert according to CW3170-R3.

E20.3.4 After proper placement and backfill of the culvert the Contractor shall rebuild the track structure to match the existing.

E20.3.5 The sub-ballast layer shall be a minimum of 300 mm in thickness. The Contractor shall utilize a 50 mm down crushed limestone material meeting CW3110-R7. It shall be placed and compacted according to CW3110.

E20.3.6 The ballast material layer shall be a minimum of 300 mm in thickness. The Contractor shall utilize a material as specified in Specification E20.2 above. It shall be placed and compacted according to CW3110.

E20.3.7 Items of Work: CSP Culvert

(a) Supply

(b) Install

E21. INSPECTION

E21.1 Construction operations for timber, concrete, steel or other structures shall not be in progress when the Contract Administrator or his representative is not on the site unless otherwise authorized by the Contract Administrator.

E22. BORING LOGS

E22.1 The City provides boring log information shown on the Plans. The information may not be representative of the soil conditions throughout the site. The following clauses in the referenced Specifications are not applicable to this project:

(a) Specification No. 1000 M, “Specifications for Excavation for Structures”, Clause 7.13.

(b) Specification No. 1016 M, “Specifications for Driving Precast Concrete Piles”, Clause 7.8.

E23. EXCAVATON FOR STRUCTURES

E23.1 In addition to the work called for in Specification No. 1000 M, “Specifications for Excavation for Structures”, the Contractor will be responsible under his Contract Price to:

E23.1.1 Remove and dispose of all surplus excavated material or any other debris on Site as directed by the Contract Administrator.

E23.1.2 Maintain the slopes to the elevations and limits as indicated on the Plans and as directed by the Contract Administrator, as well as transitioning, as required, to meet the existing slopes or new roadway embankment.

E23.2 Measurement and payment made for excavation of structures shall be based upon Specification E12.4.2. The remaining items within Specification No. 1000 M shall be considered incidental to and paid for under the lump sum contract price.

E24. PRECAST CONCRETE PILES

E24.1 Notwithstanding and in addition to Bridge Specification 1016 M, "Specifications for Driving Precast Concrete Piles", the following shall apply:

E24.2 Materials

E24.2.1 Precast concrete piles shall be supplied and installed by the Contractor. The Contractor shall submit shop drawings of the piles, connections to abutment cap and pile extension (if required) to the Contract Administrator for approval. Each drawing submitted shall bear the signature and stamp of a qualified Professional Engineer registered in the province of Manitoba. Each pile, its extension (if required) as well as its connection to abutment cap shall have design structural capacity as stated on the plan.

E24.3 Construction

E24.3.1 At each piling location, a hole shall be bored down to 1.50 m (minimum) below the invert elevation of the aqueduct as shown on the plan. The diameter of the pre-bored hole shall be the same as that of the pile.

E24.3.2 Piles shall be inserted into the pre-bored holes and then driven to refusal. A driven pile shall be regarded as reaching refusal when it advances 1 in (25 mm) or less after driven by 15 blows of hammer having a rated energy of 26 ft-kip (35 kJ) per blow. The Contractor shall consult the Contract Administrator for refusal criteria for pile driving equipment having rated energy other than 35 kJ per blow.

E25. VOID FORM

E25.1 Cellular corrugated paper Void Form shall be of a type specified on the Plans or equivalent as approved by the Contract Administrator.

E25.2 No measurement or separate payment shall be made for supplying and placing void form. The works shall be considered incidental to and paid for under the lump sum contract price.

E26. MIXING AND PLACING CONCRETE

E26.1 Construction of the abutments, bridge slab and approach slabs shall be in accordance with the Specifications 1030M, 1031M and 1032M. All materials required for the constructions shall be furnished by the Contractor from sources approved by the Contract Administrator.

E26.2 Notwithstanding the Specifications, referenced above, the contractor will also be responsible for the following:

E26.2.1 Supplying and applying concrete curing compound with fugitive dye to all exposed horizontal surfaces of the concrete abutments. The compound shall be water-based membrane-forming and of a type approved by the Contract Administrator. It shall conform to the requirements of ASTM C309 and be applied as directed by the manufacturer and in accordance with the specification.

E26.2.2 Wet-curing of all exposed portions of superstructure concrete, as directed by the Contract Administrator. The curing shall be accomplished by applying a clean damp burlap or polyester blanket within 30 minutes of finishing operations. The burlap or polyester blanket shall receive an additional cover of 4 mil white or opaque polyethylene as soon as the surface conditions permit.

E26.2.3 Supplying and incorporating water-reducing admixture. Ensuring that the concrete mix does not contain any retarding agent.

E26.2.4 Ensuring compatibility of all admixtures included in the concrete mix.

E26.3 No measurement or separate payment shall be made for the works, stated in the above two subsections, as they will be considered incidental to and paid for under the lump sum contract price.

E26.4 Should deepening of the abutment caps be required, as a result of unexpected foundation condition, the contractor shall submit shop drawings to the Contract Administrator describing his proposed modifications to the abutment caps. The Contractor shall proceed with the construction of the abutment caps upon approval from the Contract Administrator. The works involved shall be paid for in accordance with GC:12..

E26.5 No measurement or separate payment shall be made for supplying, mixing and placing lean-mixed concrete working base. The works shall be considered incidental to and paid for under the lump sum contract price

E26.6 No measurement or separate payment shall be made for supplying and placing insulator. The works shall be considered incidental to and paid for under the lump sum contract price.

E27. COMPRESSION SEAL

E27.1 The contractor shall supply and install preformed compression seals including accessories at the joints between bridge deck and approach slabs. No separate payment will be made for the work as it will be considered incidental to the Contract Lump Sum Price.

E28. HOT POURED RUBBERIZED ASPHALT WATERPROOFING

E28.1 The hot poured rubberized asphalt water proofing shall be applied on the bridge deck and approach slabs to the limits shown on the Plans. The asphalt waterproofing shall be “HYDROTECH Flexible Waterproofing Membrane 6125” or an approved equivalent.

E28.2 Further to Specification 1055 M,the Contractor shall supply and install hot poured rubber asphalt waterproofing in accordance with the following:

(a) Sandblasting to clean concrete surface onto which the asphalt waterproofing is to be applied.

(b) Smoothing levelling of the concrete surface by mean of light chipping or grinding or other approved methods.

(c) Final cleaning of the concrete surface by mean of high velocity compressed air, immediately prior to the application of the hot poured rubberized asphalt waterproofing.

(d) Supplying and installing an approved heavy duty elastomeric sheet which is compatible with the hot poured rubberized asphalt water proofing. The elastomeric sheet shall be “ELSRO PETROTACT 240” or an approved equivalent. The installation shall be in accordance with the manufacturer’s recommendations.

(e) Supplying and installing approved protection boards to cover the hot poured rubberized asphalt water proofing on the bridge deck and approach slabs. The protection board shall

be “SEALTIGHT VIBRAFLEX 70” or an approved equivalent. The installation shall be in accordance with the manufacturer’s recommendations. This shall replace the dusting requirement, i.e. Section 7.2(g) of the referenced Specification.

E29. ASPHALT PAVING ON BRIDGES

E29.1 Asphalt paving on bridge deck and approach shall be done in conformance with Specifications 1052 M, "Specifications for Asphalt Paving on Bridges”. The asphalt mix shall be pre-approved based on trial samples supplied by the Contractor and tested by the City’s designated laboratory prior to placement on site.

E29.2 Application of tack coat onto the protection board is required. The asphalt paving machine shall proceed in the same direction as the protection board. The Contractor shall saw-cut the asphalt, supply and place an approved joint sealant as shown on the Plans.

E29.3 No measurement or separate payment shall be made for the works, stated in the above two subsections, as they will be considered incidental to and paid for under the lump sum contract price.

E30. MISCELLANEOUS METAL

E30.1 Notwithstanding Specifications 1062 M, "Specifications for Placing Miscellaneous Metal” and Specifications 1064 M “Specifications for Placing Steel Beam Guard Railing”, the Contractor shall add the following:

E30.2 The Contractor shall supply all material, labour, plant and equipment required to complete the work as hereinafter specified and as shown on the Drawings including but not necessarily confined to the following:

(a) Supply and installation of bridge railing anchors

(b) Supply and installation of bridge railing rail post washers

E30.3 Materials

E30.3.1 All miscellaneous metal shall be new structural carbon steel and conform to CAN/CSA-G40.20 and CAN/CSA-G40.21.04 grade 300 W.

E30.3.2 High strength bolts shall be ASTM A325M including suitable nuts and plain hardened washers.

E30.3.3 All miscellaneous metal shall be hot dip galvanized in accordance with CSA Standard G164 after fabrication.

E30.3.4 All metal surfaces to be galvanized shall be cleaned thoroughly of rust, rust scale, mill scale, dirt, paint and other foreign material by commercial sand, grit or shop blasting or pickling prior to galvanizing. Heavy deposits of oil and grease shall be removed with solvents prior to blasting or pickling.

E30.4 Construction Methods

E30.4.1 All miscellaneous metal shall be fabricated in strict accordance with the Drawings. Work shall be straight and true to curve or radius, shape and size. Exposed ends and edges of metal shall be made smooth.

E30.4.2 All miscellaneous metal shall be galvanized after fabrication.

E30.4.3 Miscellaneous metal must be handled in a careful and workmanlike manner and must be stored on build-up platforms in such a manner as to protect the finish.

E30.4.4 Miscellaneous metal shall be installed and fastened as shown on the drawings.

E30.4.5 High tensile bolts shall be tightened to provide the following minimum bolt tension:

Bolt Size	**Minimum Bolt Tension**
M 16 mm diameter	85 KN
M 20 mm diameter	125 KN
M 22 mm diameter	174 KN

E30.4.6 At no time shall the bolt tension be in excess of the required minimum bolt tension given above by more than 15%.

E30.4.7 Unless otherwise specified, bolts shall be tightened by the turn-of-the-nut method. Where necessary the bolt may be turned while the nut is prevented from rotating.

E30.4.8 The turn-of-the-nut method is as follows. First a sufficient number of bolts shall be brought to a “snug-tight” condition to ensure that the parts of the joint are brought into full contact with each other. “Snug-tight” shall be defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial step, bolts shall be placed in all remaining holes and brought to snug-tightness. After all bolts are snug-tight, each bolt in the connection shall then be further tightened by a rotation of one-half turn with tightening progressing systematically from the most rigid part of the joint to its free edges. During this operation there shall be no rotation of the part not turned by the wrench. If this is not practical, the bolt and nut shall be match-marked to enable the amount of relative rotation to be determined.

E30.4.9 All steel work shall be accurately set and secured in place. The use of iron sledges in driving or hammering steel members into position will not be permitted. Failure of the material to fit properly shall be reported to the Contract Administrator before any corrective measures are taken.

E30.4.10 All welding shall conform to the requirements of CSA Standard W59-03 and AWS D1.1, and shall be made by an approved fabricator to the requirements of CSA Standard W47.1-03.

E30.4.11 No measurement or separate payment shall be made for the works, stated in this section, as they will be considered incidental to and paid for under the lump sum contract price.

EXCAVATION AND BACKFILLING FOR STRUCTURES

1. GENERAL

1.1 Work Included

.1 Work under this Section includes, but is not necessarily limited to the following items:

.1 Excavation to required elevations for the base slab, slab thickenings and pile caps, void form and granular levelling pad.

.2 Shoring, bracing and sheetpiling where indicated on Drawings.

.3 Supply and placement of 50 mm thick granular levelling material below the void form.

.4 Supply, placement, and compaction of backfill and fill materials to attain indicated grades and profiles.

.5 Disposal of surplus excavated material.

.6 Dewatering of excavations.

1.2 Reference Standards

.1 Conform to requirements of the NBC and the Canadian Construction Safety Code.

.2 Comply with excavation and trenching regulations of Provincial authorities.

1.3 Design of Shoring, Bracing and Sheet Piling

.1 Employ a Professional Engineer registered in the Province of Manitoba for the shoring, bracing, and sheet piling design.

.2 Design documentation shall be signed and sealed by a Professional Engineer registered in the Province of Manitoba.

1.4 Shop Drawings

.1 Submit Shop Drawings in accordance with Specification E11.

1.5 Samples

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

.2 All materials shall be reviewed and accepted by the Contract Administrator at least ten (10) days before any construction is undertaken.

.3 For granular materials, submit a 25 kg sample for coarse, gravelly soil or 75 kg sample for coarse, crushed stone of each type, clearly labelled for type and source of the materials, for

analysis by testing laboratory. Ship samples prepaid or deliver in tightly closed containers to testing laboratory designated by Contract Administrator.

.4 Costs for analysis will be paid by the City.

1.6 Compaction Testing

.1 Testing of compacted fill materials will be performed by an independent inspection and testing firm appointed and paid by the City. Testing will be performed so as to least encumber the performance of the Work.

.2 The City will pay for the first series of tests only, on the area being evaluated. Pay costs for additional testing, if required, due to improper performance of Work.

.3 Tests will be performed in accordance with ASTM D698 for Standard Proctor Density on representative samples to control compaction requirements. The Contract Administrator will decide the frequency and number of tests required.

.4 The field density of the compacted layers shall be verified by field density tests in accordance with ASTM D2922, using nuclear methods performed by the inspection and testing firm. The frequency and number of tests required will be decided by the Contract Administrator.

.5 Notify the Contract Administrator when Work of this Section or portions of Work are completed to own satisfaction. Do not proceed with additional portions of Work until test results have been verified and accepted.

.6 During Work tests, if tests indicate that compacted materials do not meet specified required materials, remove defective Work, replace and re-test at own expense as directed by the Contract Administrator.

.7 Ensure compacted fills are tested and accepted before proceeding with placement of surface materials.

1.7 Geotechnical Information

.1 Refer to Specification E2 for a list of test hole logs and reports available associated with the Site.

2. PRODUCTS

2.1 General

.1 All materials to be subject to Contract Administrator's acceptance.

.2 Granular materials to be composed of sound, hard, uncoated particles, free from injurious quantities of clay, flaky particles, soft shale, friable materials, roots, vegetable matter, and frozen lumps.

.3 Grading of granular materials to show no marked fluctuations between opposite ends of extreme limits.

.1 Type 1: pit run granular backfill shall consist of a clean, well-graded, and free-draining pit run material with a maximum size of 75 mm, and less than 5% by weight finer than 0.075 mm.

.2 Type 2: crushed gravel graded within following limits:

Canadian Metric Sieve Size	% Passing	
	Crushed Granular	Crushed Limestone
25,000	100	-
20,000	80 - 100	100
5,000	40 - 70	40 - 70
2,500	25 - 55	25 - 60
315	13 - 30	8 - 25
80	5 - 15	6 - 17

At least 60% of material retained on 5 mm sieve to have at least one (1) freshly fractured face.

.4 Type 3: pit run sand for levelling with maximum stone size 40 mm.

.5 Type 4: common backfill shall be free from organic material and rocks larger than 150 mm in size and building debris. Fill under landscaped areas to be free from alkali, salt, petroleum products, and other materials detrimental to plant growth. Common backfill shall be obtained from Disposal Sites 1 and 2 indicated on the Drawings subject to review by Contract Administrator.

.6 Type 5: impervious clay fill shall consist of high plasticity clay (CH) material as defined by the Unified Soil Classification System, with liquid limit (LL) greater than 50%, and permeability lower than 10 to 7 cm per second, and shall be free from stones, roots, or any other deleterious material as accepted by the Contract Administrator.

.7 Subdrain granular material is specified in Section 02620 – Sub-Drainage.

3. EXECUTION

3.1 Finish Elevations and Lines

.1 For setting and establishing finish elevations and lines, secure the services of a registered surveyor or experienced instrumentman acceptable to the Contract Administrator.

.2 Carefully preserve all data and all monuments set by the registered surveyor. If displaced or lost, immediately replace to the acceptance of the Contract Administrator, at no additional cost to the City.

3.2 Excavation

.1 Perform excavation in strict compliance to Work Place Safety and Health and authorities have jurisdiction.

.2 Excavate to noted limits and as required for walls and foundations. Stockpile material to be used for backfilling on-site as directed by the Contract Administrator. Excess material is to be disposed of immediately as per Item 3.6 – Disposal.

.3 When complete, request Contract Administrator to review excavations.

.4 Local pockets of material which, in the opinion of the Contract Administrator are unsuitable, shall be removed to such depths as required by the Contract Administrator.

.5 The completed excavation shall provide clean, level, solid, and water-free surfaces at the required elevations, ready to receive construction.

.6 Excavations are not to encroach on existing slopes and as indicated in the geotechnical information.

.7 Backfill and compact all over-excavated areas under structure surfaces with Type 1 fill and compact to 90% Standard Proctor Density and at no additional cost to the City.

.8 Make good all damage occurring as a result of inadequate, unauthorized, or defective methods of protection.

.9 Areas used for temporary stockpiling shall be restored to existing condition or better.

3.3 Shoring, Bracing, and Sheet Piling

.1 Supply and install all shoring, bracing, and sheet piling required to prevent damage to existing structures, excavations, and injury to personnel where necessary for safe work within the excavated area.

.2 Comply with all applicable rules and regulations of governmental authorities.

.3 Erect shoring, bracing, and sheet piling independent of utilities and structures.

.4 Prefabricated cages or shields may be used to supplement or replace conventional shoring, provided they comply with all applicable safety regulations and permit placing and compacting of backfilling material around new construction.

.5 Maintain shoring, bracing, and sheet piling during backfilling and remove in stages as backfilling progresses.

.6 Remove all shoring, bracing, and sheet piling unless otherwise permitted by Contract Administrator.

.7 If shoring, bracing, and sheet piling are allowed to remain, cutoff to an elevation at least 1000 mm below finish grade and structures.

.8 Assume full responsibility for any failure, collapse, or movement of existing structures, shoring, bracing, sheet piling, earth banks, trenches, and other excavations.

3.4 Dewatering

.1 Provide site drainage and dewatering in accordance with Specification E6.

3.5 Backfilling, Fill, and Compaction

.1 Preparation

.1 Ensure areas to be backfilled are free from debris, snow, ice, and water and that ground surfaces are not in a frozen condition.

.2 Backfilling and Filling

.1 Backfill and fill to grades, contours, levels, and elevations indicated on Drawings.

.2 Backfilling shall be performed only after the watertightness testing has been performed and the structure has been accepted by the Contract Administrator. If backfilling or partial backfilling is performed for construction reasons prior to watertightness testing, the fill shall be excavated for the watertightness testing to fully expose the structure walls.

.3 Do not backfill against foundation walls until the walls and the perimeter drainage system have been accepted by the Contract Administrator.

.4 Do not backfill against foundation walls until the floor slabs framing into the walls, where such slabs exist, have been completed. The wall concrete must have attained the twenty eight (28) day minimum compressive strength, and the slab concrete must have attained 80% of the twenty eight (28) day minimum compressive strength before backfilling. Do not backfill without the prior written permission of the Contract Administrator.

.5 Maintain optimum moisture content of materials to permit compaction to specified densities.

.6 Compact each soil layer to at least the specified minimum degree; repeat compaction process until plan grade is attained. Compaction densities indicated herein are based on ASTM D698 for Standard Proctor Density.

.3 Bedding over Sub-Grade

.1 Type 1 pit run gravel fill for over excavation shall be placed in uniform lifts not greater than 200 mm in thickness and shall be compacted to a density of at least 95% Standard Proctor Density.

.2 Type 3 pit run sand for the levelling layer shall be spread on the subgrade in the required minimum compacted thickness (100 mm) to attain smooth surfaces and required elevations indicated on the Drawings for the placement of the voidform under the footings and base slabs.

.4 Backfill around structure walls

.1 Type 1 pit run gravel fill and Type 4 common backfill shall be placed in lifts not greater than 200 mm in thickness to the extents shown on the Drawings and shall be compacted to a density of at least 95% Standard Proctor Density to allow equipment tractability and limit settlement, but not result in a significant decrease in permeability of the Type 1 pit run gravel.

.2 Successive lift placement of Type 1 and Type 4 shall be coordinated so that the maximum difference in the elevations of the respective working surfaces shall not exceed 200 mm.

.3 Type 5 impervious clay fill shall be placed in lifts not great than 150 mm in thickness to the extents shown on the Drawings and shall be compacted to a density of at least 95% Standard Proctor Density. Each compacted lift shall be scarified a minimum of 50 mm prior to placement of successive lifts to ensure adequate bonding between each lift.

.4 A homogeneous, continuous, low permeability zone of impervious clay shall be achieved, free from any clay lumps, cracks, rutting, or deleterious material, to the satisfaction of the Contract Administrator.

.5 The geotextile material for use as a separator between the impervious clay and Type 1 pit run gravel shall conform to Geotextile A as specified in specification Section 02620 – Sub-Drainage.

.6 Care shall be taken when placing fill materials immediately adjacent to the structure walls to ensure no damage occurs to the walls and any covering materials. Any damage shall be repaired by the Contractor at his expense.

.5 Sub-drain

.1 Requirements for the perimeter sub-drain coarse granular drainage material are specified in Section 02620 – Sub-Drainage.

3.6 Disposal

.1 Surplus material not required for backfill and fill purposes shall be disposed of on-site to a location designated by the Contract Administrator at no extra cost to the City.

3.7 Clean-Up

.1 As excavation proceeds, keep roads clean of dirt and excavated material.

.2 Clean-up and wash down to remove all dirt and excavated materials caused by Work of this Section.

.3 Clean at the end of each working day as directed by the Contract Administrator.

END OF SECTION

PILE FOUNDATIONS, GENERAL

1. GENERAL

1.1 Work Included

.1 Supply, pick-up, delivery and install piles as specified in D2.2.

1.2 Storage, Handling, and Installation

.1 Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes from the point of pick-up, and during storage and handling. Install piles to stated driving tolerances.

.2 Replace rejected piles to satisfaction of Contract Administrator. Causes for pile rejection are as follows:

.1 Out of fabrication tolerances at time of installation

.2 Cracked, spalled, or broken piles

.3 Out of stated driving tolerances

1.3 Geotechnical Information

.1 Refer to Specification E2.2 for a list of test hole logs and reports available associated with the Site.

.2 Notify Contract Administrator in writing if subsurface conditions at Site differ materially from those indicated and await further instructions from Contract Administrator.

2. PRODUCTS

2.1 Materials

.1 Piles to be supplied under the Contract as listed in 1.1.1 shall be fabricated as specified in Section 02468 – Precast Concrete Piles**.** Piles shall be full length piles as indicated, without cutting and splicing requirements. Contractor shall provide equipment to handle full length piles.

.2 Piles supplied by the City as listed in 1.1.1 are full length piles as indicated. Contractor shall provide equipment to handle full length piles.

.3 In the event that Site conditions require pile extensions, the extensions shall be constructed in accordance with the detail shown on the Drawings. This Work is in addition to the Scope of Work as defined in D2 and not included in the bid price.

3. EXECUTION

3.1 Delivery, Storage, and Handling

.1 Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes during delivery, storage, and handling.

3.2 Equipment

.1 Prior to the commencement of pile installation, submit details of equipment for installation of piles to Contract Administrator for review.

.1 Impact hammers: provide to the Contract Administrator; Manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.

.2 Hammer

.1 Hammers to be selected on the basis of driveability analysis using wave equation theory, performed to show that piles can be driven to levels indicated.

.2 The driveability analysis shall include, but not be limited to, the following: hammer, cushion, and capblock details; static soil parameters; quake and damping factors, total soil resistance, blow count, pile stresses, and energy throughput at representative penetrations.

.3 Driveability analysis shall be submitted to the Contract Administrator for review of the hammer or hammers.

.4 When required criteria cannot be achieved with the proposed hammer, use larger hammer and take other measures as required.

.5 Drop hammers are not permitted.

.3 Leads

.1 Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means to ensure support to pile while being driven.

.2 Length: provide length of leads so that use of a follower is unnecessary.

.3 Swing leads: firmly guy top and bottom to hold pile in position during driving operation.

.4 Followers: when permitted, provide followers of such size, shape, length, and mass to permit driving pile in desired location to required depth and resistance. Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.

3.3 Preparation

.1 Ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation. Make provision for access and support of piling equipment during performance of work.

.2 Pre-bore with an auger bit to a depth no lower than elevation 224.375.

3.4 Field Measurement

.1 Contractor shall cooperate with the Contract Administrator and shall allow access during the pile installation operations so that all the field measurements can be performed expeditiously.

3.5 Driving

.1 Drive precast piles only when concrete has attained strength of 35 MPa as determined by related concrete compression testing in accordance with CSA A23.2-00. Use driving caps and cushions to protect piles. Reinforce pile heads as required by Contract Administrator. Piles with damaged heads as determined by Contract Administrator will be rejected.

.2 Hold piles securely and accurately in position while driving.

.3 Deliver hammer blows along axis of pile.

.4 Drive piles to practical refusal, as outlined in the geotechnical information. Blow count requirements shall be determined by the Contract Administrator. If followers are used, established criteria for refusal will be increased by 50%.

.5 When driving precast concrete piles, adjust hammer, as required, to deliver reduced impact so that reflected tensile stress in pile does not exceed allowable.

.6 Do not drive piles within 10 m of masonry or concrete which has been in place less than seven (7) days. Do not drive piles within 30 m of masonry or concrete which has been in place less than one (1) day.

.7 Plan pile driver setup elevation, pile length, and pile installation sequence so as to minimize pile rebound. Continuously check pile top elevations within a minimum 6 m radius of active driving. Re-strike driven piles lifted during driving of adjacent piles to confirm and assure pile set for all piles.

.8 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.

.9 Cut off piles neatly and squarely at elevation ranges as indicated on the Drawings. Final cutoff elevations will be confirmed during construction. Provide sufficient length above cutoff elevation so that the part damaged during driving is cutoff. Do not cut tendons or other reinforcement which will be used to tie supported structure above to pile. A minimum

of 450 mm of strands shall remain for this purpose. The cutoff surface of the piles shall be mechanically chipped to expose sound concrete.

.10 Remove cutoff lengths from Site on completion of Work.

3.6 Design Load Capacity

.1 Allowable design load capacity of piles at specified loads is:

.1 400 mm diameter hex – 800 kN

.2 Installation of each pile will be subject to the review of the Contract Administrator. Contract Administrator will be the sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration, or other criteria used to determine load capacity. Contractor shall allow Contract Administrator to review final driving of all piles prior to removal of pile driving rig from Site.

3.7 Driving Tolerances

.1 Pile heads shall be within ± 100 mm of locations as indicated.

.2 Piles shall not to be more than 2% of length out of vertical alignment.

3.8 Obstructions

.1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, proceed as directed by Contract Administrator.

3.9 Repair/Restoration

.1 The Contract Administrator may require one (1) or more of the following remedial measures:

.1 Remove rejected pile and replace with a new, and if necessary, a longer pile.

.2 Remove rejected pile and fill hole as directed by Contract Administrator.

.3 Leave rejected pile in place and cut off as directed by Contract Administrator.

.4 Leave rejected pile in place, place adjacent pile(s), and modify pile cap as directed by Contract Administrator.

.2 No extra compensation will be made for removing and replacing or other Work made necessary through rejection of defective piles.

3.10 Protection

.1 Protect adjacent structures, services, and Work of other sections from hazards due to pile driving operations.

.2 Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at own expense.

.3 Undertake review of all adjacent infrastructures with the Contract Administrator complete with a photographic record sufficient to establish pre-driving conditions of the existing adjacent infrastructure.

.4 Protection for pile strand ends:

.1 Highly visible protection safety caps shall be installed for all pile reinforcing strand ends immediately following strand exposure operations. One (1) protection cap may be used for each pile by grouping and securely tying the strands.

.2 The protection caps shall be highly visible and shall be made secure so that accidental contact will not easily dislodge the caps. Dislodged caps shall be re-installed immediately.

.3 Pile reinforcing strands shall be protected from severe bending. Kinked or broken strands shall be repaired to the satisfaction of the Contract Administrator.

END OF SECTION

PRECAST CONCRETE PILES

1. GENERAL

1.1 Work Included

.1 Fabrication, storage and loading of 400 mm diameter precast concrete piles supplied and installed under this Contract as specified in D2.2.

.2 For piles supplied by the City as specified in D2.2, the following is provided for information.

1.2 References

.1 CSA

.1 CSA- A23.1-00/A23.2-00, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete

.2 CSA- A23.4-00/A251-00, Precast Concrete – Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products

.3 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004, and A3005)

.2 ASTM

.1 ASTM A82, Cold-Drawn Steel Wire for Concrete Reinforcement

1.3 Design

.1 Piles shall be solid core prestressed concrete piles with longitudinal prestressing strands and spiral reinforcement.

.2 Strand tensioning stress shall be 0.7 times the tensile strength of the strand.

.3 Pile splices at predetermined locations shall be of the mechanical locking type.

1.4 Shop Drawings

.1 Submit Shop Drawings in accordance with Specification E11.

.2 Each drawing submitted shall bear the signature and stamp of a qualified Professional Engineer registered in the Province of Manitoba.

.3 Indicate the following items:

.1 Lifting point details and locations

.2 Storage support point locations

.3 Mechanical pile splice details complete with calculations

.4 Concrete strength

.5 Reinforcing details

.6 Type and grade of steel

1.5 Certificates

.1 Piles delivered to Site to be certified by Manufacturer that each batch of piles meets the strength requirement of 35 MPa at twenty eight (28) days.

2. PRODUCTS

2.1 Materials

.1 Concrete mixes and materials: to CSA-A23.1-00 and CSA-A23.4-00.

.2 Reinforcing steel: to CAN/CSA-G30.18-M92.

.3 Cold-drawn steel wire for concrete reinforcement: to ASTM A82.

.4 Fabricate and supply full length piles as indicated, and provide equipment capable to handle piles without altering them.

2.2 Concrete Mixes

.1 Proportion normal density concrete in accordance with CSA-A23.1-00, Alternative 1, to give following properties:

.1 Use Type 50 Portland Cement.

.2 Minimum compressive strength at twenty eight (28) days: 35 MPa.

.3 Minimum cement content: 365 kg/m^3 of concrete.

.4 Maximum water to cementitious material ratio: 0.45.

.5 Nominal size of coarse aggregate: 16 mm maximum.

.6 Air content: 5 to 8%, to ASTM C260.

.7 Chemical admixtures: in accordance with CAN/CSA -A3000-03.

.8 Pozzolanic mineral admixtures: in accordance with CAN/CSA-A3000-03.

3. EXECUTION

3.1 Fabrication

.1 Fabricate piles to following finish tolerances:

.1 Length: ± 3 mm/m of length.

.2 Cross section:

.1 Side width: - 5 mm to + 10 mm.

.2 Deviation from straight line: not more than 3 mm/m of length and not more than 10 mm in full length.

.3 Deviation of reinforcing cage from true position: 10 mm.

.4 Pile head: 10 mm/m from true right angle plane; surface irregularities 3 mm.

.5 Location of reinforcing steel main reinforcing cover: - 3 mm to + 5 mm; spiral: 10 mm.

.2 Prestress piles under the direction of an experienced and competent supervisor. All personnel operating the stressing equipment shall have been trained in its use.

.3 De-tension in a manner to keep eccentricity to a minimum.

3.2 Handling and Storage

.1 Inspect the fabricated product prior to shipment and certify that the product is free from any damage or defects.

.2 Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes during storage and handling.

.3 Replace damaged piles to satisfaction of Contract Administrator.

END OF SECTION

SUB-DRAINAGE

1. GENERAL

1.1 Section Includes

.1 Materials and installation for constructing subdrains and geotextile filter material.

1.2 Reference Standards

.1 Conform to requirements of the NBC and the Canadian Construction Safety Code.

.2 Comply with excavation and trenching regulations of Provincial authorities.

1.3 Samples

.1 All materials incorporated into the Work of this Specification shall be subject to review and testing by the Contract Administrator, including all operations from the selection and separation of the materials, through to final acceptance of the specified Work.

.2 The Contractor shall be wholly responsible for the control of all operations incidental to the Work, notwithstanding any review or acceptance that may have previously been given.

.3 The Contract Administrator reserves the right to reject any materials or Works which are not in accordance with the requirements of this Specification.

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

.5 For granular materials, submit a 25 kg sample. Ship samples prepaid or deliver in tightly closed containers to testing laboratory designated by Contract Administrator.

.6 Costs for analysis will be paid by the City.

1.4 Delivery, Storage, and Handling

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris, and rodents.

.2 The geotextile shall remain wrapped in a protective covering until it is used.

.3 The Contractor shall ensure that breakdown or contamination of the subdrain materials does not occur due to any handling or hauling, including contamination from hauling equipment.

2. PRODUCTS

2.1 Material

.1 Coarse Granular Drain Material

.1 The coarse granular for the subdrains shall consist of a clean and processed, free draining granular material for use as a high permeability backfill.

.2 The granular drain material shall consist of clean, crushed limestone aggregate or a processed granular material (pea-gravel), ranging in size from 5 to 19 mm. If limestone is used, durable white crystalline limestone shall be used. Softer buff or yellow dolomite or dolostone will not be accepted. The material shall be free from sod, roots, organics, snow, and any other deleterious material.

.3 Individual rock particles shall be dense, sound, and resistant to abrasion and shall be free of cracks, seams, and other defects that would tend to reduce resistance to destruction by water and frost action. The Los Angeles Abrasion Loss, determined by using ASTM test procedures, shall not exceed 30%.

.2 Geotextile

.1 Nonwoven geotextile filter fabric at least 4.6 m in width.

.2 Minimum tensile strength: 800 N to ASTM D4632 Grab Test or CAN/CGSB 4.2 No. 9.2.

.3 Minimum trapezoid tear: 330 N to ASTM D4533 or CAN/CGSB 4.2 No. 11.2.

.4 Minimum equivalent opening size: 0.210 mm to ASTM D4751.

.5 Acceptable products: Trevira 1125 or Texel 7612 or accepted alternate.

.3 Drainage Pipe

.1 PVC Pipe

.1 The perforated pipe shall be 200 m nominal diameter, Schedule 80 PVC pipe with standard perforations of two (2) rows of 5 mm diameter holes positioned at 120^0 radially along the pipe. The longitudinal spacing of the holes shall be at 75 mm centre to centre along the length of the pipe.

.2 All fittings for the drain pipe, including bends, tees, elbows, and couplings shall be 200 mm nominal diameter, Schedule 80 PVC.

.2 Solid PVC Pipe

.1 The solid pipe shall be 200 mm nominal diameter, Schedule 80 PVC pipe.

.2 All fittings for the drain pipe, including bends, tees, elbows, and couplings shall be 200 mm nominal diameter, Schedule 80 PVC.

.4 Manholes

.1 Manholes and manhole covers to allow access to the subdrain pipes as shown on the Drawings shall conform to CW 2131-R3.

3. EXECUTION

3.1 General

.1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work of this Specification.

3.2 Finish Elevations and Lines

.1 For setting and establishing finish elevations and lines, secure the services of a registered surveyor or experienced instrumentman acceptable to the Contract Administrator.

.2 Carefully preserve all data and all monuments set by the instrumentman. If displaced or lost, immediately replace to the acceptance of the Contract Administrator, at no additional cost to the City.

3.3 Geotextile

.1 All Work related to the geotextile storage, handling, and installation shall comply with the procedures and recommendations of the Manufacturers.

.2 Prior to placing the fabric, the bedding material shall be cleared of all unsuitable material to provide a smooth uniform surface to prevent puncturing or tearing the fabric.

.3 The fabric shall be overlapped at all joints a minimum of 600 mm. The overlap shall be pinned or secured as acceptable to the Contract Administrator.

.4 The fabric shall be loosely placed in order to allow conformity to the bedding surface. Folds and wrinkles in the fabric shall be avoided. Pins, nails, or weights shall be installed to hold the fabric in place. A minimum of 300 mm of material shall be placed over the fabric prior to equipment passage.

.5 Damaged geotextile, as identified by the Contract Administrator, 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 specified density.

3.4 Granular Drain Material

.1 The coarse granular drain material in the subdrains and roof drains shall be placed in such a manner that no damage to the geotextile will occur.

.2 Some hand placing and levelling may be required to produce a neat and uniform surface conforming to the shape, dimensions, and grades shown on the Drawings and to ensure that adequate support below the haunches of the drain pipe is provided.

.3 The coarse granular drain material shall be placed in lifts not greater than 150 mm in thickness and shall be compacted to a density of at least 95% Standard Proctor Density to ASTM D698. Surround the perforated pipes as shown on the Drawings.

.4 Do not place granular material in frozen conditions.

3.5 Perforated and Solid PVC Pipe

.1 All pipes shall be placed at the locations and inverts shown on the Drawings.

.2 Care shall be taken to protect the pipe from damage, collapse, or crushing, particularly from equipment passage. Damaged pipe shall be replaced at the Contractor's expense.

.3 The perforated pipes shall be placed on a minimum 50 mm of bed of coarse granular drain material at invert elevations shown on the Drawings. Place pipe true to line and grade with inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with bed through out full length with particular attention below the haunches.

.4 Lay perforated pipes with perforations downwards at 4 o'clock and 8 o'clock positions.

.5 Make joints tight in accordance with Manufacturer's instructions.

.6 Plug open upstream ends of pipes with watertight covers.

.7 Backfill of the solid PVC pipe and all interconnections to the existing manholes shall conform to CW 2130-R5.

3.6 Manholes

.1 The manholes complete with manhole covers shall be installed to the dimensions and at the grades as shown on the Drawings, in accordance with CW 2131-R3, and as accepted by the Contract Administrator.

3.7 Disposal

.1 Surplus material not required shall be disposed of on Site to a location designated by the Contract Administrator at no extra cost to the City.

3.8 Clean-Up

.1 As Work proceeds, keep all Work areas clean of dirt, excavated material, and construction debris.

.2 Clean at the end of each working day.

END OF SECTION

CONCRETE FORMWORK

1. GENERAL

1.1 Work Included

.1 Forms for all concrete and supporting falsework including design.

.2 Formliner all for interior wall surfaces of water retaining structures.

.3 Wood or steel forms for all cast-in-place concrete.

.4 Void forms between structural elements and soil below.

.5 Shoring, bracing, and anchorage.

.6 Form openings for other trades.

.7 Coordinate installation of concrete accessories.

.8 Set anchor bolts, anchors, sleeves, frames, and other items supplied by other trades.

.9 Clean erected formwork prior to concrete placement.

.10 Remove forms and supporting falsework.

1.2 Design Standards

.1 Design and detail forms and supporting falsework in accordance with the NBC, Canadian Standards Association CAN/CSA-A23.1-00, CSA S269.1, CAN/CSA S269-3, ACI 347R, and applicable provincial and federal construction safety regulations.

.2 Design to be done by a Professional Engineer, registered in the Province of Manitoba.

.3 Design and detail compressible fill Void Form. Design to be done by the Void Form material supplier.

1.3 Quality Assurance

.1 Construct and erect concrete formwork in accordance with CAN/CSA-A23.1-00, CAN/CSA S269.3, ACI 347R, and all applicable provincial and federal construction safety regulations for the place of Work.

1.4 Shop Drawings

.1 Submit Shop Drawings in accordance with Specification E11.

.2 Clearly indicate sizes, methods of construction, materials, arrangement of joints, ties and shores, location and size of falsework, schedule of erection and stripping, reshoring, etc.

.3 Shop Drawings and design briefs are to bear the seal of a Professional Engineer, registered in the Province of Manitoba.

.4 Formwork, falsework, and reshoring are to be reviewed by the same Professional Engineer prior to each concrete pour.

.5 Professional Engineer to report, in writing, that reviewed formwork, falsework, and reshoring are in accordance with the design prior to each concrete pour.

.6 Submit shop drawings for Void Form for each building area. The Contract Administrator will coordinate the shop drawing review with the Geotechnical Consultant.

2. PRODUCTS

2.1 Exposed Surfaces

.1 Square-edged, smooth surfaced panels true in plane, free of holes, surface markings, or defects.

2.2 Unexposed Surfaces

.1 Square-edged T&G lumber, plywood or other material, suitable to retain concrete without leakage or distortion.

2.3 Wood Materials

.1 Plywood: douglas fir, conforming to CSA O121-M solid one side, sheathing grade. Sound undamaged sheets with clean true edges. Use only new material for exposed surfaces.

.2 Lumber: conforming to CSA O141-M.

.3 Nails, Spikes and Staples: galvanized; conforming to CSA B111.

2.4 Prefabricated Forms

.1 Steel Type: minimum 1.6 mm steel thickness; well matched, tight fitting, and adequately stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.

.2 Tubular Column Type: round, spirally wound laminated fibre material, internally treated with release agent; sizes indicated on Drawings.

.3 Void Form:

.1 Expanded polystyrene structurally sufficient to support weight of reinforcing steel, wet concrete mix, and a construction live load allowance until initial set. The installed thickness shown for each of the building areas is an estimate for tendering purposes. The final thickness will be determined after review by the Geotechnical Consultant:

.1 M: 300mm

.2 A: 400mm

.3 P: 150mm

.4 R: 400mm

.5 O: 500mm

.6 C: 250mm

.7 F: 500mm

.2 Acceptable product is GeoVoid by Plasti-Fab Ltd.

.3 Side protection for Void Form shall be one (1) 19 mm thick spruce plywood sheeting.

2.5 Accessories

.1 All materials used on surfaces that will be in contact with potable water shall satisfy the requirements of NSF 60/61.

.2 Plain form liner: Design standard is Zemdrain MD-2 by Dupont, complete with drainage profile on exterior surface of the form liner. Alternate products with proven performance, equal to that of the design standard, are subject to acceptance by the Contract Administrator.

.3 Form ties: removable snap-off metal type, galvanized, fixed length, minimum working strength of 13 kN when assembled. For water retaining structures use form ties that leave a minimum cutback of 50 mm. Form ties shall have a metal waterstop. Form ties with plastic sleeves are not acceptable for water retaining structures. For non-water retaining structures use minimum 25 mm deep plastic cone snap type or screw type on exposed surfaces. Wire ties are not permitted.

.4 Form release agent: colourless mineral oil which will not stain concrete or impair natural bonding or colour characteristics of coating intended for use on concrete.

.5 Corner or chamfer fillets: mill finished pine, widths as indicated on the Drawings, maximum possible lengths, mitered ends.

.6 Reglets: mill finished pine, shaped to required cross-section, maximum possible lengths, mitered ends.

.7 Sealing tape: reinforced, self-adhesive, waterproof kraft tape.

3. EXECUTION

3.1 Erection

.1 Verify lines, levels, and centres before proceeding with formwork. Ensure dimensions agree with Drawings.

.2 Construct formwork and falsework to meet design and regulatory requirements, and to produce finished concrete conforming to surfaces, shapes, lines, and dimensions indicated on Drawings.

.3 Arrange and assemble formwork to permit removal without damage to concrete.

.4 Align joints and make watertight to prevent leakage of cement paste and disfiguration of concrete. Keep form joints to a minimum. Tape as necessary.

.5 Arrange forms to allow removal without removal of principal shores, where these are required to remain in place.

.6 Obtain Contract Administrator's acceptance before framing openings in concrete slabs, walls, beams, and columns not indicated on Drawings.

.7 Provide falsework to ensure stability of formwork. Brace or strengthen all previously constructed parts liable to be overstressed by construction loads.

.8 Position form joints to suit any expressed lines required in exposed concrete.

.9 Provide chamfer on all internal and external corners and edges of exposed concrete unless shown otherwise.

.10 Form chases, slots, openings, drips, and recesses as detailed on Drawings.

.11 Set screeds with top edge level to required elevations.

.12 Check and readjust formwork to required lines and levels during placing of concrete.

.13 Coordinate location of construction joints for walls, beams and suspended slabs with the Contract Administrator prior to erecting formwork.

.14 Provide reveals or reglets on construction joints as shown on the Drawings.

3.2 Void Form

.1 Void Forms shall be placed on prepared surfaces of levelling gravel so that the top of the Void Forms presents planar forming surfaces.

3.3 Tolerance

.1 Construct formwork to produce concrete with dimensions, lines, and levels within tolerances specified in ACI 347R, Guide to Formwork for Concrete.

.2 Camber slabs and beams 6 mm per 3 m of span unless otherwise indicated on the Drawings. Review method of providing camber with Contract Administrator prior to proceeding. Maintain beam depth and slab thickness from cambered surface.

3.4 Inserts/Embedded Items/Openings

.1 Provide formed openings where required for pipes, conduits, sleeves, and other Work to be embedded in and passing through concrete members.

.2 Accurately locate and set in place items which are to be cast directly into concrete.

.3 Coordinate Work of other Sections and cooperate with trades involved in forming openings, slots, recesses, chases, and setting sleeves, bolts, anchors, and other inserts.

.4 Coordinate installation of concrete accessories specified in Section 03250 – Concrete Accessories.

.5 Provide temporary ports or openings in formwork where required to facilitate cleaning and construction review. Locate openings at bottom of forms to allow flushing water to drain.

.6 Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so no leakage occurs, and to provide uniform surface on exposed concrete.

3.5 Field Quality Control

.1 Inspect and check complete formwork, falsework, shoring, and bracing to ensure that Work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and parts are secure. Submit written report from Professional Engineer responsible for this Work as specified in Clause 1.4 Shop Drawings.

.2 Inform Contract Administrator when formwork is complete and has been cleaned, to allow for review. Contract Administrator's review will be for verification that forms are clean and free from debris.

.3 Allow Contract Administrator to review each section of formwork prior to re-use. Formwork may be re-used if acceptable to the Contract Administrator.

3.6 Cleaning

.1 Clean forms to remove foreign matter as erection proceeds. Remove cuttings, shavings, and debris from within forms. Flush completely with water to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

.2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction

proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 Formwork Preparation

.1 Apply form release agent in accordance with Manufacturer's recommendations, prior to placing reinforcing steel, anchoring devices, and embedded parts.

.2 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing concrete.

.3 Form liner shall be used on all columns and on the water holding side of walls and slabs in water holding structures. The form liner shall be installed in strict accordance with the Manufacturer's instructions. The Manufacturer's Representative shall be on-site at the beginning of the formliner installation, and as required to ensure recommended procedures are followed. Wrinkles or folding of the formliner during concrete placement will not be accepted.

3.8 Form Removal

.1 Notify Contract Administrator prior to removing formwork.

.2 Forms shall remain in place a minimum of two (2) days and the concrete shall have attained a minimum of 75% of design strength verified by field cured test cylinders.

.3 Clause 3.9.1 not withstanding do not remove forms and falsework until concrete has gained sufficient strength to carry its own weight, plus construction and design loads which are likely to be imposed. Verify strength of concrete by compression tests to satisfaction of Contract Administrator.

.4 Remove falsework progressively, in accordance with regulatory requirements and ensure that no shock loads or imbalanced loads are imposed on structure.

.5 Loosen forms carefully without damaging concrete surfaces. Do not apply tools to exposed concrete surfaces.

.6 If forms are left loosely in place for protection until curing requirements are complete, ensure all concrete surfaces are kept continuously moist. Otherwise remove forms and start moist cure immediately. Curing with compound may be an option but will be subject to review by the Contract Administrator on a case by case basis.

3.9 Reshoring

.1 If reshoring is required, prepare and submit a schedule to Contract Administrator for review.

.2 Reshore structural members where required due to design requirements or construction conditions under the direction of the Professional Engineer responsible for this work.

.3 Install reshoring as required to permit progressive construction.

END OF SECTION

CONCRETE REINFORCEMENT

1. GENERAL

1.1 Work Included

.1 Reinforcing steel bars and welded steel wire fabric for cast-in-place concrete complete with tie wire.

.2 Support chairs, bolsters, bar supports, and spacers for reinforcing.

1.2 Quality Assurance

.1 Perform fabrication and placement of concrete reinforcement in accordance with CSA CAN/CSA-A23.1-00.

1.3 Inspection and Testing

.1 If requested by Contract Administrator, submit three (3) certified copies of mill test report of reinforcement supplied, indicating physical and chemical analysis.

1.4 Shop Drawings

.1 Submit bar lists and placing drawings in accordance with Specification E11.

.2 Clearly indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

.3 Drawings and details to conform to CAN/CSA-A23.1-00, CAN/CSA-A23.3-00, and RSIO Reinforcing Steel Manual of Standard Practice.

.4 Detail placement of reinforcing where special conditions occur.

.5 Detail lap lengths and bar development lengths to CAN/CSA-A23.3-00, unless otherwise shown on the Drawings.

1.5 Delivery and Storage

.1 Deliver, handle, and store reinforcement in a manner to prevent damage and contamination.

.2 Deliver bars in bundles, clearly identified in relation to bar lists.

2. PRODUCTS

2.1 Reinforcing Materials

.1 Reinforcing steel: 400R and 400W as shown on the Drawings; deformed billet steel bars conforming to CAN/CSA-G30.18; plain finish.

.2 Welded steel wire fabric: plain type, conforming to ASTM A185; flat sheets; plain finish.

.3 Stainless steel bars: ASTM Type 316.

2.2 Accessory Materials

.1 Tie wire: minimum 1.6 mm annealed type, or patented system accepted by Contract Administrator.

.2 Chairs, bolsters, bar supports, spacers: adequately sized for strength and support of reinforcing steel during construction.

.3 Bar chairs for exposed surfaces: non-corrosive PVC chairs or concrete chairs, purpose made. Steel bar chairs, galvanized bar chairs, concrete bricks, broken concrete blocks, or wood supports are not acceptable.

.4 Bar chairs for non-exposed surfaces: broken concrete blocks, stones, and wood supports are not acceptable.

.5 Threaded couplers: conforming to CSA-A23.3, ACI 318, and ACI 349, complete with temporary cap, sizes as shown on Drawings, as manufactured by Bar Grip Canada or accepted alternate.

3. EXECUTION

3.1 Fabrication

.1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1-00 and Drawings.

.2 Locate reinforcing splices not indicated on Drawings at points of minimum stress.

.3 Fabricate within the following tolerances:

.1 Sheared length: +0, -25 mm.

.2 Depth of truss bars: +0, -10 mm.

.3 Stirrups, ties, and spirals: +0, -10 mm.

.4 Other bends: +0, -25 mm.

.4 All bending shall be done cold with a suitable machine accurately producing all lengths, depths, and radii shown on the bending details.

.5 After initial fabrication, reinforcing steel shall not be rebent or straightened unless so indicated on the Drawings.

.6 Heating of reinforcing steel will not be permitted.

3.2 Installation

.1 Place reinforcing steel in accordance with reviewed placing Drawings and CAN/CSA-A23.1-00. Chair slab reinforcing not further apart than 1.2 m in either direction. Tie reinforcing steel at maximum spacing 600 mm.

.2 Adequately support reinforcing and secure against displacement within tolerances permitted.

.3 Place reinforcing steel to provide concrete cover required by CAN/CSA-A23.1-00, but not less than shown on Drawing Concrete Notes.

.4 Maintain alignment as follows:

Item	**Tolerances (millimetres) Plus or Minus**
Slabs	5
Other Structural Members	10
Rebar Bends and Ends	50

.5 Do not disturb or damage polyethylene film or void form while placing reinforcing steel.

.6 Install protective sleeves on horizontal slab and footing dowels and projecting bars to prevent concrete splatter from contaminating bars. Remove sleeves prior to next concrete pour.

.7 Install purpose made highly visible protective safety caps on all exposed projecting bar ends to the satisfaction of the Contract Administrator.

3.3 Cleaning

.1 Ensure concrete reinforcing is clean and free from oil and deleterious matter.

.2 Remove all loose scale, loose rust, concrete from prior pours, and other deleterious matter from surfaces of reinforcing.

.3 Remove concrete splatter on bars before concrete has hardened.

END OF SECTION

CONCRETE ACCESSORIES

1. GENERAL

1.1 Work Included

.1 Joint Sealants

.2 Joint Filler

.3 Waterstops

.4 Epoxy grout

.5 Non-ferrous Grout

.6 Latex Patching Agent

.7 Epoxy Bonding Agent

.8 Curing Compound

.9 Moisture Retention Film

.10 Fasteners

.11 Neoprene bearings

.12 Concrete inserts

2. PRODUCTS

2.1 General

.1 All materials that will come in contact with potable water shall meet the requirements of NSF 60/61.

.2 All materials shall be subject to acceptance by the Contract Administrator.

2.2 Materials

.1 Joint Sealants:

.1 Sealants for all joints shall be non-sag two-part polysulphide to CAN/CGSB-1925M, NSF approved for contact with potable water, Thiokol 2235M by PolySpec or accepted alternate.

.2 Use compatible primer as per sealant Manufacturer's requirements.

.2 Joint Filler:

.1 Expansion joint filler: rigid closed cell foam, CPD PVC Closed Cell Joint Filler or accepted alternate.

.3 Waterstops:

.1 PVC waterstops shall conform to CGSB 41-6P-35M PVC, size indicated on Drawings. Acceptable products: Wirestop CR-9380 by Paul Murphy; Greenstreak waterstops, prepunched holes, with characteristics equal to Paul Murphy waterstops.

.2 Stainless steel waterstop, ASTM A-370, Grade 316L, size indicated on Drawings. Acceptable products: Greenstreak.

.3 Waterstop PVC shall meet or exceed the performance criteria of Corps of Engineers Specification CRD-C 572-74 and the following:

.1	Tensile strength	13.8 MPa
.2	Ultimate elongation	370% minimum
.3	Hardness Shore A	80 ±3
.4	Stiffness in flexure	4.8 MPa
.5	Water absorption	0.5 maximum (48 hours)

.4 All PVC waterstop material shall be Arctic Grade.

.5 All flat and vertical PVC waterstop tees, crosses and L's shall be factory made.

.6 Expansive Waterstop: acceptable products are SikaSwell S Sealant by Sika and CS-231 Controlled Expansion Waterstop by ConSeal Concrete Sealants.

.7 Neoprene waterstop expansion joint system: acceptable products are Jeene Structural Sealing Joint System supplied by Harris Specialty Chemicals Inc, and Capflex by Cappar Limited.

.4 Epoxy grout: Sika Talygrout, CPD Epoxy Grout, or accepted alternate.

.5 Non-ferrous Grout: pre-mixed, non-shrink, Master Builders 713, Sika M-Bed, CPD Non-Shrink Grout, Steel C1 Grout, Grace In-Pakt Grout, minimum compressive strength 35 MPa.

.6 Latex Patching Agent: Acrl Stix, Daraweld-C Latex Bonding Agent, or accepted alternate.

.7 Epoxy Bonding Agent: Master Builders Concresive 1001 LPL, Dural Duralbond, Sikadur 32 HI-bond, or accepted alternate.

.8 Moisture Retention Film: Master Builders Confilm or accepted alternate.

.9 Curing Compound: sodium silicate, Miracle Kote or accepted alternate.

.10 Fasteners: fasteners (all nuts, bolts, washers, screws, etc.) stainless steel for all aluminum items, conforming to ASTM 316, sizes and locations as required by item manufacturer.

.11 Neoprene bearing pads and strips Grade 70 Durometer A.

.12 Lifting eye bolt: LEB by NCA/Acrow-Richmond Ltd., or F-49 by Dayton Superior Canada Limited.

2.3 Shop Drawings

.1 Submit Shop Drawings in accordance with Specification E11.

.2 Submit Product information for review for materials to be incorporated into the Work.

3. EXECUTION

3.1 Installation

.1 Coordinate Work of this Section with other construction.

.2 Install all concrete accessories in accordance with Drawings and Manufacturer's recommendations and ensure compatibility. Install straight, level, and plumb.

.3 Ensure items are not disturbed during concrete placement.

.4 Curing and sealing compounds are to be used for curing purposes of all concrete where practical or compatible with finishes. All floors and water retaining walls shall be moist cured in accordance with Section 03300 – Cast-in-Place Concrete. Application of curing compounds for these structural elements is subject to prior review by the Contract Administrator.

.5 Joint sealant shall be applied per manufacturer’s instructions. If joint surfaces are damp, dry and apply primer as recommended by Manufacturer.

.6 Joint filler shall be installed per Manufacturer’s instructions in expansion joints as indicated on Drawings.

.7 PVC Waterstop:

.1 Install PVC waterstop in expansion joints as indicated on Drawings.

.2 Install continuous waterstop without displacing reinforcement. Secure in place to prevent dislodgment during placing of concrete.

.3 Splicing: For tees, crosses and L's use only items plant fabricated by the Manufacturer. Only straight butt weld field splices are acceptable. Butt weld splices to Manufacturer's directions. All field splices shall be heat-fused and tested for seal completeness by use of a "corona" discharge unit. Testing shall be paid for by Contractor.

.4 Take particular care to correctly position the waterstop during installation. Tie the waterstop adequately for support in accordance with Manufacturer's instructions, but at spacings no greater than 300 mm to ensure proper embedment, symmetrical about the joint, and to prevent displacement during concrete placement. Fully compact the concrete in the region of the waterstop during the placing of the concrete.

.5 Do not place concrete until waterstop has been reviewed by the Contract Administrator.

.8 Neoprene and waterstop expansion joint system:

.1 Inspect, clean, and prepare surfaces of joint in accordance with Manufacturer's printed instructions.

.2 Assemble intersections, splice, and install waterstop in accordance with Manufacturer's printed instructions

.3 Install factory-made splices for tees and ells to form continuous unbroken seal.

.9 Latex Patching Agent is to be used for patching formed concrete surfaces where required.

.10 Epoxy Bonding Agent is to be used to bond new concrete to existing concrete surfaces.

END OF SECTION

CAST-IN-PLACE CONCRETE

1. GENERAL

1.1 Work Included

.1 All cast-in-place concrete shown on the Drawings.

.2 Setting anchors, inserts, frames, sleeves, and other items supplied by other Sections.

.3 Repairing concrete imperfections.

.4 Finishing formed concrete surfaces.

.5 Watertightness testing of water retaining structures.

.6 Curing of concrete.

1.2 Quality Assurance

.1 Cast-in-place concrete shall conform to CSA CAN/CSA-A23.1-00.

.2 Testing shall conform to CAN/CSA-A23.2-00.

.3 These standards shall be available in the Contractor's Site office for the use of the Contractor, sub-trades, and Contract Administrator.

.4 A concrete pour release form shall be completed prior to each concrete pour. The Contractor shall be responsible for completing the forms. Each form shall be signed by the Contractor and Contract Administrator prior to each pour.

1.3 Performance Requirements

.1 Watertightness

.1 Provide watertight concrete structures for all Type A concrete. No visible leaks will be permitted.

.2 28-day Concrete Compressive Strength

.1 Normal-density concrete:

.1 Type A: 35 MPa, Concrete for liquid holding/containment structures, containing reinforcing bars, unless specified otherwise.

.2 Type B: 30 MPa, Concrete for structures, containing reinforcing bars, unless specified otherwise.

.3 Type C: 15 MPa, Fill concrete unless specified otherwise.

.3 Density

.1 Normal density 2350 ± 50 kg/m^3.

.4 Construction Tolerances

.1 Comply with Clause 10-CSA A23.1-00 unless noted otherwise.

1.4 Submittals

.1 Concrete Mix Design

.1 Submit proposed performance mix, and supplier's applicable standard deviations for each type of concrete to the Contract Administrator for review minimum two (2) weeks prior to commencement of the Work. Pay costs for all mix design.

.2 Tabulate concrete mixes. Indicate range of cementing materials content, type of cements, size of coarse aggregate, water/cementing material ratio, admixtures used, air content, slump, and locations of use for each mix.

.3 For high-slump flowing concrete submit a mix that will not result in segregation.

.4 Submit detailed plan for cold weather curing and protection of concrete placed and cured in weather below 5°C.

.5 Submit detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 27°C.

.6 Concrete mix designs will be reviewed for conformance with requirements of the Specifications and will be returned with Contract Administrator’s comments.

.2 Placement Drawings and Plans:

.1 Submit Drawings indicating concrete placement sequence, and identifying location of each type of construction joint.

.2 Submit detailed plan for cold weather curing and protection of concrete placed and cured in weather below 4°C.

.3 Submit detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 27°C.

1.5 Inspection & Testing

.1 Notify the Contract Administrator at least forty eight (48) hours before complete formwork and concrete reinforcement are ready for review. Reinforcing in walls shall be reviewed prior to closing forms. Concrete sampling, inspection, and testing is to be performed by a CSA certified inspection and testing firm appointed and paid for by the City.

.2 Provide unencumbered access to all portions of Work and cooperate with appointed firm.

.3 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

.4 Notify the Contract Administrator at least twenty four (24) hours in advance of any concrete placement. Under no circumstances shall concrete be placed without notifying Contract Administrator.

.5 At least three (3) concrete test cylinders will be taken for every seventy five (75) or less cubic metres of each class of concrete placed.

.6 At least three (3) test cylinders will be taken daily for each class of concrete placed.

.7 One (1) slump test and one (1) air content test will be taken for each set of test cylinders taken.

.8 Additional slump and air content tests may be taken as necessary (up to every truck) to verify quality of concrete at the discretion of the Contract Administrator.

.9 Testing of concrete shall be performed in accordance with CAN/CSA-A23.2-00. Test results will be issued to the Contractor, the Contract Administrator, and the City.

.10 The Contractor shall pay costs for required retesting due to defective materials or workmanship.

.11 If accepted by the Contract Administrator, the Contractor may arrange and pay for additional tests for use as evidence to expedite construction.

.12 To conform to the strength requirements, the average of all tests shall exceed the specified strength. When three (3) or more tests of the same type of concrete are available, the average of any three (3) consecutive tests shall be equal to, or greater than the specified strength, and no strength test shall fall more than 3.5 MPa below the specified strength. If any of the criteria of the above clause are not met, the Contract Administrator shall have the right to require one or more of the following:

.1 Changes in mix proportions for the remainder of the Work.

.2 Cores drilled and tested from the areas in question as directed by the Contract Administrator and in accordance with CAN/CSA-A23.2-00. The test results shall be indicative of the strength of the in-place concrete.

.3 Load testing of the structural elements.

.4 The changes in the mix proportions, cores drilled and tested, and load testing shall be at the Contractor's expense.

.5 Concrete failing to meet the strength requirements of this Specification shall be strengthened or replaced at the Contractor's expense.

2. PRODUCTS

2.1 General

.1 All materials that will come in contact with potable water shall meet the requirements of NSF 60/61.

2.2 Concrete Materials

.1 Cement: Normal Type 10 and Type 50 Portland Cement conforming to CSA-A3000.

.2 Fine Aggregate: Conforming to Normal-Density Fine Aggregate, CAN/CSA-23.1-00. If requested by the Contract Administrator, submit evidence at least two (2) weeks before use in concrete mix showing conformance to Normal-Density Fine Aggregate, CAN/CSA-A23.1-00, Table 4 and Table 6.

.3 Coarse Aggregate: Conforming to Normal-Density Coarse Aggregate, CAN/CSA-23.1-00, Group I, 20-5 millimetres, and 10 to 2.5 millimetres. If requested by the Contract Administrator, submit evidence at least two (2) weeks before use in concrete mix showing conformance to Normal-Density Coarse Aggregate, CAN/CSA-A23.1-00, Table 5 and Table 6. Group II may be used for special requirements such as gap grading, pumping, or for blending two (2) or more sizes to produce Group I gradings.

.4 Ensure that no aggregates are used that may undergo volume change due to alkali reactivity, moisture retention, or other causes. Confirm suitability of aggregate with a petrographic analysis if deemed necessary by the Contract Administrator.

.5 Water: Potable, clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious matter.

.6 Materials are to be obtained from the same source of supply or Manufacturer for the duration of the project.

.7 Pozzolans: Type C fly ash, conforming to CSA-A23.5, source of material to be acceptable to the Contract Administrator.

2.3 Admixtures

.1 No admixtures other than air-entraining agent, water-reducing agent, and superplasticizer shall be used without the written authorization of the Contract Administrator, unless specified.

.2 Air entrainment: conforming to ASTM Standard C260.

.3 Water-reducing agent: Type WN conforming to ASTM Standard C494.

.4 Superplacticizer: conforming to ASTM Standard C494.

.5 General Chemical Admixtures: conforming to ASTM Standard C494.

.6 Calcium chloride or admixtures containing calcium chloride shall not be used in concrete.

2.4 Accessories

.1 Curing Sealer: sodium silicate, Miracle Kote or accepted alternate.

.2 Moisture Retention Film: Master Builders Confilm or accepted alternate.

.3 Non-metallic floor hardener: premixed blend of mineral aggregates, wetting and densifying agents, and Portland cement, shake-on type; Diamag 7 or Durag Premium by Sika Canada Inc., Maximent or Mastercron by Master Builders Technologies, Ltd., Surflex by Euclid Admixture Canada, Inc., or Quartz Tuff by Dayton Superior Canada Limited.

2.5 Concrete Mixes

.1 Pay all costs for mix design. Submit mix design to the Contract Administrator for review a minimum of two (2) weeks prior to concrete pour.

.2 Provide concrete mixed in accordance with requirements of CAN/CSA-A23.1-00 and as indicated on the Drawings. The Drawing requirements shall govern where there is a difference between the Drawings and CAN/CSA-A23.1-00, Tables 6 to 10 requirements.

.3 Maximum allowable substitution of cement with fly ash material shall be 20% by weight when acceptable to the Contract Administrator.

.4 Use accelerating admixtures in cold weather only when accepted by the Contract Administrator. If accepted, the use of admixtures will not relax cold weather placement requirements. Do not use calcium chloride.

.5 Use set-retarding admixtures during hot weather only when accepted by the Contract Administrator.

.6 All admixtures must be compatible within the mix. Concrete with freezing and thawing exposure must satisfy the durability requirements of CAN/CSA-A23.1-00, Sections 14 and 15.

.7 All admixtures are subject to acceptance by the Contract Administrator. List all proposed admixtures in mix design submission. Do not change or add admixtures to accepted design mixes without the Contract Administrator's review and acceptance.

.8 The water: cementing ratio must be calculated and shown based on all available mixing water excluding aggregate absorption.

.9 Concrete delivered to Site must be accompanied by a delivery slip indicating time of completion of mixing, design strength of concrete, air content, and actual water-cement ratio.

.10 Patching Mortar:

.1 The patching mortar shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one (1) part cement to two and a half (2.5) parts sand by damp loose volume.

.2 White Portland Cement shall be substituted for a part of the grey Portland Cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch.

.3 The quantity of mixing water shall be no more than necessary for handling or placing. Mixing water shall include one (1) part latex bonding agent to three (3) parts water. Maximum water to cement ratio shall be 0.40.

.11 Materials are to be obtained from the same source of supply or Manufacturer for the duration of the project.

.12 Self-compacting concrete mixes will not be permitted for use on this project.

3. EXECUTION

3.1 Placing Concrete

.1 Place concrete in accordance with requirements of CAN/CSA-A23.1-00 and as indicated on the Drawings. Layout of the Work and accuracy of same is the Contractor's sole responsibility.

.2 All concrete shall be placed within 90 minutes of mixing. The concrete shall be placed rapidly and evenly to its final position without re-handling and flowing by methods ensuring to minimize the risk of segregation, loss of ingredients, and cold joints. Under no circumstances shall the concrete, which has partially hardened, be deposited in the forms.

.3 Ensure all anchor bolts, seats, plates, and other items to be cast into concrete are securely placed and will not interfere with concrete placement.

.4 All equipment for transporting the concrete shall be cleaned of hardened concrete and foreign materials before placing concrete.

.5 Immediately before concrete is placed, Contractor shall carefully inspect all forms to ensure that they are properly placed, sufficiently rigid and tight, and that all reinforcing steel and embedded parts are in the correct position and secured against movement during the placing operation. All forms shall be thoroughly cleaned and all debris removed.

.6 Concrete shall be thoroughly compacted by mechanical vibrators during placing operations. It shall be thoroughly worked around the reinforcement, embedded fixtures, and into the corners of the forms. Vibrators shall not be used to move concrete.

.7 Vibrate concrete using the appropriate size equipment as placing proceeds, in accordance with CAN/CSA-A23.1-00. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

.8 Prepare set or existing concrete by removing all laitance and loose or unsound materials. Roughen concrete surfaces to an amplitude of 6 mm. Apply bonding agent in accordance with Manufacturer's recommendations.

.9 In locations where new concrete is dowelled to existing concrete, drill holes in existing concrete, insert steel dowels, and pack solidly with non-shrink grout accepted by the Contract Administrator.

.10 Where placing operations would involve dropping the concrete more than 1500 mm, it shall be placed through canvas hoses or galvanized iron chutes. Concrete shall not be raised at a rate greater than that for which proper vibration may be affected.

.11 A minimum of three (3) days shall elapse between adjacent pours separated by construction joints or expansion joints.

.12 Do not place concrete if carbon dioxide producing equipment has been in operation in the building or in the enclosure during the twelve (12) hours preceding the pour. This equipment shall not be used during placing or for twenty four (24) hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or an impermeable membrane from direct exposure to carbon dioxide, combustion gases, or drying from heaters.

.13 Honeycomb or embedded debris is not acceptable.

.14 Remove and replace defective concrete.

.15 Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.2 Cold Weather Concreting

.1 When the mean daily temperature may fall below 5°C during placing or curing concrete, a complete housing of the Work, complete with heaters, fuel, maintenance, and attendants, shall be provided.

.2 Supplementary equipment as required below shall be at the job Site if concrete is likely to be placed in cold weather.

.3 Formwork, reinforcing steel, and existing adjacent concrete shall be heated to at least 5°C before concrete is placed.

.4 The temperature of the concrete shall be maintained at not less than 10°C for seven (7) days. Following that, the concrete shall be kept above freezing temperature for a period of at least seven (7) days. In no case, shall the heating be removed until the concrete has reached a minimum compressive strength which will be specified by the Contract Administrator as

determined from compressive strength tests on specimens cured under the same conditions as the concrete Works in question.

.5 Aggregates shall be heated to a temperature of not less that 20°C and not more than 65°C. Water shall be heated to a temperature between 55°C and 65°C. The temperature of the concrete at the time of placing in the forms shall be within the range specified in CAN/CSA-A23.1-00 for the thickness of the section being placed.

.6 Combustion-type heaters may be used if their exhaust gases are vented outside the enclosures and not allowed to come into contact with concrete surfaces. Fire extinguishers must be readily at hand wherever combustion-type heaters are used.

.7 Before depositing any of the concrete, the Contractor shall show that enough heating equipment is available to keep the air temperature surrounding the forms within the specified range. This shall be accomplished by bringing the temperature inside of the housing to the specified 10°C at least twelve (12) hours prior to the start of the concrete placing.

.8 When the ambient temperature is below -15°C, the housing shall be constructed so as to allow the concrete to be placed without the housing having to be opened. If the mixing is done outside of the housing, the concrete shall be placed by means of hoppers installed through the housing. The hoppers are to be plugged when not in use.

.9 When the ambient temperature is equal to or above -15°C, the Contractor will be permitted to open small portions of the housing for a limited time to facilitate the placing of the concrete.

.10 The Contractor shall supply all required heating apparatuses and the necessary fuel. When dry heat is used, a means of maintaining atmospheric moisture shall be provided.

.11 Sufficient standby heating equipment must be available to allow for any sudden drop in outside temperatures and any breakdowns which may occur in the equipment.

.12 The Contractor shall keep a curing record of each concrete pour. The curing record shall include date and location of the pour, mean daily temperature, temperatures above and below the concrete within the enclosures, temperatures of the concrete surface at several points, and notes regarding the type of heating, enclosure, unusual weather conditions, etc. This record shall be available for review by the Contract Administrator at all times, and shall be turned over to the Contract Administrator at the end of the concreting operations.

3.3 Hot Weather Concreting

.1 General

.1 The requirements of this section shall be applied during hot weather, i.e., air temperatures above 25°C during placing.

.2 Concrete shall be placed at as low a temperature as possible, preferably below 15°C, but not above 27°C. Aggregate stockpiles may be cooled by water sprays and sun shades.

.3 Ice may be substituted for a portion of the mixing water provided the ice has melted by the time mixing is completed.

.4 Form and conveying equipment shall be kept as cool as possible before concreting by shading them from the sun, painting their surfaces white, and/or the use of water sprays.

.5 Sun shades and wind breaks shall be used as required during placing and finishing.

.6 Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".

.7 The Contract Administrator's acceptance is necessary before the Contractor may use admixtures such as retardants to delay setting, or water-reducing agents to maintain workability and strength, and these are to be included in the mix designs submitted to the Contract Administrator.

.8 Curing shall follow immediately after the finishing operation.

.2 Hot-Weather Curing

.1 When the air temperature is at or above 25°C, curing shall be accomplished by water or by using saturated absorptive fabric, in order to achieve cooling by evaporation. Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.

.3 Job Preparation

.1 When the air temperature is at or above 25°C, or when there is the probability of its rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, as defined in Clause 3.4.5.2 of this Specification Section, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by fogging and evaporation.

.4 Concrete Temperature

.1 The temperature of the concrete as placed shall be as low as practicable and in no case greater than that shown below for the indicated size of the concrete section.

Thickness of Section (metres)	**Temperatures (°C)**	
	Minimum	**Maximum**
less than 0.3	10	27
0.3 – 1	10	27
1.2	5	25

.5 Protection from Drying

.1 Moderate Drying Conditions

.1 When surface moisture evaporation exceeds 0.75 kg per square metre per hour, windbreaks shall be erected around the sides of the structural element.

.2 Severe Drying Conditions

.1 When surface moisture evaporation exceeds 1.0 kg per square metre per hour, additional measure shall be taken to prevent rapid loss of moisture from the surface of the concrete. Such additional measures shall consist of the following:

.1 Erecting sunshades over the concrete during finishing and placing operations.

.2 Lowering the concrete temperature.

.3 Increasing humidity by applying fog spray immediately after placement and before finishing.

.4 Care shall be taken to prevent accumulation of water that may reduce the quality of the cement paste.

.5 Beginning the concrete curing immediately after trowelling.

.3 Surface Moisture Evaporation Rate

.1 The monograph, Figure D1, Appendix D of CAN/CSA-A23.1-00 shall be used to estimate surface moisture evaporation rates.

3.4 Concrete Protection for Reinforcement

.1 Ensure reinforcement is placed to provide minimum concrete cover in accordance with Section 03200 – Concrete Reinforcement.

3.5 Construction Tolerance

.1 The Work shall be carefully and accurately set out; true to the positioning, levels, slopes, and dimensions shown on the Drawings and conforming to Sections 03100 – Concrete Formwork and 03200 – Concrete Reinforcement.

.1 Sizes of Member or Thickness of Slabs: +6 mm, -0 mm.

.2 Cover of Concrete over Reinforcement: ±3 mm.

.3 Variations from Plumb: 6 mm in 3 m, 10 mm maximum.

.4 Variations from Flat: 3 mm in 3 m, 6 mm maximum.

.2 If these tolerances are exceeded the Contractor may, at the discretion of the Contract Administrator, be required to remove and replace or to modify the placed concrete before

acceptance. The costs incurred by the Contract Administrator for such investigation, testing, or review of reconstruction and the cost of reconstruction shall be borne by the Contractor.

3.6 Finishing Slab Surfaces

.1 Concrete flatwork finishing is to be done by skilled personnel having at least five (5) years of proven, satisfactory experience in this trade. Submit proof of qualifications in writing to the Contract Administrator.

.2 Finish all slab surfaces conforming to CAN/CSA-A23.1-00, Clause 22 and as specified below.

.3 Bull Floating

.1 Flatness for suspended concrete slabs to be achieved by means of hiway straight edge (minimum 3 m width) in lieu of standard bull float. Immediately after screeding, bull float floor surfaces to remove ridges and fill voids.

.2 Complete bull floating before any excess moisture or bleed water is visible on surface.

.4 Mechanical Floating

.1 Mechanical float floor surfaces when bleed water has disappeared and surfaces are sufficiently hard to prevent working excess mortar to surface.

.2 Continue floating as necessary to produce surfaces of uniform texture, free from hollows, bumps, and screed marks.

.3 For surfaces to be trowelled, continue floating as necessary to embed coarse aggregate particles firmly below surface mortar.

.4 Hand float in corners, restricted areas, and around cast-in items.

.5 Trowelling

.1 Trowel floor surfaces with mechanical trowelling machines fitted with steel blades.

.2 Commence trowelling when surfaces are sufficiently hard to prevent working excess fine material to surface.

.3 Perform additional trowelling at intervals so final trowelling is done just before concrete becomes so hard that further trowelling is ineffective.

.4 Finish trowelled surfaces to be hard, dense, and free from blemishes and other imperfections.

.5 Hand trowel in corners, restricted areas, and around cast-in items.

.6 Cure concrete as specified.

.7 Protect all floors from damage during construction.

3.7 Floor Hardener

.1 Floors shall receive floor hardener in areas shown on the Drawings:

.1 Apply non-metallic floor hardener as a shake-on application on concrete slab during the final finishing stage of steel blade trowelling. Shake apply floor hardener at a minimum rate of 7.5 kg/m². Apply the shake mix in two separate applications using approximately two-thirds of the total amount specified for the first application and the balance for the second.

.2 Apply hardener evenly over the floor surface in one direction.

.3 Machine float just enough to bring moisture completely through the shake and to embed and compact the shake into the base concrete.

.4 Immediately following the floating of the first shake apply the balance of the hardener. Spread and shake evenly and in direction perpendicular to the first shake. Float as specified for the first shake.

.5 Comply with manufacturer's printed instructions for installation and curing.

3.8 Curing and Protection

.1 Cure and protect freshly placed concrete in accordance with Clause 21 of CAN/CSA-A23.1-00.

.2 All concrete shall receive moist curing for a period of at least seven (7) days. One (1) of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marring:

.1 Surface covered with canvas or other satisfactory material and kept thoroughly and continuously moist.

.2 A liquid membrane forming curing sealer, applied at the rate recommended by the Manufacturer. Curing sealer shall not be used on a surface where bond is required for the finishes.

.3 Surfaces of concrete, which are protected by formwork that is left in place for seven (7) days, shall not require any additional curing (except as specified for hot weather). If the formwork is removed in less than seven (7) days, the concrete shall receive moist curing as above.

.3 No concreting will be allowed until all materials required for the curing phase are on Site and ready for use.

.4 At the end of the curing and protection period, the temperature of the concrete shall be reduced gradually at a rate not exceeding 10°C per day until the outside air temperature has been reached.

.5 Concrete that is allowed to freeze or attain insufficient curing conditions shall be subject to all necessary investigations and testing as deemed necessary by the Contract Administrator and all such concrete shall be removed and the portion reconstructed as directed by the Contract Administrator, at Contractor's cost.

.6 The supply (both quantity and time of supply) of water for curing concrete shall be subject to control of the City and prior arrangements shall be made by the Contractor with the City for its supply. The Contractor shall be responsible for, at his own cost, to supply, install, maintain, and move extensions to water services as required for conveying water to the work Site. Water required for curing concrete will be supplied by the City, from the DBPS.

3.9 Formed Concrete

.1 Allow the Contract Administrator to review concrete surfaces immediately upon removal of the forms.

.2 Modify or replace concrete not conforming to qualities, lines, details, and elevations specified herein or indicated on the Drawings to the acceptance of the Contract Administrator.

3.10 Finishing Formed Surfaces

.1 Interior formed concrete surfaces.

.1 Columns and walls of water retaining structures to receive form liner finish as per Section 03100 – Concrete Formwork.

.2 Finish surfaces exposed to view surfaces to Smooth-Form Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.6.

.3 Finish non-exposed surfaces to Rough-Formed Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.5.

.2 Exterior formed concrete surfaces:

.1 Surfaces to receive vapour barrier, insulation, waterproofing material, or roofing material are to be finished to Smooth-Formed Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.6.

.2 Other surfaces to be finished to Rough-Formed Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.5.

3.11 Equipment Pads and Cast in Metal Frames

.1 Supply and install concrete pads and supports for equipment where and as indicated on Drawings. Adjust dimensions to reviewed equipment Shop Drawings.

.2 Insert bolts and sleeves and pack solidly with non-shrink grout, in accordance with setting details and templates.

.3 Steel trowel surface smooth. Chamfer exposed horizontal and vertical edges.

.4 Clean excess concrete from metal frames, inserts, weld plates, etc. Clean and tool concrete around the above noted items.

3.12 Grouting

.1 Grout all miscellaneous anchor bolts with non-ferrous or epoxy grout as specified using templates for accurate positioning.

.2 Grout under base plates and other items to provide continuous support over the entire contact area as required and shown on the Drawings.

3.13 Defective Concrete

.1 Concrete not meeting the requirements of the Specifications and Drawings will be considered defective concrete.

.2 Concrete not conforming to the lines, details, and grades specified herein or as shown on the Drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator. Finished lines, dimensions, and surfaces shall be correct and true within tolerances specified herein and in Section 03100 – Concrete Formwork.

.3 Concrete not properly placed resulting in honeycombing and other defects shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator.

3.14 Patching

.1 Allow Contract Administrator to review concrete surfaces immediately upon removal of all formwork.

.2 Remove all exposed metal form ties, nails and wires, break off fins, and remove all loose concrete.

.3 Any imperfect joints, voids, stone pockets, or other defective areas and tie holes, as specified, shall at once be patched before the concrete is thoroughly dry. Defective areas shall be chipped away to a depth of not less than 40 mm with the edges perpendicular to the surface. The area to be patched and a space at least 150 mm wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar.

.4 Cure all patches thoroughly in accordance to Manufacturer’s instructions.

3.15 Watertightness Testing

.1 All water retaining structures shall be watertight and all precautions shall be taken, especially joint treatment, to construct watertight structures.

.2 The structures, when filled with water, shall be reviewed for leakage including monitoring for visible leaks and testing for leaks by measurement. Each compartment or cell shall be tested independently.

.3 Filling the structures in preparation of the watertightness test shall be performed only after the complete concrete structure has attained 100% of the design strength, and before backfill has been placed against the walls.

.4 The supply (both quantity and time of supply) of water for the watertightness test shall be subject to control of the City and prior arrangements shall be made by the Contractor with the Contract Administrator for its supply. The Contractor shall be responsible for, at his own cost, to supply, install, maintain, and move extensions to water services as required for conveying water to the Work Site. Water required for the watertightness testing will be supplied by the City. Source location and handling requirements will be communicated by the Contract Administrator.

.5 Notify the Contract Administrator at least two (2) working days before commencing the watertightness test.

.6 Testing procedure:

.1 Each structure shall be tested by filling it with water gradually to the high liquid level as directed by the Contract Administrator. Fill the tanks with clean water over a forty eight (48) hour period, prior to monitoring for visible leaks and testing for leaks by measurement, to allow for full saturation of the concrete.

.2 Visible leaks, if any, shall be stopped by grouting or any other methods reviewed and accepted by the Contract Administrator. After all visible leaks have been stopped, the structure shall be refilled with water to the high liquid level over a period of next sixty (60) hours before beginning a test period of seventy two (72) hours. Water level shall be measured and recorded during the test period, and the exposed faces of the structure must show no signs of leakage, visible moisture or wetness. The measurements will be witnessed by the Contract Administrator.

.3 If any test shows loss of water from the structure to exceed the amount estimated for evaporation plus 10 millimetres during the test period, the structure shall be emptied, carefully examined and all defects repaired by grouting, cutting out or remaking joints as reviewed and accepted by the Contract Administrator. Such tests shall be repeated at no additional cost to the City until the leakage is less than the above stipulated amount. Complete Form 103 for each structure upon successful watertightness testing.

.4 The loss due to evaporation can be estimated by mooring a floating liquid-tight container on the surface of the structure over the test period and measuring the loss of liquid from within the container.

.7 All water used for retesting shall be supplied by the City as outlined in 3.15.4 above. Disposal of the water for the initial test and all retests shall be to the ditch north of the GWWD railway as directed by the Contract Administrator and shall be at the Contractor's expense.

.8 Water used for testing shall be subject to chlorine residual testing prior to disposal. The Contractor shall retain water in the tanks as required to de-chlorinate to the satisfaction of the Contract Administrator.

3.16 Construction Joints

.1 Construction joint locations shall be as shown on the Drawings.

.2 Joints not indicated on the Drawings shall be located so as to least impair the strength of the structure. The location of these joints shall be subject to prior review and acceptance by the Contract Administrator. Joints shall be in accordance with CAN/CSA-A23.1-00, or as indicated on the Drawings.

.3 The surface of hardened concrete shall be thoroughly cleaned of foreign matter and laitance by sand blasting, and shall be thoroughly wetted with water, but not saturated, and the forms shall be re-tightened against the face of the hardened concrete before depositing additional concrete. Any concrete splatter on reinforcing bars shall be removed by sand blasting.

.4 PVC waterstop shall be protected with suitable 12 mm thick protection boards on both sides secured firmly together by mechanical clamps (i.e., c-clamps) or other method acceptable to the Contract Administrator during the sand blast cleaning operations.

.5 For horizontal construction joints, the concrete shall be thoroughly compacted by hand trowel in and around the reinforcing bars and along the PVC waterstops.

3.17 Clean-Up

.1 As Work progresses and at the completion of Work, remove from Site all debris, excess materials, and equipment.

END OF SECTION

PRECAST CONCRETE ROOF PANELS

1. GENERAL

1.1 Work Included

.1 Double-tee and hollow core panels.

.2 Connecting and supporting devices.

.3 Formed openings in panels.

.4 Grouting.

1.2 Design Requirements

.1 Design of precast concrete members and connections to conform to CSA-A23.4 and Canadian Prestressed Concrete Institute Design Handbook, under direct supervision of a professional engineer registered in the Province of Manitoba, fully experienced in the design of precast concrete structural units.

.2 Design all members and connections to safely support their own weight, superimposed loads shown on Drawings, and all other forces and loads to which the structural members may be subjected.

.3 Design connections to provide for building movement. Provide adjustable connections to accommodate misalignment of structure and camber of double-tee panels.

.4 Design roof deck for a maximum deflection of 1/360 of the span.

1.3 Qualifications

.1 Manufacturer is to be certified for prestressed precast concrete products under CSA-A251.

1.4 Quality Assurance

.1 Fabricate and install precast concrete roof deck in accordance with requirements of CSA-A23.4.

.2 Maximum allowable manufacturing and erection tolerances are not to exceed those given in CSA-A23.4.

1.5 Inspection and Testing

.1 Inspection and testing will be performed by a firm appointed and paid by the City. Notify Contract Administrator at commencement of shop work so inspection and testing may be scheduled.

.2 Provide free access to all portions of manufacturing plant and cooperate with appointed firm.

.3 If requested by Contract Administrator, submit proposed mix design for review prior to commencement of work.

.4 Testing of cement and aggregates may be required to ensure conformance with requirements stated herein.

.5 Testing of concrete will be performed in accordance with CSA-A23.4.

.6 If defects are revealed during testing of concrete and/or inspection of fabricated precast concrete members, Contract Administrator will request additional testing and/or inspection to ascertain full degree of defects.

.7 Correct defects and/or irregularities to the satisfaction of the Contract Administrator. Further testing and/or inspection, under similar conditions as earlier, will be performed. The Contractor shall pay all costs for retesting and re-inspection.

.8 Test results will be issued to Contract Administrator.

1.6 Shop Drawings

.1 Submit shop drawings in accordance with Specification E11.

.2 Prepare shop drawings under the seal of a professional engineer registered in the Province of Manitoba.

.3 Provide for Contract Administrator's review, copies of design calculations for reinforcing, and hoisting, and connection and anchorage devices.

.4 Clearly indicate product locations, fabrication details, unit identification marks, reinforcement, connection details, dimensions, erection support points, anchors and relationship to adjacent materials in sufficient detail to cover manufacture, handling and erection.

.5 Do not proceed with fabrication until shop drawings and design calculations have been reviewed by the Contract Administrator.

1.7 Transportation/Handling/Storage

.1 Handle all precast members in a position consistent with their shape and design. Do all lifting and supporting only from support points indicated on shop drawings.

.2 Embedded lifting or handling devices are to be capable of supporting members in all positions anticipated during manufacture, storage, transportation and erection. Maintain capacity of lifting devices sufficient to resist forces of minimum 2.5 times weight of member.

.3 Deliver members to site completely finished. Clearly mark members as indicated on shop drawings, with date of production and final position on structure.

.4 Block and laterally brace members during transport and while stored on site. Provide lateral bracing sufficient to prevent bowing and warping. Blocking and bracing to be clean, non-staining, and it shall not prevent uniform curing of exposed surfaces.

.5 Provide edges of members with adequate protection to prevent staining, chipping or spalling of concrete.

2. PRODUCTS

2.1 General

.1 Use forms and beds which are rigid, adequate to withstand prestressing forces and constructed of materials that will result in finished products conforming to requirements stated herein and on the Drawings.

.2 Establish concrete mix design by tests on trial batches to achieve required strengths. Maintain water content as constant as possible during manufacture.

.3 Provide concrete protection of reinforcement in accordance with CSA-A23.4.

.4 Provide concrete protection of reinforcement to provide 1.5 hour fire performance rating.

.5 Deposit and vibrate concrete to ensure proper consolidation, elimination of unintentional cold joints, and to minimize entrapped air on surfaces.

.6 Fabricate all required connecting devices, plates, angles, inserts, bolts and accessories.

.7 Provide anchors and inserts to support loads as shown on the Drawings.

.8 Perform shop welding of connecting and supporting devices in accordance with requirements of CSA-W59.

.9 Ensure anchors, inserts, plates, angles and other cast-in items are accurately located. Maintain in position while concrete is placed and consolidated.

.10 Provide 20 mm diameter holes at 1200 mm centre-to-centre through every stem on double-tee panels. Provide other holes indicated on Drawings.

2.2 Finish

.1 Finish deck slabs to conform to requirements of CSA-A23.4, Commercial Grade.

2.3 Concrete Materials

.1 Cement: normal Portland cement - type GU, conforming to CSA-A3001.

.2 Fine and Coarse Aggregates: conforming to CSA-A23.4, from a single source for each type of aggregate for entire job.

.3 Water: potable, free of deleterious matter that may interfere with finish, strength and colour of concrete.

2.4 Reinforcement

.1 Reinforcing Steel: 400W MPa yield grade, deformed billet steel bars conforming to CSA-G30.18, galvanized finish.

.2 Reinforcing Wire: 480 MPa yield grade, deformed steel wire, conforming to CSA-G30.14, galvanized finish.

.3 Welded Steel Wire Fabric: plain type conforming to CSA-G30.5 galvanized finish.

.4 Prestressing Tendons: uncoated seven-wire, stress relieved strand, conforming to CSA-G279.

2.5 Hardware

.1 Connections, Supporting Devices: Type W Grade 300 steel, conforming to CSA-G40.21, all galvanized to CSA-G164, 600 g/m^2 min. zinc coating after fabrication. Flange connectors of double-tee panels shall be Type 304 stainless steel.

.2 Bolts, Nuts and Washers: conforming to ASTM A325-M.

.3 Anchors, Inserts: patented, load-tested galvanized steel.

.4 Welding Materials: conforming to CSA-W48 Series.

2.6 Prime Paint

.1 Touch-up Primer on galvanized surfaces: zinc dust/zinc oxide alkyd type, conforming to CGSB 1-GP-178.

2.7 Fabrication

.1 Maintain plant records and quality control program during the production of precast structural concrete, as required by CSA-A251, Appendix D. Make records available to Contract Administrator upon request.

3. EXECUTION

3.1 Erection

.1 Provide temporary bracing for all stresses and induced loads during erection. Maintain temporary bracing in place until final support is provided.

.2 Provide all hoisting equipment and operate in accordance with all applicable safety regulations.

.3 Discontinue work and advise Contract Administrator when members require adjustment beyond design criteria. Required modifications shall be performed at the Contractor's cost.

.4 Erect members without damage to shape or finish. Replace or repair damaged members to approval of Contract Administrator, at the Contractor's cost.

.5 Erect all units level, plumb, square and true within allowable tolerances.

.6 Securely fasten units in place.

.7 Perform welding of connecting and supporting devices in accordance with requirements of CSA-W59.

.8 Prime paint field welds and touch up scratched and damaged galvanized surfaces.

.9 Grout differential camber over 6mm between tops of adjacent roof deck slabs with 1:3 mixture of cement and sand. Trowel and feather grout to smooth slope, not exceeding 1:12.

.10 Fill all joints and grout keys between hollow core slabs with 1:3 mixture of cement and sand, trowel smooth.

.11 Remove all grout from underside of hollow core slabs and walls and floors immediately after grouting.

END OF SECTION

MISCELLANEOUS STEEL FABRICATIONS

1. GENERAL

1.1 Work Included

.1 Supply and installation of anchor bolts, fastenings and other inserts to be built into concrete elements and required for anchorage and support of fabricated steel components.

.2 Supply and installation of lifting eyes, plates and miscellaneous steel embedded items.

.3 Supply and installation of fabricated steel components to be built into concrete.

.4 Supply instructions and templates as required for accurate setting of inserts and components.

.5 Finishes to items specified herein.

1.2 Standards

.1 CAN/CGSB-1.108-M Bituminous Solvent Type Paint

.2 CGSB 1-GP-181M Coating, Zinc-Rich, Organic, Ready Mixed.

.3 CAN/CSA-S16.1-M Limit States Design of Steel Structures.

.4 CAN/CSA G40.21-M General Requirements for Rolled or Welded Structural Quality Steel.

.5 CSA G164-M Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA W47.1 Certification of Companies for Fusion Welding of Steel Structures.

.7 CSA W55.3-M Resistance Welding Qualification Code for Fabricators of Structural Members used in Buildings.

.8 CSA W59-M Welded Steel Construction (Metal Arc Welding).

.9 ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.10 ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.11 ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.12 ASTM A307 Specification for Carbon Steel Bolts and Studs, 60000 psi.

.13 ASTM A325 Specification for High-Strength Bolts for Structural Steel Joints.

.14 ASTM A666 Specification for Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar for Structural Applications.

.15 ASTM F738-M Specification for Stainless Steel Metric Bolts, Screws and Studs.

.16 ASTM F1136 Specification for Chromium/Zinc Corrosion Protective Coating for Fasteners.

.17 SSPC.

.18 Local Building By-Laws

.19 CGSB

1.3 Submittals

.1 Submit Shop Drawings in accordance with Specification E11.

.2 Clearly indicate components, finishes, materials, dimensions, profiles, sizes, fabrication details, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

.3 Include installation instructions, erection drawings, elevations, and details where applicable.

.4 Indicate welded connections using CISC standard welding symbols. Clearly indicate net weld lengths.

.5 Welding Procedure for Steel and Stainless Steel:

.1 Submit certificate that companies which will be welding stainless steel are CSA accepted.

.2 Comply with CSA –W47.1 and W59-M.

2. PRODUCTS

2.1 Materials

.1 Plate Steel and Loose Lintels: CAN/CSA-G 40.21, Grade 300W.

.2 Structural Steel: CAN/CSA-G40.21, Grade 350W.

.3 Steel anchors, studs, taps and bolts: ASTM A307, Grade B carbon steel.

.4 Unless otherwise specified, provide fasteners as follows:

.1 Steel bolts - ASTM A 325.

.2 Stainless steel bolts - ASTM A320, Grade B8, (AISI Type 316).

.3 Fastenings in stainless steel and aluminum work - stainless steel.

.5 Steel pipe: ASTM A-53, Type S Grade A or ANSI B36.10.

.6 Stainless steel: Alloy 304 and 316 as indicated on Drawings:

.1 Plates, Sheets and Strips: ASTM A167, S30400 or S30403.

.2 Fasteners and anchors: ASTM A193, A194,F738,F1136, Grade B8A.

.7 Deformed Steel Reinforcing Bars to CSA G30.18, Grade 400W.

.8 Stud Anchors - Nelson stud headed concrete anchors or accepted alternate.

.9 Nuts, bolts, and fastening devices connecting steel parts to aluminum: stainless steel Type 316 , with appropriate isolation devices.

.10 Isolation coating: CAN/CGSB-1.108-M, quick drying asphalt utility enamel.

.11 Prime paint: CISC/CPMA 2-75a unless otherwise required for finish coating.

.12 Zinc rich primer: CGSB 1-GP-181M, Sealtight Galvafroid Zinc-Rich Coating by W.R.Meadows Ltd.

.13 Galvanizing – to CSA-G164, having a finish coating of 600 g/m^2.

2.2 Fabrication

.1 Shop fabricate components where possible.

.2 Verify all dimensions on-site prior to fabrication to ensure accurate fitting.

.3 Assembly:

.1 Accurately cut, machine and fit joints, corners, mitres so that junctions between components fit together tightly, and in true planes.

.2 Fasten work with concealed methods, unless indicated on the Drawings.

.3 Weld all connections where possible, and bolt where not possible, cut off bolts flush with nuts. Countersink bolt heads and prevent loosening of nuts. Ream holes drilled for fastenings.

.4 Weld joints tight, flush, and grind smoother, in true planes with base metals. Make welds continuous at joints where entry of water into building or into voids of members or assemblies is possible.

.5 Provide for differential movements with assemblies and at junctions of assemblies with surrounding work.

.6 Lifting eyes:

.1 Design eyes to withstand load imposed and with a safety factor of 3 minimum.

.2 Cast eyes into concrete at locations shown.

.3 Submit design details for review by Contract Administrator.

.4 Steel angles and shelf angles:

.1 Fabricate where indicated and as detailed.

.2 Hot-dip galvanize after fabrication.

2.3 Surface Preparation

.1 Thoroughly clean and suitably pretreat steel prior to finishing.

.2 Remove loose mill scale, rust, oil, grease, dirt and other foreign matter using one or more of the following methods:

.1 solvent cleaning

.2 wire brushing

.3 power wire brushing

.4 sandblasting

.3 Grind smooth sharp projections.

.4 After fabrication, clean, scrape and remove rust, mill scale, grease and other extraneous material, and prepare surface in accordance to CGSB 31-GP-404.

2.4 Finishes

.1 Prime paint:

.1 Clean metal in accordance with surface preparation requirements of CAN/CGSB-1.181.

.2 Apply a full smooth coat of primer to ferrous metal components to be painted in accordance with CAN3-S16.1. Apply primer at temperature above 7°C to a dry film thickness of 50 to 75 micrometers.

.3 Leave surfaces to be welded unpainted.

.4 Work primer into corner and open spaces so that all visible and accessible surfaces are fully covered. do not prime portion where items are to be built into concrete except for 25 mm adjacent to exposed portion.

.2 Hot Dip Galvanizing:

.1 After fabrication, hot dip all ferrous metals miscellaneous parts, including bolts, nuts, washers, and hangers to ASTM A123, having a finished coating of 600 g/m2.

.2 Where size permits galvanize components after assembly.

.3 Back Painting: Back-paint metal surfaces (except stainless steel) in contact with dissimilar metal or concrete with bituminous paint, one millimetre (1.0)mm DFT minimum for the following conditions: (1) exterior components (2) interior components exposed to high humidity.

.4 Paint galvanized metal surfaces to be in contact with or encased in concrete with rust inhibitive epoxy coating ICI Devoe Coating:Devran 201. Prepare surfaces to SSPC SP1, and apply paint to 125 microns DFT.

.5 Carbon Steel:

.1 Where carbon steel is intended to be exposed to atmospheric conditions, hot-dip galvanize the fabrications.

.2 Where carbon steel is intended to be in contact with concrete, hot-dip galvanized the surfaces to be in such contact.

.6 Stainless steel:

.1 Remove rust and postweld discoloration from stainless steel by grinding, using only stainless steel tools.

.2 Passivate stainless steel, which was cleaned by grinding, with a solution of 12-15% nitric acid and 3% hydrofluoric acid.

.3 Finishes: No.4 finish XL Blend S

.7 Touch up shop painted items which have chipped or abrased during transportation using same material.

3. EXECUTION

3.1 Installation

.1 Obtain the Contract Administrator’s permission prior to site cutting or making adjustments which are not part of the scheduled work.

.2 Install items plumb, square and level; fit accurately, and maintain free from distortion or defects detrimental to appearance and performance.

.3 Make provisions for erection stresses and temporary bracing. Keep work in alignment at all times.

.4 Replace items damaged in course of installation.

.5 Perform required field welding. Visible field welds to be smooth, grind as required.

.6 Perform all field assembly bolting and welding to match standard of shop bolting and welding. Bolts and screws are to be concealed whenever possible.

.7 Supply and install anchors for setting in concrete as shown on Drawings but not less than 125 mm embedment.

.8 Lifting eyes: cast lifting eyes into concrete above each item of equipment with net weight in excess of 600 kg.

.9 Prevent electrolysis between aluminum and dissimilar metals in contact with appropriate isolation devices.

.10 Install components square, straight and true to line.

.11 Securely anchor components in place.

.12 After installation, site clean and refinish damaged finishes, welds, bolt heads and nuts.

.13 Refinish with primer or zinc rich paint to match original finish.

3.2 Schedule of Components

.1 Supply and install components as specified herein and as shown on Drawings:

.1 Lifting eye bolts.

.2 Edge protection angles.

.3 Stair landing angles.

.4 Embedded wall/column plates and floor plates.

.5 Fabricated wall manholes.

.6 Fabricated service doors.

.7 Anchors for precast roof panels.

.8 Monorail beam and crane runway beam anchors.

.9 Stainless steel grating support beams.

.10 Stainless steel weir plates.

.11 Anchors for equipment.

.12 Supports for masonry veneer.

END OF SECTION

ALUMINUM FABRICATIONS

1. GENERAL

1.1 Work Included

.1 Supply and installation of aluminum access hatch frames to be cast into concrete.

.2 Supply and installation of grating and covers for the access hatch frames specified in 1.1.1.

1.2 Standards

.1 Do aluminum Work to CSA CAN3-S157

.2 Welding to CSA W59.2

.3 Company certification to CSA W47.2

1.3 Shop Drawings

.1 Submit Shop Drawings in accordance with Specification E11.

.2 Clearly indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

.3 Include erection drawings, elevations, and details where applicable.

.4 Indicated welded connections using CISC standard welding symbols. Clearly indicate net weld lengths.

2. PRODUCTS

2.1 Materials

.1 Aluminum: to CSA Standard HA, 6061-T6 or 6351-T6 Alloy unless specified otherwise.

.2 Nuts, bolts, and fastening devices connecting aluminum parts to aluminum, concrete, or other materials: stainless steel ASTM Type 316 , with appropriate isolation devices.

.3 Bituminous Paint: alkali-resistant, to CGSB 1.108M.

.4 Aluminum Grating: acceptable Manufacturer is Fisher & Ludlow Fisholow Galok Aluminum Grating, Type 30-102M, sizes as indicated on the Drawings.

2.2 General Fabrication

.1 Verify all dimensions on-site prior to fabrication.

.2 Grating:

.1 Connect bearing bars in a panel with a bar of same depth as bearing bars and minimum thickness of 5 mm.

.2 Finish openings requiring the cutting of four (4) or more bearing bars in the same manner as the end of the panel.

.3 Match position of bars and tie rods in adjacent panels to preserve a continuous appearance.

.3 Cover exposed aluminum surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating before shipping to Site. Leave protective covering in place until final cleaning of structures. Provide instruction for removal of protective covering.

3. EXECUTION

3.1 Erection

.1 Obtain the Contract Administrator's permission prior to Site cutting or making adjustments which are not part of the scheduled Work.

.2 Install items plumb, square and level; fit accurately, and maintain free from distortion or defects detrimental to appearance and performance.

.3 Make provisions for erection stresses and temporary bracing. Keep Work in alignment at all times.

.4 Replace items damaged in course of installation.

.5 Perform required field welding. Visible field welds to be smooth, grind as required.

.6 Perform necessary cutting and altering for the installation of Work of other Sections, and as indicated the Drawing. No additional cutting is to be done without the acceptance of the Contract Administrator.

.7 Perform all field assembly bolting and welding to match standard of shop bolting and welding. Bolts and screws are to be concealed whenever possible.

.8 Grating:

.1 Clip adjacent grating panels edges together at 1500 mm spacing to prevent differential vertical movement.

.2 Supply and install two (2) hold-down clips at each end of the panels if not detailed on the Drawings.

.9 Supply and install anchors for setting in concrete with minimum 100 mm embedment.

.10 Paint aluminum surfaces in contact with concrete with two (2) coats of alkali-resistant bituminous paint.

.11 Prevent electrolysis between aluminum and dissimilar metals in contact with appropriate isolation devices.

END OF SECTION

EPDM WATERPROOF MEMBRANE

1. GENERAL

1.1 Work Included

.1 Supply and installation of ethylene propylene diene monomer (EPDM) membrane and insulation to extents shown on the Drawings including the following major items of Work:

.1 Wall and footing membrane.

.2 Flashings.

.3 Polyethylene slip sheets and protection board at perimeter of walls to be backfilled.

.4 Insulation.

1.2 Storage and Handling

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store materials on supports to prevent deformation.

.3 Remove only in quantities required for same day use.

.4 Store uncured flashing and jointing materials to prevent premature curing and freezing.

.5 Store materials in accordance with Manufacturer's written instructions.

1.3 Environmental Requirements

.1 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.

.2 Maintain air temperature and substrate temperature at membrane installation area above 5°C for twenty four (24) hours before, during, and twenty four (24) hours after installation, or as recommended by the Manufacturer.

.3 Do not apply membrane in wet weather.

1.4 Shop Drawings

.1 Submit Shop Drawings in accordance with Specification E11.

.2 Shop Drawings shall indicate material and membrane sheet joint layout.

1.5 Mock-Up

.1 Construct mock-up of minimum 10 m^2 size showing typical lap joint, typical corner, insulation, and protection board with slip sheet.

.2 Reviewed and accepted mock-up may form part of completed Work.

.3 Allow twenty four (24) hours for review of mock-up by Contract Administrator before proceeding with membrane work.

.4 Arrange for membrane Manufacturer's representative to be on-site during mock-up and periodically during progress of the Work to ensure installation is in accordance with Manufacturer's instructions and requirements.

1.6 Qualifications

.1 The Contractor shall provide documentation showing the firm to be a membrane material applicator approved by the membrane Manufacturer.

.2 Work is to be performed in accordance with elastomeric membrane Manufacturer's printed application instructions unless specified otherwise.

1.7 Guarantees

.1 The membrane Manufacturer shall provide a pro-rated written guarantee against manufacturing defects in the membrane materials for a period of twenty (20) years from the date of Total Performance. The Manufacturer shall complete and sign the enclosed Form W1: Manufacturer Guarantee Agreement (attached to this Section) upon Award of Contract. The Manufacturer shall indicate his written approval in Form W1 of the selected membrane material applicator for the installation of the membrane system.

.2 The Sub-Contractor shall provide a written guarantee stating that the membrane system will provide leak-free service for a period of five (5) years from the date of Total Performance. The Sub-Contractor shall complete and sign the enclosed Form W2: Sub-Contractor Guarantee Agreement (attached to this Section) upon Award of Contract.

2. PRODUCTS

2.1 Materials

.1 EPDM Membrane:

.1 EPDM membrane shall be felt-backed EPDM synthetic rubber waterproofing membrane applied with hot rubberized asphalt for the walls and footings. Membrane shall be Lexcan Design D, 1.5 mm thick felt-backed membrane or accepted alternate.

.2 Splice cleaner, adhesive, tape, and sealant shall conform to the membrane Manufacturer's recommendations.

.3 Asphalt for wall application shall conform to CAN/CGSB-37.5, 7106 Foundation Mastic by Insulmastic Building Products or accepted alternate.

.4 Membrane material shall conform without exception to all performance characteristics shown on Table 1 attached to this Section.

.2 Polystyrene Insulation:

.1 Polystyrene insulation shall conform to CAN/CGSB-51.20-M, Type 4, 100 mm in thickness, shiplapped edges, and minimum compressive strength of 240 kPa, Foamular 400 by Owens Corning or accepted alternate.

.3 Polyethylene Slip-Sheet:

.1 Polyethylene Slip-Sheet shall conform to CAN2-51.34, Type 1, 0.25 mm thick.

.4 Protection Board:

.1 Protection board shall be Type 2 fibreboard as accepted by the Contract Administrator.

3. EXECUTION

3.1 Substrate Examination

.1 Notify the Contract Administrator of any conditions such as concrete fins or sharp projections that would jeopardize proper completion of this Work.

.2 Prior to commencement of Work ensure substrates are firm, straight, smooth, dry, free of snow, ice, or frost, and swept clean of dust and debris

3.2 Protection

.1 At end of each day's Work or when stoppage occurs due to inclement weather, provide protection for completed work and materials out of storage.

.2 Seal and secure exposed edges.

3.3 Membrane Application

.1 General:

.1 Do not install EPDM membrane when air and substrate temperature remains below 5°C in accordance with Manufacturer's recommendations or when wind chill gives equivalent cooling effect.

.2 Install EPDM membrane on dry smooth substrate, free of deleterious materials and sharp projections. Use only dry materials and apply only during weather that will not introduce moisture into the system.

.3 Ensure that temperature of substrate and its moisture content conforms to Manufacturer's minimum requirements, before proceeding with Work.

.4 Membrane shall be installed only after successful watertightness testing.

.2 Positioning Membrane Sheets

.1 Ensure substrate is clean, flat, and free from dirt or debris that might be detrimental to the performance of the membrane.

.2 Unroll membrane sheets from the top of wall and position according to accepted Shop Drawings, ensuring a tight butt-edge with adjacent sheets. Do not over-lap sheets.

.3 Bonding to Substrate:

.1 Apply specified asphalt base by trowel in accordance with the Manufacturer's instructions to achieve a coverage of a minimum of 1.0 kg of material per square metre. Limit application to the applied roll width of EPDM membrane.

.2 While the asphalt is still in an adhesive state, roll the membrane into asphalt, avoiding air bubbles or wrinkles (refer to flash cure set period from Manufacturer's product information). Brush down on the membrane with a push broom to achieve maximum contact. Ensure proper alignment at butt seam joints.

.3 Leave a minimum of 500 mm of un-bonded membrane at the top of the membrane application for incorporation into the building envelope wall assembly.

.4 Splicing Membrane Sheets

.1 Clean a 20 cm wide strip of EPDM membrane with Seam Cleaner. Ensure any asphalt spills are scraped off. Apply a 20 cm wide strip of splice adhesive to the membrane, centred over the seam. Apply with a paint brush using straight painting strokes (not a circular motion). Allow adhesive to dry until it is tacky, but does not stick to a dry finger touch.

.2 Remove paper backing and apply Overlay Seam Tape to the membrane, centred lengthwise over the seam. Overlap tape ends and "T" junctions a minimum of 10 cm. Roll tape heavily with a steel roller.

.3 Apply 30 cm^2 overlay patches of flashing centred over all seam "T" junctures, seam overlays, and corners. Apply with Splice Adhesive according to adhesive Manufacturer's application directions.

.4 Caulk both edges of Overlay Seam Tape all exposed membrane of flashing edges with Lap Sealant. Feather sealant with tool provided.

3.4 Insulation Application

.1 Insulation to be laid in parallel rows with ends staggered.

3.5 Flashing Application

.1 Install cured or uncured EPDM membrane flashings in accordance with Manufacturer's written instructions.

.2 Flash pipes, conduits, and other penetrations trough waterproofing, using prefabricated or field fabricated membrane flashings.

3.6 Protection Board and Slipsheet Application

.1 Install protection board and slipsheet concurrently with backfilling.

3.7 Cleaning

.1 Clean soiled surfaces, spatters, and damage caused by work of this Section to satisfaction of Contract Administrator.

END OF SECTION

Table 1: Required Membrane Characteristics

PROPERTY	ASTM TEST	REQUIREMENTS
Thickness	D751	± 10%
Breaking Strength, minimum	D751	14.0 kN/m
Elongation @ Fabric Break	D751	80%
Elongation @ Rubber Break	D751	350%
Elongation, Ultimate	D421	400%
Tearing Resistance, minimum	D624, DIEC	35.0 kN/m
Tongue Tear Strength, minimum	D751	156 N
Brittleness Point, maximum	D2137	-60˚C
Ozone Resistance (7 days @ 100 pphm, 20% elong 40C)	D1149	No cracks @7 x mag
Water Absorption, maximum	D471	+ 1%
Factory Seam Strength	D816	9.6 kN/m
Breaking Strength, minimum	D751	7.5 kN/m
Elongation @ Rubber Break	D751	250%
Elongation, Ultimate	D421	250%
Tearing Resistance, minimum	D624, DIEC	30.6 kN/m
Tongue Tear Strength, minimum	D751	111 N
Linear Dimensional Change, maximum	D1204	±1%

Form W1: Manufacturer Guarantee Agreement

Sheet 1 of 2

WATER TREATMENT PLANT MEMBRANE SYSTEM

GUARANTEE TO THE CITY OF WINNIPEG

FOR PROJECT:

WATER TREATMENT PROGRAM – WATER TREATMENT PLANT FOUNDATIONS AND CONCRETE STRUCTURES

BID OPPORTUNITY NO. 583-2005

Manufacturer's Name and Address

does hereby provide, in accordance with the Specifications of the Contract, the following Guarantee for the herein identified Water Treatment Plant Membrane System.

The EPDM membrane material is guaranteed against the following defects attributable to defective material for a period of twenty (20) years from the date of issue of the Certificate of Total Performance of the membrane system:

1. Premature deterioration in forms of cracking, brittleness, loss of elongation characteristics, tearing resistance, water absorption qualities to the point of failure under the effects of historical climatic conditions.
2. The membrane system shall be defined as membrane, rubberized asphalt, flashing, tapes, adhesives, sealant, and joint reinforcement membrane strips and any other products required for use in the membrane system.
3. Material failure shall be defined as any defects that results in the loss of leak free performance during the guarantee period.

Remedial works covered by this guarantee shall include the repair or replacement of the defective membrane area. The cost of removal and replacement of material above or adjacent to the membrane is not included in this guarantee.

All remedial works shall carry a minimum twenty (20) year guarantee as stipulated above.

Form W1: Manufacturer Guarantee Agreement

Sheet 2 of 2

MANUFACTURER'S APPROVAL OF SELECTED APPLICATOR

We, the Manufacturer, approve the selection of _____ as the membrane material applicator of our wall and roof membrane system.

MANUFACTURER

Name of Company Officer	Corporate Position	Signature of Company Officer
Name of Witness	Signature of Witness	Date

CONTRACTOR

Name of Company Officer	Corporate Position	Signature of Company Officer
Name of Witness	Signature of Witness	Date

Form W2: Sub-Contractor Guarantee Agreement Sheet 1of 1

WATER TREATMENT PLANT MEMBRANE SYSTEM

GUARANTEE TO THE CITY OF WINNIPEG

FOR PROJECT:

WATER TREATMENT PROGRAM – WATER TREATMENT PLANT FOUNDATIONS AND CONCRETE STRUCTURES

BID OPPORTUNITY NO. 583-2005

Sub-Contractor's Name and Address

does hereby provide, in accordance with the Specifications of the Contract, the following Guarantee for the herein identified Water Treatment Plant Membrane System.

The Membrane System is guaranteed against the following defects attributable to faulty installation for a period of five (5) years from the date of issue of the Certificate of Total Performance with respect to the membrane system:

1. Leak free performance of the membrane system. The membrane system shall be defined as membrane, rubberized asphalt, flashing, tapes, adhesives, sealant, and joint reinforcement membrane strips and any other products recommended by the Manufacturer for use in the membrane system.
2. Debonding of the EPDM sheet membrane material from the wall and foundation construction.

Remedial works covered by this guarantee shall include the repair or replacement of the defective membrane area. The cost of removal and replacement of material above or adjacent to the membrane is not included in this guarantee.

All remedial works shall carry a minimum five (5) year guarantee as stipulated above.

SUB-CONTRACTOR (Applicator)

Name of Company Officer	Corporate Position	Signature of Company Officer
Name of Witness	Signature of Witness	Date

CONTRACTOR

Name of Company Officer	Corporate Position	Signature of Company Officer
Name of Witness	Signature of Witness	Date

COATING SYSTEMS FOR STEEL TANKS AND PIPES

1. GENERAL

1.1 References

.1 The following is a list of standards which may be referenced in this Section:

.1 NSF: 61, Drinking Water System Components-Health Effects.

.2 SSPC:

.1 SP 1, Surface Preparation Specification No. 1, Solvent Cleaning.

.2 SP 2, Hand Tool Cleaning.

.3 SP 3, Power Tool Cleaning.

.4 SP 5, White Metal Blast Cleaning.

.5 SP 6, Commercial Blast Cleaning.

.6 SP 7, Brush-Off Blast Cleaning.

.7 SP 8, Pickling.

.8 SP 10, Near-White Blast Cleaning.

.9 SP 11, Power Tool Cleaning to Bare Metal.

.10 SP 12, High Pressure Water Jetting.

.3 American Water Workers Association:

.1 C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

1.2 Definitions

.1 Terms used in this Section:

.1 Coverage: Total minimum dry film thickness in mil, or m^2/L.

.2 MDFT: Minimum Dry Film Thickness, mm.

.3 MDFTPC: Minimum Dry Film Thickness per Coat, mm.

.4 Mil: Thousandth of an inch.

.5 PSDS: Paint System Data Sheet.

.6 SP: Surface preparation.

1.3 Submittals

.1 Action Submittals:

.1 Data Sheets:

.1 For each paint system used, furnish a painting system data sheet, and paint colours available (where applicable) for each product used in the paint system, except for products applied by equipment manufacturers.

.2 Submit required information on a system-by-system basis.

.3 Provide copies of paint system submittals to coating applicator.

.4 Indiscriminate submittal of Manufacturer's literature only is not acceptable.

.2 Detailed chemical and gradation analysis for each proposed abrasive material.

.3 Samples: Proposed Abrasive Materials: 2 kg minimum Sample for each proposed.

.2 Informational Submittals:

.1 Anticipated tank coating sequence.

.2 Coating Manufacturer's Certificate of Compliance.

.3 Copy of applicable NSF listings.

.4 Applicator's Qualification: List of references substantiating experience.

.5 Manufacturer's written instructions for applying each type of coating.

.6 Field Testing: Inspection and test reports.

.7 Manufacturer's Certificate of Proper Installation.

1.4 Quality Assurance

.1 Applicator Qualifications: Minimum five (5) years' experience in application of specified products.

.2 Regulatory Requirements:

.1 Meet federal, provincial, and local requirements limiting the emission of volatile organic compounds.

.2 Perform surface preparation and painting in accordance with recommendations of the following:

.1 Paint Manufacturer's instructions.

.2 SSPC-PA Guide No. 3, Guide to Safety in Paint Applications.

.3 Federal, provincial, and local agencies having jurisdiction.

.3 Mockup:

.1 Before proceeding with Work under this Section, finish one complete space or item of each colour scheme required showing selected colours, finish texture, materials, quality of Work, and special details.

.2 After approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

1.5 Delivery, Storage, and Handling

.1 Deliver materials to Site in unopened containers labeled with designated name, date of manufacture, colour, and Manufacturer.

.2 Store paints in a protected area that is heated or cooled as required to maintain temperatures within the range recommended by paint Manufacturer.

.3 Shipping:

.1 Protect precoated items from damage. Batten coated items to prevent abrasion.

.2 Use nonmetallic or padded slings and straps in handling.

1.6 Environmental Requirements

.1 Do not apply paint in temperatures outside of Manufacturer's recommended maximum or minimum allowable, or in dust, smoke-laden atmosphere, damp or humid weather.

.2 Do not perform abrasive blast cleaning whenever relative humidity exceeds 85%, or whenever surface temperature is less than 3°C above dewpoint of ambient air.

2. PRODUCTS

2.1 Manufacturers

.1 Ameron Protective Coatings, Brea, CA.

.2 Benjamin Moore Paints, New York, NY.

.3 Carboline Coatings Company, St. Louis, MO.

.4 ICI Devoe, Louisville, KY.

.5 DuPont Chemical Co., Wilmington, DE.

.6 Hempel/Reliance Paints, Houston, TX.

.7 Keeler and Long, Inc., Watertown, CT.

.8 Master Builders, Inc., Cleveland, OH.

.9 Plas-Chem Coatings, St. Louis, MO.

.10 International Protective Coatings, Houston, TX.

.11 Sherwin-Williams, Cleveland, OH.

.12 Tnemec Coatings, Kansas City, MO.

.13 Plasite Protective Coatings, Green Bay, WI.

.14 Cloverdale Paint, Surrey, BC.

.15 Enviroline, Pompano Beach, FL.

2.2 Materials

.1 Quality: Manufacturer's highest quality products and suitable for intended use.

.2 Abrasives: As recommended by paint Manufacturer to produce surface profile recommended for specific paint system.

.3 Materials Including Primer and Finish Coats: Produced by same paint Manufacturer.

.4 Thinners, Cleaners, Driers, and Other Additives: As recommended by paint Manufacturer of the particular coating.

.5 Polyamide Epoxy: Polyamide epoxy coatings approved for potable water contact conforming to NSF 61.

.6 Polyurethane Enamel: Two-component, aliphatic or acrylic based polyurethane; high gloss finish.

.7 Wash Primer: Vinyl butyral acid.

.8 Rust Inhibitive Primer: Single package steel primer with anticorrosive pigment loading.

.9 Alkyd Enamel: Gloss finish, medium oil length.

2.3 Colours

.1 Formulate with colorants free of lead and lead compounds.

.2 Furnish as selected by Contract Administrator.

.3 Proprietary identification of colours is for identification only; selected manufacturer may supply matches.

2.4 Mixing

.1 Multiple-Component Coatings:

.1 Prepare using all the contents of the container for each component as packaged by paint Manufacturer.

.2 No partial batches will be permitted.

.3 Do not use multiple-component coatings that have been mixed beyond their pot life.

.4 Furnish small quantity kits for touchup painting and for painting other small areas.

.5 Mix only components specified and furnished by paint Manufacturer.

.6 Do not intermix additional components for reasons of colour or otherwise, even within the same generic type of coating.

.2 Keep paint material containers sealed when not in use.

3. EXECUTION

3.1 General

.1 Coatings and linings on steel piping shall be applied in strict accordance with AWWA C210.

3.2 Preparation

.1 Notify the Contract Administrator at least seven (7) days prior to start of shop blast cleaning to allow for inspection of the Work during surface preparation and shop application of paints. Work shall be subject to the Contract Administrator approval before shipment to Site.

.2 Items such as structural steel, metal floor doors, manways, and frames, metal louvers, and similar fabricated items may be shop prepared and primed. Centrifugal wheel blast cleaning is an acceptable alternative to shop blast cleaning.

.3 Remove, mask, or otherwise protect hardware, machined surfaces, nameplates on machinery, and other surfaces not intended to be painted.

.4 Protect all surfaces adjacent to, or downwind of Work area from overspray. Contractor shall be responsible for any damage resulting from overspray.

3.3 Preparation of Surfaces

.1 Metal Surfaces:

.1 Meet requirements of the following SSPC Specifications as referenced in specific coating systems:

.1 Solvent Cleaning: SP 1.

.2 Hand Tool Cleaning: SP 2.

.3 Power Tool Cleaning: SP 3.

.4 White Metal Blast Cleaning: SP 5.

.5 Commercial Blast Cleaning: SP6

.6 Brush-Off Blast Cleaning: SP 7.

.7 Near-White Blast Cleaning: SP 10.

.8 Power Tool Cleaning to Bare Metal: SP 11.

.9 High Pressure Water Jetting: SP 12.

.2 Wherever the words “solvent cleaning”, “hand tool cleaning”, “wire brushing”, or “blast cleaning”, or similar words of equal intent are used in these Specifications or in paint Manufacturer’s specifications, they shall be understood to refer to the applicable SSPC Specifications listed above.

.3 Hand tool clean areas that cannot be cleaned by power tool cleaning.

.4 Preblast Cleaning Requirements:

.1 Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.

.2 Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.

.3 Clean small isolated areas as above or solvent clean with suitable solvents and clean cloths.

.4 Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.

.5 Welds and Adjacent Areas:

.1 Prepare such that there is:

.1 No undercutting or reverse ridges on weld bead.

.2 No weld spatter on or adjacent to weld or other area to be painted.

.3 No sharp peaks or ridges along weld bead.

.2 Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

.6 Blast Cleaning Requirements:

.1 Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.

.2 Select type and size of abrasive to produce a surface profile that meets coating Manufacturer's recommendations for particular primer to be used.

.3 Use only dry blast cleaning methods.

.4 Do not reuse abrasive, except for designed recyclable systems.

.5 Meet applicable federal, provincial, and local air pollution and environmental control regulations for blast cleaning and disposition of spent aggregate and debris.

.7 Post-Blast Cleaning and Other Cleaning Requirements:

.1 Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.

.2 Paint surfaces the same day they are blast cleaned. Reblast surfaces that have started to rust before they are coated.

3.4 Application

.1 General:

.1 The intention of these Specifications is for new interior and exterior metal and submerged metal surfaces to be painted, whether specifically mentioned or not, except as modified herein. Prime coat structural steel surfaces.

.2 Extent of Coating (Immersion): Coatings shall be applied to all internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.

.3 For coatings subject to immersion, obtain full cure for completed system. Consult coatings Manufacturer's written instructions for these requirements. Do not immerse coating until completion of curing cycle.

.4 Apply coatings in accordance with paint manufacturer's Recommendations. Allow sufficient time between coats to assure thorough drying of previously applied paint.

.5 Paint units to be bolted together and to structures prior to assembly or installation.

.6 Where more than one (1) coat of a material is applied within a given system, alternate colour to provide a visual reference that the required number of coats have been applied.

.2 Shop Primed Surfaces:

.1 Schedule inspection with the Contract Administrator before shop primed items are delivered to Site.

.2 Hand or power sand areas of chipped, peeled, or abraded coating, feathering the edges. Follow with a spot primer using specified primer.

.3 For two-package or converted coatings, consult coatings Manufacturer for specific procedures as relates to Manufacturer's products.

.4 Prior to application of finish coats, clean shop primed surfaces free of dirt, oil, and grease and apply mist coat of specified primer, 1 mil dry film thickness.

.5 After welding, prepare and prime holdback areas as required for specified paint system. Apply primer in accordance with Manufacturer's instructions.

.3 Stripe Coating:

.1 Stripe coat all field welds, edges, angles, fasteners, and other irregular surfaces located inside tanks.

.2 Stripe coat shall consist of one coat, brush applied, to the coating thickness specified.

.3 Apply stripe coat between intermediate and final coats.

.4 Stripe coat colour shall contrast intermediate coat to allow visual verification of application.

.4 Film Thickness:

.1 Number of Coats: Minimum required without regard to coating thickness. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in Manufacturers' products, and atmospheric conditions.

.2 Maximum film build per coat shall not exceed coating Manufacturer's recommendations.

.3 Film Thickness Measurements and Electrical Inspection of Coated Surfaces:

.1 Perform with properly calibrated instruments.

.2 Recoat and repair as necessary for compliance with the Specifications.

.3 All coats are subject to inspection by the Contract Administrator and coating Manufacturer's representative.

.4 Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.

.5 Thickness Testing:

.1 After repaired and recoated areas have dried sufficiently, final tests will be conducted by the Contract Administrator.

.2 Measure coating thickness specified in mils with a magnetic type dry film thickness gauge.

.3 Test finish coat for holidays and discontinuities with an electrical holiday detector, low voltage, wet sponge type.

.4 Check each coat for correct millage. Do not make measurement before a minimum of eight (8) hours after application of coating.

.5 Damaged Coatings, Pinholes, and Holidays:

.1 Feather edges and repair in accordance with recommendations of paint Manufacturer.

.2 Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat in accordance with the Specifications. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.

.3 Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and colour-matched appearance.

.6 Unsatisfactory Application:

.1 If item has an improper finish colour, or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified colour and coverage. Obtain specific surface preparation information from coating manufacturer.

.2 Evidence of runs, bridges, shiners, laps, or other imperfections are causes for rejection.

.3 Repair defects in coating systems in accordance with written recommendations of coating manufacturer.

.4 Leave all staging up until the Contract Administrator has inspected surface or coating. Replace staging removed prior to approval by the Contract Administrator.

3.5 Field Quality Control

.1 Testing Gauges:

.1 Provide a magnetic type dry film thickness gauge to test coating thickness specified in millimetres, as Manufactured by Nordson Corp., Anaheim, CA, Mikrotest.

.2 Provide an electrical holiday detector, low voltage, wet sponge type to test finish coat, except zinc primer, high-build elastomeric coatings, and galvanizing, for holidays and discontinuities as manufactured by Tinker and Rasor, San Gabriel, CA, Model M-1.

3.6 Manufacturer's Services

.1 The coating manufacturer's representative shall be present at shop or Site as follows:

.1 On the first day of application of any coating.

.2 A minimum of two (2) additional inspection visits, each for a minimum of four (4) hours, in order to provide Certificate of Satisfactory Installation.

.3 As required to resolve field problems attributable to, or associated with the Manufacturers' product.

3.7 Cleanup

.1 Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at the end of each day.

.2 Upon completion of the Work, remove staging, scaffolding, and containers from the Site or destroy in a legal manner.

.3 Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.8 Protective Coatings Systems

.1 System No. 1 Submerged Metal-Potable Water:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (SP10)	Potable Grade, Polyamide Epoxy Coating	3 coats, 0.08mm MDFTPC (3 mils MDFTPC)

.1 Application Schedule:

.1 Use this system on all metal surfaces inside piping and tanks, including, but not limited to, steel plates and structural steel; interior and exterior surfaces of the inlet, outlet, and overflow piping; manhole covers; hatches; ladders; landings; couplings; and vents.

.2 Use this system on the exposed surfaces of direct buried and concrete encased steel pipe.

.3 Coating is not required for the bottom side of the floor plates.

.4 Provide full coating thickness to the top of all structural steel that will be covered by the roof plates, or otherwise shielded from full coating thickness, before the structural steel members are installed. Remove coating in areas to be welded.

.2 System No. 5 Exposed Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Polyamide, Anticorrosive Epoxy Primer (Beige Colour)	1 coat, 0.064mm MDFT (2.5 mils MDFT)
	Polyurethane Enamel	1 coat, 0.08mm MDFT (3 mils MDFT)

.1 Application Schedule: Use this system on exposed exterior metal surfaces of piping and tanks. For galvanized surfaces to be coated, reference System No. 10.

.2 Tank Coating Sequence Anticipated:

.1 Shop prime all surfaces of shell plates and roof and floor plates and structural steel associated with the exterior of the tank; hold back shop primer where required for field welding.

.2 Shop priming of galvanized steel surfaces is not required.

.3 After tank erection, abrasive blast welds (SP 10) and damaged areas; apply primer.

.4 Clean primed surfaces and brush blast.

.5 Apply mist coat of primer.

.6 Apply finish coats.

.7 Touch up as required.

.3 System No. 6 Exposed Metal-Atmospheric:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 6)	Rust-Inhibitive Primer	1 coat, 0.05 mm MDFT (2 mils MDFT)
	Alkyd Enamel	2 coats, 0.1 mm MDFT (4 mils MDFT)

.1 Application Schedule: Use this system on exposed exterior metal surfaces of tanks. For galvanized surfaces to be coated, reference System No. 10.

.2 Tank Coating Sequence Anticipated:

.1 Shop prime all surfaces of shell plates and roof and floor plates and structural steel associated with the exterior of the tank; hold back shop primer where required for field welding.

.2 Shop priming of galvanized steel surfaces is not required.

.3 After tank erection, abrasive blast welds (SP 10) and damaged areas; apply primer.

.4 Clean primed surfaces and brush blast.

.5 Apply mist coat of primer.

.6 Apply finish coats.

.7 Touch up as required.

.4 System No. 10 Galvanized Metal Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1) Followed by Hand Tool (SP 2), Power Tool (SP 3), or Brushoff Blast (SP 7)	Wash primer or coating manufacturers' recommended primer followed by System No. 5	1 coat, 0.01 mm MDFT (0.4 mils MDFT)

.1 Application Schedule: Use on galvanized surfaces, including handrails and gratings, before application of System No. 5.

.2 Coating Sequence Anticipated:

.1 Clean galvanized surfaces.

.2 Apply primer.

.3 Apply intermediate and finish coats (See System No. 5).

END OF SECTION

GENERAL MECHANICAL PROVISIONS

1. GENERAL

1.1 Intent

.1 Contract Documents and Drawings of this Division are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.2 Follow manufacturers' recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.3 Install equipment generally in locations and routes shown. Run piping and ductwork close to building structure, parallel to building lines to maximize head room and with minimum interference with other services and free space. Remove and replace improperly installed equipment to satisfaction of the Contract Administrator at no extra cost.

.4 Install equipment to provide access and ease of maintenance.

.5 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the City. Uncrate equipment, move in place and install complete; start-up and test.

1.2 Coordination of Work

.1 Cooperate and coordinate with other trades on the project.

.2 Where dimensional details are required, work with the applicable architectural and structural Drawings.

.3 Full size and detailed Drawings shall take precedence over scale measurements from Drawings.

.4 Any areas indicated as space for future materials or equipment shall be left clear.

1.3 Metric Conversion

.1 All units in this division are expressed in SI units.

.2 Submit all Shop Drawings and maintenance manuals in SI units.

.3 On all submittals (Shop Drawings etc.) use the same SI units as stated in the Specification.

.4 Equivalent Nominal Diameters of Pipes - Metric and Imperial:

.1 Where pipes are specified with metric dimensions and Imperial sized pipes are available, supply and install equivalent nominal Imperial sized pipe as indicated in the

table, and supply and install at no extra cost adapters to ensure compatible connections to all metric sized fittings, equipment and piping.

.2 When CSA approved pipes for equipment where nominal SI Metric pipes are provided, the Contractor shall supply and install at no extra cost adapters to ensure compatible connections between the SI Metric pipes and all new and existing pipes, fittings, and equipment.

mm (Inches) (NPS)	mm (Inches) (NPS)	mm (Inches) (NPS)
3 (1/8)	65 (2-1/2)	375 (15)
6 (1/4)	75 (3)	450 (18)
10 (3/8)	100 (4)	500 (20)
15 (1/2)	125 (5)	600 (24)
20 (3/4)	150 (6)	750 (30)
25 (1)	200 (8)	
30 (1-1/4)	250 (10)	
40 (1-1/2)	300 (12)	
50 (2)		

.5 Metric Duct Sizes:

.1 The metric duct sizes are expressed as 25 mm = 1 inch.

1.4 Shop Drawings

.1 Provide printed copies of Shop Drawing, in accordance with E11, for all scheduled equipment and as specified in specific equipment sections of this Specification.

.2 Identify materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Contract Administrator's office. O&M Manuals are not suitable submittal material.

.3 Clearly mark submittal material using arrows, underlining or circling to show differences from specified, e.g. ratings, capacities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps seals materials or painting.

.4 Include weights, dimensional, and technical data sufficient to check if equipment meets requirements. Include wiring, piping, and service connection data and motor sizes. Provide additional information as specified in specific equipment sections of this specification.

.5 Installed materials and equipment shall meet specified requirements regardless of whether or not Shop Drawings are reviewed by the Contract Administrator.

.6 Do not order equipment or material until the Contract Administrator has reviewed and returned Shop Drawings.

.7 Retain one (1) copy of Shop Drawings on-site for review.

1.5 Cutting, Patching and Coring

.1 Provide holes and sleeves, cutting and fitting required for mechanical Work. Relocate improperly located holes and sleeves.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Provide openings and holes required in precast members for mechanical work. Cast holes 100 mm (4 in) or larger in diameter. Field-cut smaller than 100 mm (4 in).

.4 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.

1.6 Equipment Protection and Clean-Up

.1 Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 Protect equipment with polyethylene covers and crates.

.3 Operate, drain and flush out unsealed bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

1.7 Miscellaneous Metals

.1 Supply and install all necessary miscellaneous metals to hang or support materials, equipment and provide access for Work under this Contract.

.2 All miscellaneous metals shall be prime painted for interior applications and galvanized for exterior applications.

1.8 Pipe Sleeves

.1 Minimum thickness: 4.7 mm.

.2 Seep Ring:

.1 Center steel flange for water stoppage on sleeves in exterior or water-bearing walls, 4.7 mm minimum thickness.

.2 Outside Diameter: Unless otherwise shown, 75 mm greater than pipe sleeve outside diameter.

.3 Continuously fillet weld on each side all around.

.4 Factory Finish:

.3 Above Grade in Nonsubmerged Areas: Hot-dip galvanized after fabrication.

.1 Hot-dip applied, meeting requirements of ASTM A153/A153M.

.2 Electroplated zinc or cadmium plating is unacceptable.

.3 As specified in Section 15200-000 – Process Piping.

.4 Below Grade or in Submerged or Damp Environments: Shop-lined and coated.

.1 Lining and coating in accordance with Section 09870 – Coating Systems for Steel Tanks and Pipes.

2. PRODUCTS

.1 Not Applicable.

3. EXECUTION

.1 Not Applicable.

END OF SECTION

PLUMBING PIPING

1. GENERAL

1.1 Scope of Work

.1 The Section covers the requirements for supply and installation of underslab, in-slab and concrete-encased building services piping including drainage piping, sump pump discharge piping, trap primer piping, plumbing vents.

.2 Pipe sleeves for pipe penetrating interior walls and floors.

.3 Some of the drainage, waste and vent piping installed under this Contract will be connected to piping systems installed by others under another contract. Terminate such piping with a flanged end, grooved end or as otherwise shown 300 mm away from the finished concrete floor or wall surface

.4 Terminate trap primer piping 300 mm above finished floor complete with cap for future connection to trap primer valve by others.

1.2 Work by Others

.1 Exposed plumbing piping including water supply, drains, and vents.

.2 Trap primer valves.

.3 Where sleeves pass through walls, the passing piping and fire stopping sealant will be provided by others under another contract.

1.3 References

.1 The following is a list of standards which may be referenced in this Section:

.1 ANSI:

.1 B2.1.001, Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel.

.2 B16.1, Cast Iron Pipe Flanges and Flanged Fittings.

.3 B16.3, Malleable Iron Threaded Fittings.

.4 B16.5, Pipe Flanges and Flanged Fittings.

.5 B16.9, Factory-Made Wrought Steel Buttwelding Fittings.

.6 B16.12, Cast Iron Threaded Drainage Fittings.

.7 B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM:

.1 A47, Standard Specification for Ferritic Malleable Iron Castings.

.2 A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.3 A74, Standard Specification for Cast Iron Soil Pipe and Fittings.

.4 A105/A105M, Standard Specification for Forgings, Carbon Steel, for Piping Components.

.5 A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.6 A181/A181M, Standard Specification for Forgings, Carbon Steel, for General-Purpose Piping.

.7 A197/A197M, Standard Specification for Cupola Malleable Iron.

.8 A234/A234M, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

.9 A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.10 A518/A518M, Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.

.11 A536, Standard Specification for Ductile Iron Castings.

.12 A563, Standard Specification for Carbon and Alloy Steel Nuts.

.13 A861, Standard Specification for High-Silicon Iron Pipe and Fittings.

.14 B32, Standard Specification for Solder Metal.

.15 B61, Standard Specification for Steam or Valve Bronze Castings.

.16 B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.17 B75, Standard Specification for Seamless Copper Tube.

.18 B88, Standard Specification for Seamless Copper Water Tube.

.19 B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

.20 B127, Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.

.21 B139, Standard Specification for Phosphor Bronze Rod, Bar, and Shapes.

.22 B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.

.23 B194, Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar.

.24 B306, Standard Specification for Copper Drainage Tube.

.25 C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.26 D1784, Standard Specification for Rigid PVC Compounds and CPVC Compounds.

.27 D1785, Standard Specification for PVC Plastic Pipe, Schedules 40, 80, and 120.

.28 D2000, Standard Classification System for Rubber Products in Automotive Applications.

.29 D2466, Standard Specification for PVC Plastic Pipe Fittings.

.30 D2564, Standard Specification for Solvent Cements for PVC Plastic Piping Systems.

.31 D2855, Standard Practice for Making Solvent-Cemented Joints with PVC Pipe and Fittings.

.32 E438, Standard Specification for Glasses in Laboratory Apparatus.

.33 F1412, Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.

.3 AWWA:

.1 C104/A21.4, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

.2 C110/A21.10, Ductile-Iron and Gray-Iron Fittings, 75 mm. Through 1200 mm for Water and Other Liquids.

.3 C111/A21.11, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

.4 C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

.5 C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.6 C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.

.7 C207, Standard for Steel Pipe Flanges for Waterworks Service-Sizes 100 mm Through 3,600 mm

.8 C606, Grooved and Shouldered Joints.

.9 C651, Disinfecting Water Mains.

.4 CISPI: 301, Specification for Cast Iron No-Hub Pipe.

.5 Conform with the Plumbing Code and the requirements of Provincial and local authorities having jurisdiction.

1.4 Submittals

.1 Shop Drawings:

.1 Product data sheets.

.2 Drawings showing changes in location of fixtures or equipment that are advisable in the opinion of Contractor.

.2 Quality Control Submittals:

.1 Changes in location of equipment or piping that affect connecting or adjacent Work, before proceeding with the Work.

.2 Complete list of products proposed for installation.

.3 Test records produced during testing.

2. PRODUCTS

2.1 Piping

.1 Piping Schedule: Refer to Section 15200-00S – Piping Schedule**.**

.2 Piping Legend: Refer to Section 15200-00L – Piping Service Legend**.**

.3 Piping Material: Refer to Piping Data Sheets:

.1 Section 15100-01 – Data Sheet – Polyvinyl Chloride Drain Waste and Vent (PVC-DWV) Pipe and Fittings.

.2 Section 15100-02 – Data Sheet-Cast Iron Soil Pipe and Fittings.

.3 Section 15100-03 – Data Sheet – Copper Drainage and Vent Pipe and Fittings.

.4 Section 15100-10 – Data Sheet- Galvanized Steel Drain and Vent Pipe and Fittings.

.5 Section 15200-13 – Data Sheet- Copper and Copper Alloy Pipe, Tubing and Fittings.

3. EXECUTION

3.1 General

.1 Field Obstructions:

.1 Drawings do not attempt to show exact details of piping. Provide offsets around obstructions.

.2 Do not modify structural components, unless approved by Contract Administrator.

.2 Sleeves:

.1 Pipe sizes shown are nominal sizes, unless shown or specified otherwise.

.2 Provide piping passing through walls, floors, or ceilings with standard-weight pipe sleeves.

.3 Concrete Encasement:

.1 Encase in concrete all plumbing piping installed under the building foundations or below the lower floor slab of the building, unless otherwise noted.

3.2 Installation

.1 Steel Pipe:

.1 Ream, clean, and remove burrs and mill scale from piping before making up.

.2 Seal joint with pipe joint sealer of Teflon tape.

.2 Copper Tubing:

.1 Cut tubing square and remove burrs.

.2 Clean both inside of fittings and outside of tubing with steel wool and hydrochloric acid before soldering.

.3 Prevent annealing of fittings and hard-drawn tubing when making connections.

.4 Do not use mitered joints for elbows or notching of straight runs of pipe for tees.

.3 Rigid PVC or CPVC:

.1 Cut, make up, and install in accordance with pipe Manufacturer's recommendations.

.2 Ream, clean, and remove burrs from cut ends before joining pipe.

.3 Lay in trench by snaking pipe from one side to the other.

.4 Offset: as recommended by Manufacturer for maximum temperature variation between time of solvent welding and final use.

.5 Do not lay pipe when temperature is below 4.5°C or above 32°C when exposed to direct sunlight.

.6 Shield ends to be joined from direct sunlight prior to and during laying operation.

.7 Use strap wrenches only for tightening threaded plastic joints. Do not over tighten fittings.

.4 Miscellaneous Piping Specialties: Install in accordance with Manufacturer's recommendations.

3.3 Sanitary Drain, Waste and Vent Piping

.1 Installation:

.1 Set piping occurring above floor slab true and plumb.

.2 Set exposed risers as close to walls as possible.

.3 Where vent stacks pass through roof slab, fit with flashing sleeve secured to roof.

.4 Extend vents minimum 305 mm above roof.

.5 Supply and install cleanouts where shown and where required by code.

3.4 Interim Cleaning

.1 As specified in Section 15200-000 – Process Piping.

3.5 Testing

.1 As specified in Section 15200-000 – Process Piping.

3.6 Cleaning

.1 As specified in Section 15200-000 – Process Piping.

3.7 Protection of Installed Work

.1 Protective Covers:

.1 Provide over floor and shower drains during construction, to prevent damage to drain strainers and keep foreign material from entering drainage system.

.2 Remove at time of Substantial Performance.

END OF SECTION

DATA SHEET – POLYVINYL CHLORIDE DRAIN WASTE AND VENT (PVC-DWV) PIPE AND FITTINGS

Item	Size	Description
Pipe and Fittings	All	PVC-DWV Schedule 40 non-pressure application, Class 12454B conforming to ASTM D2665, ANSI/NSF Standard 14 system, and CSA B181.2.
Joints	All	Solvent cemented conforming to ASTM D2855 except where connection to equipment may require future removal.
Solvent Cement	All	As recommended by the pipe and fitting Manufacturer conforming to ASTM D2564.

END OF SECTION

DATA SHEET – CAST IRON SOIL PIPE (CISP) AND FITTINGS

Item	Size	Description
Pipe	150 mm and smaller	Hubless, CISPI 301, service weight, no-hub ends, CSA B70.
	200 mm and larger	Hub and spigot, ASTM A74, service weight, single hub and spigot, CSA B70.
Joints	150 mm and smaller	Compression: Neoprene sealing sleeve with 24-gauge Type 304 stainless steel shield and clamp assembly.
	200 mm and larger	Rubber gaskets, ASTM C564.
Fittings	All	ASME B16.4; ASME 16.12, CISPI 301, CSA B70.
Coating	All	Bituminous-coated inside and out; marked with Manufacturer's name or trademark and CISPI symbol.

END OF SECTION

DATA SHEET - COPPER DRAINAGE AND VENT PIPE AND FITTINGS

Item	Size	Description
Tubing	75 mm and smaller	Copper drainage tube, DWV type conforming to ASTM B306.
Fittings	75 mm and smaller	Wrought copper or wrought copper alloy solder joint drainage fittings, DWV, conforming to ANSI B16.22.
Solder	All	Wire solder (95% tin), conforming to ASTM B32 Alloy Grade Sn95. Do not use cored solder. Solder joints in accordance with ANSI B16.22.

END OF SECTION

DATA SHEET - GALVANIZED STEEL DRAIN AND VENT PIPE AND FITTINGS

Item	Size	Description
Pipe	100 mm & smaller	Carbon steel, galvanized, furnace butt welded, ASTM A53, Grade F, Schedule 40.
Fittings	100 mm & smaller	Cast iron, galvanized, screwed drainage fittings, ASTM A126, Class B, dimensions conforming to ANSI B16.12. Malleable iron, ductile iron, or galvanized steel grooved end galvanized drainage fittings, materials conforming to ASTM A47, ASTM A536, and ASTM A53, Grade B, respectively, permitted in aboveground roof drainage systems only.
Joints	100 mm & smaller	Screwed threads conforming to ASTM A47; made with Teflon tape or joint compound that is insoluble in water. Grooved end joints are permitted in aboveground roof drainage systems.

END OF SECTION

PROCESS PIPING

1. GENERAL

1.1 Scope

.1 This Section covers the supply, installation, testing, cleaning and placing into operation of all process piping systems including fittings.

1.2 References

.1 The following is a list of standards which may be referenced in this Section and any supplemental Data Sheets:

.1 ANSI:

.1 A21.52, Ductile Iron Pipe, Centrifugally Cast, Gas

.2 B1.20.1, Pipe Threads, General Purpose (Inch)

.3 B16.1, Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

.4 B16.3, Malleable Iron Threaded Fittings

.5 B16.5, Pipe Flanges and Flanged Fittings

.6 B16.9, Factory-Made Wrought Steel Buttwelding Fittings

.7 B16.11, Forged Fittings, Socket-Welding and Threaded

.8 B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250

.9 B16.21, Nonmetallic Flat Gaskets for Pipe Flanges

.10 B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

.11 B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings Class 150, 300, 400, 600, 900, 1500 and 2500

.12 B16.25, Butt Welding Ends

.13 B16.42, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300

.2 ASME:

.1 Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels

.2 Boiler and Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

.3 B31.1, Power Piping

.4 B31.3, Process Piping

.5 B31.9, Building Services Piping

.6 B36.10M, Welded and Seamless Wrought Steel Pipe

.3 ASNT: SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.

.4 ASTM:

.1 A47, Standard Specification for Ferritic Malleable Iron Castings

.2 A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.3 A105/A105M, Standard Specification for Carbon Steel Forgings for Piping Applications

.4 A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

.5 A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

.6 A135, Standard Specification for Electric-Resistance-Welded Steel Pipe

.7 A139, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)

.8 A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

.9 A181/A181M, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping

.10 A182/A182M, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

.11 A183, Standard Specification for Carbon Steel Track Bolts and Nuts

.12 A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

.13 A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service or Both

.14 A197/A197M, Standard Specification for Cupola Malleable Iron

.15 A216/A216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

.16 A234/A234M, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

.17 A240/A240M, Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

.18 A276, Standard Specification for Stainless Steel Bars and Shapes

.19 A283/A283M, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

.20 A285/A285M, Standard Specification for Pressure Vessel Plates, Carbon Steel, Low and Intermediate Tensile Strength

.21 A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

.22 A312/A312M, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes

.23 A320/A320M, Standard Specification for Alloy/Steel Bolting Materials for Low-Temperature Service

.24 A395/A395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures

.25 A403/A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

.26 A409/A409M, Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service

.27 A536, Standard Specification for Ductile Iron Castings

.28 A563, Standard Specification for Carbon and Alloy Steel Nuts

.29 A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry

.30 A774/A774M, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures

.31 A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

.32 B32, Standard Specification for Solder Metal

.33 B43, Standard Specification for Seamless Red Brass Pipe, Standard Sizes

.34 B61, Standard Specification for Steam or Valve Bronze Castings

.35 B62, Standard Specification for Composition Bronze or Ounce Metal Castings

.36 B75, Standard Specification for Seamless Copper Tube

.37 B88, Standard Specification for Seamless Copper Water Tube

.38 B98/B98M, Standard Specification for Copper-Silicone Alloy Rod, Bar and Shapes

.39 C582, Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment

.40 D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

.41 D413, Standard Test Methods for Rubber Property - Adhesion to Flexible Substrate

.42 D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

.43 D1330, Standard Specification for Rubber Sheet Gaskets

.44 D1784, Standard Specification for Rigid PVC Compounds and CPVC Compounds

.45 D1785, Standard Specification for PVC Plastic Pipe, Schedules 40, 80, and 120

.46 D2000, Standard Classification System for Rubber Products in Automotive Applications

.47 D2310, Standard Classification for Machine-Made “Fibreglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

.48 D2464, Standard Specification for Threaded PVC Plastic Pipe Fittings, Schedule 80

.49 D2466, Standard Specification for PVC Plastic Pipe Fittings, Schedule 40

.50 D2467, Standard Specification for PVC Plastic Pipe Fittings, Schedule 80

.51 D2564, Standard Specification for Solvent Cements for PVC Plastic Piping Systems

.52 D2996, Standard Specification for Filament-Wound "Fibreglass" (Glass-Fibre-Reinforced Thermosetting-Resin) Pipe

.53 D3222, Standard Specification for Unmodified Polyvinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials

.54 D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for PE Plastic Pipe and Tubing

.55 D3350, Standard Specification for PE Plastics Pipe and Fittings Materials

.56 D4101, Standard Specification for Propylene Plastic Injection and Extrusion Materials

.57 F714, Standard Specification for PE Plastic Pipe (SDR-PR) Based on Outside Diameter

.5 AWWA:

.1 C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

.2 C110/A21.10, Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches for Water and Other Liquids

.3 C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

.4 C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

.5 C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water

.6 C153/A21.53, Ductile-Iron Compact Fittings 3 Inches through 24 Inches and 54 Inches through 64 Inches, for Water Service

.7 C200, Steel Water Pipe - 6 Inches and Larger

.8 C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inches and Larger - Shop Applied

.9 C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 Inches through 144 Inches

.10 C208, Dimensions for Fabricated Steel Water Pipe Fittings

.11 C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines

.12 C213, Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

.13 C214, Tape Coating Systems for the Exterior of Steel Water Pipelines

.14 C217, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Buried/Submerged Steel Water Pipelines

.15 C606, Grooved and Shouldered Type Joints

.16 M11, Steel Pipe - A Guide for Design and Installation

.6 AWS:

.1 A5.8, Specification for Filler Metals for Brazing and Braze Welding

.2 QC 1, Standard for AWS Certification of Welding Inspectors

.7 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS): SP43, Wrought Stainless Steel Butt-Welding Fittings Including Reference to Other Corrosion Resistant Materials

.8 NFPA: 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances

1.3 Design Requirements

.1 Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

.1 Boiler and Steam Piping: ASME B31.1

.2 Process Piping: ASME B31.3

.3 Building Service Piping: ASME B31.9, as applicable

.4 Natural Gas Piping: CSA B149.1, Natural Gas and Propane Installation Code

.5 Buried Piping: H20-S16 traffic load with 1.5 impact factor, AASHTO Standard Specifications for Highway Bridges, as applicable

.6 Provincial Regulations

1.4 Submittals

.1 Shop Drawings:

.1 Shop Fabricated Piping:

.1 For epoxy coated steel piping, all sizes, and stainless steel piping, sizes 50 mm and larger, provide detailed pipe fabrication or spool drawings showing fittings and bends, dimensions, field weld locations, coatings, hydrotest information and other pertinent information.

.2 Layout Drawings showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.

.2 Hydraulic Thrust Restraint for Restrained Joints: details including materials, sizes, assembly ratings, and pipe attachment methods

.3 Dissimilar Buried Pipe Joints: joint types and assembly Drawings

.2 Quality Control Submittals:

.1 Manufacturer's Certification of Compliance

.2 Laboratory Testing Equipment: certified calibrations, Manufacturer's product data, and test procedures

.3 Certified welding inspection and test results

.4 Qualifications:

.1 Weld Inspection and Testing Agency: Certification and qualifications

.2 Welding Inspector: certification and qualifications

.3 Welders:

.1 List of qualified welders and welding operators

.2 Current test records for qualified welder(s) and weld type(s) for factory and field welding

.5 Weld Procedures: records in accordance with ASME Boiler and Pressure Vessel Code, Section IX for weld type(s) and base metal(s)

.6 Nondestructive inspection and testing procedures

.7 Manufacturer's Certification of Compliance:

.1 Pipe and fittings.

.2 Welding electrodes and filler materials.

.3 Factory applied resins and coatings.

.8 Certified weld inspection and test reports

.9 Test logs

.10 Pipe coating applicator certification

1.5 Qualifications

.1 Independent Inspection and Testing Agency:

.1 Ten (10) years' experience in field of welding and welded pipe and fittings' testing required for this project.

.2 Calibrated instruments and equipment, and documented standard procedures for performing specified testing.

.3 Certified in accordance with ASNT SNT-TC-1A for testing procedures required for this Project.

.4 Testing Personnel: qualified for non-destructive test methods to be performed.

.5 Inspection Services: qualified welding inspector.

.2 Welding Inspector: AWS certified, AWS QC 1 qualified, with prior inspection experience of welds specified.

.3 Welder and Welding Operator Qualifications:

.1 Qualified by accepted inspection and testing agency before starting Work in accordance with Section IX, Article III of the ASME Boiler and Pressure Vessel Code.

.2 Qualified to perform groove welds in Positions 2G and 5G for each welding process and pipe material specified.

.3 Qualification tests may be waived by the Contract Administrator based on evidence of prior qualification.

1.6 Quality Control

.1 Quality Control: Provide services of independent inspection and testing agency for welding operations.

.2 Welding materials, fabrication standards and labour qualifications shall conform to ANSI/ASME B31.1, ANSI/ASME B31.3, ANSI B16.25, ASME Boiler and Pressure Vessel Code, Section 9, CSA W59 and the Provincial Board of Labour Regulations.

.3 Use welders fully qualified and licensed by provincial authorities in accordance with CSA W59.

1.7 Delivery, Storage, and Handling

.1 General:

.1 Flanges: securely attach metal, hardboard, or wood protectors over entire gasket surface.

.2 Threaded or Socket Welding Ends: fit with metal, wood, or plastic plugs or caps.

.3 Linings and Coatings: prevent excessive drying.

.4 Cold Weather Storage: locate Products to prevent coating from freezing to ground.

.5 Handling: use heavy canvas or nylon slings to lift pipe and fittings.

2. PRODUCTS

2.1 Piping

.1 As specified on Piping Data Sheets and Piping Schedule located at the end of this Section as Supplement.

.2 Diameters Shown:

.1 Standardized Products: nominal size.

.2 Fabricated Steel Piping (Except Cement-Lined): outside diameter, ASME B36.10M.

.3 Cement-Lined Steel Pipe: lining inside diameter.

2.2 Joints

.1 Grooved End System:

.1 Rigid, except where joints are used to correct misalignment, to provide flexibility, or where shown, furnish flexible type.

.2 Flanges: when required, furnish with grooved type flange adapters of same Manufacturer as grooved end couplings.

.2 Flanged Joints:

.1 Flat-faced carbon steel or alloy flanges when mating with flat-faced cast or ductile iron flanges.

.2 Higher pressure rated flanges as required to mate with equipment when equipment flange is of higher pressure rating than required for piping.

.3 Threaded Joints: NPT taper pipe threads in accordance with ANSI B1.20.1.

.4 Mechanical Pipe Couplings: Provide Depend-O-Lok pipe couplings where shown on drawings.

.5 Thrust Tie-Rod Assemblies: NFPA 24; tie-rod attachments relying on clamp friction with pipe barrel to restrain thrust are unacceptable.

.6 Mechanical Joint Anchor Gland Follower:

.1 Ductile iron anchor type, wedge action, with break off tightening bolts.

.2 Manufacturer and Product: EBAA Iron Inc.; Megalug.

.7 Flexible Mechanical Compression Joint Coupling:

.1 Stainless steel, ASTM A276, Type 305 bands.

.2 Manufacturers:

.1 Pipeline Products Corp.

.2 Fernco Joint Sealer Co.

.8 Mechanical connections of high density PE pipe to auxiliary equipment such as valves, pumps, tanks, and other piping systems shall be through flanged connections consisting of the following:

.1 A PE stub end thermally butt-fused to end of pipe.

.2 ASTM A240, Type 304 stainless steel backing flange, 863 kPag, ANSI B16.1 standard. Insulating flanges shall be used where shown.

.3 Bolts and nuts of sufficient length to show a minimum of three (3) complete threads when the joint is made and tightened to Manufacturer's standard. Retorque nuts after four (4) hours.

.4 Gaskets as specified on Data Sheet.

2.3 Welding

.1 Welding materials shall be in accordance with CSA W48.

2.4 Gasket Lubricant

.1 Lubricant shall be supplied by pipe manufacturer and no substitute or "or-equal" will be allowed.

2.5 Fabrication

.1 Mark each pipe length on outside:

.1 Size or diameter and class

.2 Manufacturer's identification and pipe serial number

.3 Location number on laying drawing

.4 Date of manufacture

.2 Code markings according to approved Shop Drawings.

.3 Flanged pipe shall be fabricated in the shop, not in the field, and delivered to the Site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by the Manufacturer.

2.6 Finishes

.1 Factory prepare, prime, and finish coat in accordance with Pipe Data Sheet(s), Section 15100-00 – Plumbing Piping and Piping Schedule.

.2 Galvanizing:

.1 Hot-dip applied, meeting requirements of ASTM A153.

.2 Electroplated zinc or cadmium plating is unacceptable.

.3 Yellow Jacket

.1 HDPE jacket extruded over a mastic base.

.2 Manufacture, test, inspect and report procedures to meet or exceed CAN3-Z299.3 (Quality Assurance Program - Category 3).

.3 Prior to mastic application, sandblast pipe in conformance with requirements or SSPC SP6.

.4 Adhesive consists of a rubberized asphalt mastic, non-hygroscopic, formulated for use with Yellow Jacket. Apply to prepared surfaces in thickness exceeding 0.175 mm.

.5 HDPE has the following minimum properties: Ultimate tensile strength, 21 MPa; Tensile elongation at break, 600%; Shore "D" hardness, 60; and Brittleness temperature -50 C.

.6 Apply HDPE by extruding over adhesive in an even thickness to provide a smooth continuous outer sheath, free of pinholes, bubbles, wrinkles, blisters, cracks, or mechanical damage.

.7 Minimum HDPE thickness will be as follows:

Nominal Pipe Diameter (mm)	Minimum HDPE Thickness (mm)
20	0.55
25	0.55
30	0.60
40	0.65
50	0.70
65	0.70
75	0.70
100	0.75
150	0.90
200 and larger	1.00

.8 All flaws (up to 3 per pipe) will be repaired by cutting out each damaged area and applying sealant lined 200 mm diameter patch or heat shrink sleeve not exceeding 400 mm in length. Overlap undamaged area by a minimum of 75 mm around cut out section.

.9 Where the number of flaws or damaged areas per pipe exceeds 3 or any flaw is too large to be repaired with a patch or sleeve, the pipe will be rejected.

.10 Tape Wrap: Shop applied tape wrap may be used as an alternative to Yellow Jacket. Two or three layer methods can be used, meeting or exceeding the application and performance requirements of AWWA C214.

3. EXECUTION

3.1 Examination

.1 Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

.2 Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

.3 Welding Electrodes: verify proper grade and type, free of moisture and dampness, and coating is undamaged.

3.2 Preparation

.1 Notify Contract Administrator at least two (2) weeks prior to field fabrication of pipe or fittings.

.2 Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

.3 Damaged Coatings and Linings: repair using original coating and lining materials in accordance with Manufacturer's instructions.

3.3 Welding

.1 Perform in accordance with Section IX, ASME Boiler and Pressure Vessel Code and ASME B31.1, B31.3 and B31.9 for Pressure Piping, as may be specified on Piping Data Sheets, and if recommended by piping or fitting Manufacturer

.2 Weld Identification: mark each weld with symbol identifying welder

.3 Pipe End Preparation:

.1 Machine Shaping: preferred

.2 Oxygen or Arc Cutting: smooth to touch, true, and slag removal by chipping or grinding

.3 Beveled Ends for Butt Welding: ANSI B16.25

.4 Surfaces:

.1 Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.

.2 Clean stainless steel joints with stainless steel wire brushes or stainless steel wool prior to welding.

.3 Thoroughly clean each layer of deposited weld metal, including final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.

.5 Alignment and Spacing:

.1 Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness.

.2 Root Opening of Joint: as stated in qualified welding procedure.

.3 Minimum Spacing of Circumferential Butt Welds: minimum four times pipe wall thickness or 25 mm, whichever is greater.

.6 Climatic Conditions:

.1 Do not perform welding if there is impingement of any rain, snow, sleet, or high wind on the weld area, or if the ambient temperature is below 0°C.

.2 Stainless Steel and Alloy Piping: If the ambient is less than 0°C, local preheating to a temperature warm to the hand is required.

.7 Tack Welds: performed by qualified welder using same procedure as for completed weld, made with electrode similar or equivalent to electrode to be used for first weld pass, and not defective. Remove those not meeting requirements prior to commencing welding procedures.

.8 Surface Defects: chip or grind out those affecting soundness of weld.

.9 Weld Passes: as required in welding procedure.

.10 Weld Quality: free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity slag inclusions, and other defects in excess of limits shown in applicable piping code.

3.4 Installation-General

.1 Join pipe and fittings in accordance with Manufacturer's instructions, unless otherwise shown or specified.

.2 Remove foreign objects prior to assembly and installation.

.3 Flanged Joints:

.1 Install perpendicular to pipe centerline.

.2 Bolt Holes: straddle vertical centerlines, aligned with connecting equipment flanges or as shown.

.3 Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.

.4 Plastic Flanges: install annular ring filler gasket at joints of raised-face flange.

.5 Raised-Face Flanges: use flat-face flange when joining with flat-faced ductile or cast iron flange.

.6 Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.

.7 Threaded flanged joints must be shop fabricated and delivered to Job Site with flanges in-place and properly faced.

.8 Manufacturer:

.1 Same as pipe Manufacturer.

.2 Victaulic flange adapter.

.4 Threaded and Coupled Joints:

.1 Conform to ANSI B1.20.1.

.2 Produce sufficient thread length to ensure full engagement when screwed home in fittings.

.3 Countersink pipe ends, ream and clean chips and burrs after threading.

.4 Make connections with not more than three threads exposed.

.5 Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.

.5 Grooved-End Joints:

.1 Type: rigid, except where joints are used to correct misalignment, to provide flexibility, and where shown otherwise, in which case provide flexible type.

.6 Soldered Joints:

.1 Use only solder specified for particular service.

.2 Cut pipe ends square and remove fins and burrs.

.3 After thoroughly cleaning pipe and fitting of oil and grease using solvent and emery cloth, apply noncorrosive flux to the male end only.

.4 Wipe excess solder from exterior of joint before hardened.

.5 Before soldering, remove stems and washers from solder joint valves.

.7 PVC and CPVC Piping:

.1 Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.

.2 Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.

.3 Do not thread Schedule 40 pipe.

.8 Fibreglass Reinforced Piping:

.1 Cut, fabricate, and install in accordance with Manufacturer's written instructions.

.2 Provide Manufacturer's representative for instructing workers on proper installation and jointing methods.

.3 Installation shall be made by workers experienced in FRP pipe lay-up techniques.

3.5 Pipe Coatings

.1 Provide internal epoxy coating and lining on piping when indicated on the piping data sheet(s).

.2 Shop apply coating and lining to the greatest extent possible. Touch up coating and linings in the field as required. Minimize the number of field welds and use only where shown on approved shop drawings. Apply coating and lining to field welds and meet the same surface preparation, coating and testing requirements as shop welds.

.3 Before applying coatings and linings to metal piping, grind and round off all sharp edges, maximum radius of edges: 6mm.

.4 All interior epoxy coatings shall conform to NSF Standard 61 – Drinking Water System Components, suitable for use in potable water applications. Coating materials and application shall be in accordance with Section 09870 - Coating Systems for Steel Tanks and Pipes.

.5 Colour of top coat: As selected by Contract Administrator from a set of standard colours which shall include white.

3.6 Tape Wrap

.1 For welded joints on Yellow jacketed pipe and at other indicated locations apply tape to buried pipe and fittings. Use Polyken, Tec-Tape or Denso tape, consisting of primer and tape applied to minimum thickness of 0.90 mm in accordance with AWWA C209.

.2 For flanged or coupled joints and for fittings use petrolatum primer, mastic and tape; Polyken, Tec-Wrap or Denso, in accordance with AWWA C217.

.3 Shrink Sleeve: As an alternative to tape wrap, shrink sleeves are acceptable if material and method of installation is reviewed and accepted by the Engineer prior to use.

3.7 Installation-Exposed Piping

.1 Piping Runs:

.1 Parallel to building or column lines and perpendicular to floor, unless shown otherwise.

.2 Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.

.2 Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

.3 Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

.4 Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other Work.

.5 Piping clearance, unless otherwise shown:

.1 Over Walkway and Stairs: minimum of 2200 mm, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

.2 Between Equipment or Equipment Piping and Adjacent Piping: Minimum 1000 mm, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

.3 From Adjacent Work: minimum 100 mm from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

.4 Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.

.5 Headroom in front of openings, doors, and windows shall not be less than the top of the opening.

.6 Do not install piping containing liquids or liquid vapours in transformer vaults or electrical equipment rooms.

.7 Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical Work.

3.8 Installation-Buried Pipe

.1 Joints:

.1 Dissimilar Buried Pipes: Supply and install flexible mechanical compression joints for pressure pipe.

.2 Concrete Encased or Embedded Pipe: do not encase joints in concrete unless specifically shown.

.2 Placement:

.1 Keep trench dry until pipe laying and joining are completed.

.2 Pipe Base and Pipe Zone: as specified in Division 2**.**

.3 Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.

.4 Measure for grade at pipe invert, not at top of pipe.

.5 Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.

.6 Prevent foreign material from entering pipe during placement.

.7 Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's Work.

.8 Lay pipe upgrade with bell ends pointing in direction of laying.

.9 Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, supply and install:

.1 Shorter pipe lengths.

.2 Special mitered joints.

.3 Standard or special fabricated bends.

.10 After joint has been made, check pipe alignment and grade.

.11 Place sufficient pipe zone material to secure pipe from movement before next joint is installed.

.12 Prevent uplift and floating of pipe prior to backfilling.

.3 PVC, CPVC, or HDPE Pipe Placement:

.1 Lay pipe snaking from one side of trench to other.

.2 Offset: As recommended by Manufacturer for maximum temperature variation between time of solvent welding and during operation.

.3 Do not lay pipe when temperature is below 5°C, or above 32°C when exposed to direct sunlight.

.4 Shield ends to be joined from direct sunlight prior to and during the laying operation.

.4 Tolerances:

.1 Deflection from Horizontal Line, Except PVC, CPVC, or HDPE**:** maximum 2 mm**.**

.2 Deflection From Vertical Grade: maximum 6 mm.

.3 Joint Deflection: maximum of 75% of Manufacturer's recommendation.

.4 Horizontal position of pipe centerline on alignment around curves maximum variation of 500 mm from position shown.

.5 Pipe Cover: minimum 2700 mm, unless otherwise shown.

3.9 Installation – Concrete Encased

.1 Supply and install reinforced concrete pipe encasement where shown on Drawings and where otherwise required. Some piping may be required to be concrete encased for pipe strength requirements that are included in the Specifications. Piping under and within the influence of buildings, utility trenches, vaults, slabs and other structures shall be concrete encased. See details on Drawings for encasement requirements.

.2 Where concrete encased piping crosses structure construction and expansion joints, supply and install flexible piping joints to coincide with structure joints to prevent excessive pipe stress and breakage.

3.10 Thrust Restraint

.1 Location:

.1 Buried Piping: where shown and where required to restrain force developed at pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist due to hydrostatic testing and normal operating pressure.

.2 Exposed Piping: at all joints in piping.

.2 Thrust Ties:

.1 Steel Pipe: attach with fabricated lugs.

.2 Ductile Iron Pipe: attach with socket clamps against a grooved joint coupling or flange.

.3 Flanged Coupling Adapters: for exposed installations, install Manufacturer's anchor studs through the coupling sleeve.

.3 Mechanical Joint Valve Restraint in Proprietary Restrained Joint Piping: install pipe joint Manufacturer's adapter gland follower and pipe end retainer, or thrust tie-rods and socket clamps.

3.11 Pipe Sleeves

.1 Refer to Section 15010 – General Mechanical Provisions.

3.12 Wall Pipes for Slab, Floor, Wall, and Roof Penetrations

.1 Steel or Stainless Steel Wall Pipe:

.1 Same material and thickness as connecting pipe, except 6 mm minimum thickness.

.2 Lining: same as connecting pipe, factory-applied.

.3 Thrust Collar:

.1 Outside Diameter: unless otherwise shown, 75 mm greater than outside diameter of wall pipe.

.2 Continuously fillet welded on each side all around.

.2 Ductile Iron Wall Pipe:

.1 Diameter and Ends: same as connecting ductile iron pipe.

.2 Thickness: equal to or greater than remainder of pipe in line.

.3 Fittings: in accordance with applicable Pipe Data Sheet.

.4 Thrust Collars:

.1 Rated for thrust load developed at 1750 kPa.

.2 Safety Factor: 2, minimum.

.3 Material and Construction: ductile iron or cast iron, cast integral with wall pipe wherever possible, or thrust rated, welded attachment to wall pipe.

.5 Manufacturers:

.1 American Cast Iron Pipe Co.

.2 U.S. Pipe and Foundry Co.

3.13 Branch Connections

.1 Do not install branch connections smaller than 13 mm nominal pipe size, including instrument connections, unless shown otherwise.

.2 When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails up to and including the first block valve in the line carrying the lower pressure, unless otherwise shown.

.3 Threaded Pipe Tap Connections:

.1 Ductile Iron Piping: connect only with service saddle or at a tapping boss of a fitting, valve body, or equipment casting.

.2 Welded Steel or Alloy Piping: connect only with welded thredolet or half-coupling as specified on Piping Data Sheet.

.3 Limitations: threaded taps in pipe barrel are unacceptable.

3.14 Vents and Drains

.1 Vents and drains at high and low points in piping required for completed system may or may not be shown. Install vents on high points and drains on low points of pipelines at all low and high point locations; except for epoxy coated pipe, install vents and drains only where shown.

3.15 Interim Cleaning

.1 Prevent accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping during fabrication and assembly.

.2 Examine piping to assure removal of foreign objects prior to assembly.

.3 Shop cleaning may employ conventional commercial cleaning method if it does not corrode, deform, swell, or otherwise alter physical properties of material being cleaned.

3.16 Testing

.1 General:

.1 Conduct hydraulic pressure and leakage tests on newly installed piping.

.2 Supply and install necessary equipment and material and make taps in pipe, as required. Provide blind flanges as required.

.3 Contract Administrator will monitor the tests. Provide advance notice of start of testing.

.4 Test Pressures: As specified.

.5 Test Records: make records of each piping system installation during the test to document the following:

.1 Date of test

.2 Description and identification of piping tested

.3 Test fluid

.4 Test pressure

.5 Remarks, including:

.1 Leaks (type, location)

.2 Repairs made on leaks

.6 Certification by Contractor and signed acknowledgment by Contract Administrator that tests have been satisfactorily completed.

.2 Testing New Pipe Connected to Existing Pipe: isolate new pipe with grooved end pipe caps, spectacle blinds, or blind flanges.

.3 Concrete Encased Piping: Test piping prior to placement of concrete.

.4 Preparation and Execution:

.1 Buried Pressure Piping:

.1 Conduct final hydrostatic acceptance tests after trench has been completely backfilled.

.2 An initial service leak test may be conducted with a partially backfilled trench and the joints left open for inspection, if field conditions permit, as determined by the Contract Administrator.

.3 Expose joints for the acceptance test on buried pressure piping to be pneumatically tested or subjected to an initial service leak test.

.2 Exposed Piping: Conduct tests after piping has been completely installed including supports, hangers, and anchors, but prior to insulation.

.5 Hydrostatic Leak Tests:

.1 Equipment: Supply and install the following:

Amount	Description
2	Graduated containers
2	Pressure gauges
1	Hydraulic force pump
	Suitable hose and suction pipe as required

.2 Procedure:

.1 Use water as the hydrostatic test fluid.

.2 Provide clean test water of such quality as to minimize corrosion of the materials in the piping system.

.3 Open vents at high points of the piping system to purge air pockets while the piping system is filling.

.4 Venting during the filling of the system may also be provided by loosening flanges with a minimum of four bolts or by the use of equipment vents.

.5 Test piping systems at the test pressure specified in the Piping Schedule.

.6 Maintain hydrostatic test pressure continuously for thirty (30) minutes minimum and for such additional time as necessary to conduct examinations for leakage.

.7 Examine joints and connections for leakage.

.8 The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of weeping or leaking.

.9 Correct visible leakage and retest to satisfaction of the Contract Administrator.

.3 Buried Water Lines:

.1 A limited amount of leakage is permissible according to the formula specified.

.2 Cement-Mortar Lined Piping: Slowly fill test section with water and allow to stand for twenty four (24) hours under slight pressure to allow cement-mortar lining to absorb water.

.3 Expel air from piping system prior to testing.

.4 Apply and maintain specified test pressure with hydraulic force pump.

.5 Valve off the piping system when test pressure is reached.

.6 Conduct pressure test for two (2) hours, reopening isolation valve only as necessary to restore test pressure.

.7 Accurately measure amount of water required to maintain test pressure by placing pump suction in a barrel or similar device, or by metering.

.8 The measurement represents leakage, defined as the quantity of water necessary to maintain the specified test pressure for the duration of the test period.

.9 Determine maximum allowable leakage in litres per hour from the following formula:

$$L_m = \frac{S\,D\sqrt{P}}{715{,}317}$$

Where:

L_m	=	Testing Allowance (makeup water), in litres per hour
S	=	Length of pipe tested, in metres
D	=	Nominal diameter of pipe, in millimetres
P	=	Average test pressure during the hydrostatic test, in kPa

These formulas are based on a testing allowance of 1.079 L/d/km/mm of nominal diameter at a pressure of 1,034 kPa.

.10 Correct leakage greater than the allowable determined under this formula, and retest to satisfaction of Contract Administrator.

.4 Test Pressure for Water: one and a half ($1^1/_2$) times system pressure.

.5 Gravity Sewers and Drains:

.1 Test by water or air exfiltration tests as prescribed by local or state plumbing codes and visually examine for leaks.

.2 Repair leaks and retest system until no further leakage is evident.

.6 Pneumatic Leak Tests:

.1 Perform on compressed air, natural gas, and vacuum piping.

.2 Equipment: Supply and install the following:

Amount	Description
1	Pneumatic compressor separator-dryer system capable of providing oil-free dry air and equipped with one or more full capacity safety relief valves set at a pressure of not more than 105% of the required primary test pressure
1	Calibrated test gauge

.3 Procedure:

.1 Perform pneumatic testing using accurately calibrated instruments and oil-free, dry air.

.2 Perform tests only on exposed piping, after piping has been completely installed, including supports, hangers and anchors, and inspected for proper installation.

.3 Test piping system at the test pressure specified in the Piping Schedule.

.4 Take necessary precautions to protect personnel from hazards associated with air testing.

.5 Secure piping to be tested to prevent damage to adjacent piping and equipment in event of a joint failure.

.6 Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by test.

.7 Apply maximum 172 kPa preliminary pneumatic test to piping system prior to final leak testing, to locate major leaks.

.8 Examine joints and connections for leakage with soap bubbles.

.9 Correct visible leaks and retest to satisfaction of the Contract Administrator.

.10 Gradually increase pressure in the system to not more than one-half of test pressure.

.11 Thereafter increase pressure in steps of approximately one tenth ($^1/_{10}$) of maximum test pressure until required test pressure is reached.

.12 Maintain pneumatic test pressure continuously for minimum ten (10) minutes and for such additional time as necessary to conduct a soap bubble examination for leakage.

.13 The piping system, exclusive of possible localized instances at pump or valve packing, shall show no evidence of leakage.

.14 Correct visible leakage retest to satisfaction of the Contract Administrator.

.15 Following pneumatic testing, thoroughly purge, with nitrogen, lines that are to carry flammable gases to assure no explosive mixtures will be present in the system during the filling process.

3.17 Cleaning

.1 Following assembly and testing, and prior to final acceptance, flush piping with water, (except as stated below), and remove accumulated construction debris and other foreign matter.

.2 Minimum Flushing Velocity: 0.8 m per second.

.3 Blow clean of loose debris plant process air, natural gas, and instrument air-lines with compressed air; do not flush with water.

.4 Remove accumulated debris through drains 50 mm and larger or by removing spools and valves from piping.

.5 Clean all oxygen and ozone piping, including vents and drains, in accordance with Compressed Gas Association Pamphlet 4.1.

3.18 Field Finishing

.1 Notify Contract Administrator at least three (3) days prior to start of any surface preparation or coating application work.

.2 As specified in Section 09870 - Coating Systems for Steel Tanks and Pipes**.**

.3 Repair any damage to coating and lining on embedded pipes and sleeves.

3.19 Pipe Identification

.1 Refer to Section 15010 – General Mechanical Provisions.

3.20 Field Quality Control

.1 Pressure test piping for leakage. Refer to Piping Schedule for test pressures and test media.

.2 Minimum Duties of Welding Inspector:

.1 Job material verification and storage.

.2 Qualification of welders.

.3 Certify conformance with approved welding procedures.

.4 Maintenance of records and preparation of reports in a timely manner.

.5 Notification to Contract Administrator of unsatisfactory weld performance within twenty four (24) hours of weld test failure.

.3 Required Weld Examinations:

.1 Perform examinations in accordance with Piping Code**:** ASME B31.3. 10% of the circumferential butt welds shall be random radiographed. For concrete encased steel pipes and pipes under foundations, provide radiographic examination of 50% of welds as selected by the Contract Administrator.

.2 Perform examinations for every pipe thickness and for each welding procedure, progressively, for all piping covered by this section.

.3 Examine at least one (1) of each type and position of weld made by each welder or welding operator.

.4 For each weld found to be defective under the acceptance standards or limitations on imperfections contained in the applicable Piping Code, examine two additional welds made by the same welder that produced the defective weld. Such additional examinations are in addition to the minimum required above. Examine, progressively, two (2) additional welds for each tracer examination found to be unsatisfactory.

3.21 Supplements

.1 Piping Schedule – 15200-00S.

.2 Data Sheets.

Number	Title
-03	Carbon Steel Pipe and Fittings-General Service
-04	Carbon Steel Pipe and Fittings-Large Diameter

PROCESS PIPING

Number	Title
-07	Galvanized Steel Pipe and Fittings – General Service
-09	Stainless Steel Pipe and Fittings-Special Service 1
-10	Polyvinyl Chloride (PVC) Pipe and Fittings
-12	Fibreglass Reinforced Plastic (FRP) Pipe and Fittings
-13	Copper and Copper Alloy Pipe, Tubing, and Fittings
-19	Stainless Steel Pipe and Fittings-Special Service 2
-20	Stainless Steel Pipe and Fittings-Special Service 3

END OF SECTION

PIPING SERVICE LEGEND

SERVICE	
AA	Aqua Ammonia
AS	Air Scour
BWS	Backwash Supply
BWW	Backwash Wastewater
CA	Compressed Air
CHS	Chilled Water Supply
CRW	Clarified Raw Water
CS	Caustic (Sodium Hydroxide)
CWR	Cooling Water Return
CWS	Cooling Water Supply
DF	DAF Float
DRA	Drainage (Floors)
DRN	Drains (Clean Drains)
FC	Ferric Chloride
FIN	Filter Influent
FIR	Fire Protection
FTR	Filter To Recycle
FW	Filtered Water
GOX	Gaseous Oxygen
HP	Hydrogen Peroxide
HYP	0.8% Hypochlorite Solution
LT	Level Transmitter Sleeve Embed
OF	Overflow
OZG	Ozone Off Gas
OZO	Ozonated Oxygen
PLD	Dry Polymer
PLS	Polymer Solution
PSW	Plant Service Water
PW	Potable Water

PIPING SERVICE LEGEND

RW	Raw Water
SAM	Sample
SAN	Sanitary Waste
SBS	Sodium Bisulphite
SCA	Sulphuric Acid
SDR	Saturated Recycle Water
SLU	Sludge
SST	Supernatant
SWD	Stormwater Drainage
TP	Trap Primer
VTA	Vent Air

EXPOSURE

BUR	Buried
EXP	Exposed
SUB	Submerged
ENC	Concrete Encased

MATERIAL

CISP	Cast Iron Soil Pipe
CLDI	Cement-Lined Ductile Iron
CMP	Corrugated Metal Pipe
COP	Copper
CPVC	Chlorinated PVC
DI	Ductile Iron
FRP-X	Fiberglass Reinforced Plastic Pipe (X = 1 to 6)
GLDI	Glass-Lined Ductile Iron
GSP	Galvanized Steel Pipe
HDPE	High Density Polyethylene
PCCP	Prestressed Concrete Cylinder Pipe

PIPING SERVICE LEGEND

PSTL	PVDF-Lined Steel
PVC	Polyvinyl Chloride
PVDF	Polyvinylidene Fluoride
RCP	Reinforced Concrete Pipe
RSTL	Rubber-Lined Steel
SST	Stainless Steel
STL	Steel
VC	Vitrified Clay Pipe

PRESSURE TEST

H	Hydrostatic
I	In Service
P	Pneumatic
NA	Not Applicable

END OF SECTION

Service	Commodity Abbreviation	Nominal Size(s) (mm)	Exposure[2]	Piping Material[2]	Specification Section	Test Type and Pressure (kPa)[1]	Remarks
DAF AREA							
Compressed Air	CA	32	EXP	COP	15200-13	P, 1035	
Clarified Raw Water	CRW	150, 250, 400	EXP	SST	15200-09	H, 345	DAF Recycle lines
Clarified Raw Water	CRW	350	Embed	Epoxy coated/lined steel	15200-03	H, 100	DAF laterals
DAF Float	DF	75,100	EXP	FRP-1	15200-12	H, 200	
DAF Float	DF	100, 300	Embed	FRP-1	15200-12	H, 100	
DAF Float	DF	300	SUB	FRP-1	15200-12	H, 100	
Process Waste Drainage	DRN	100	EXP	PVC	15200-10	H, 100	In DAF Pump Gallery
Process Waste Drainage	DRN	100	ENC	PVC	15200-10	H, 100	From mud valves to DAF Pump Gallery
Process Waste Drainage	DRN	100	Embed	Epoxy coated/lined steel	15200-03	H, 100	Transition through wall from under DAF tanks into DAF Pump Gallery
Process Sump Pump	DRN	100, 300, 400	EXP, Conc Encased	Epoxy coated/lined steel	15200-03	H, 100	
Ferric Chloride	FC	50	EXP	PVC	15200-10	H, 1050	
Raw Water	RW	300, 450, 600, 1050, 1200, 1350	EXP	Epoxy coated/lined steel	15200-03, 15200-04	H, 345	
Sample	SAM	25	EXP	PVC	15200-10	H, 100	Sample lines to analyzers
Sulfuric Acid	SCA	50	EXP	SST	15200-09	H, 1050	
Saturated Recycle Water	SDR	150, 250, 300, 450	EXP	SST	15200-09	H, 1500	Sections of the 150 and 250 are being supplied by Leopold (316 SS)
OZONE AREA							
Closed Loop Cooling Water Return	CWR	19, 38, 75, 100	EXP	SST	15200-09	H, 800	
Closed Loop Cooling Water Supply	CWS	38, 75, 100	EXP	SST	15200-09	H, 800	
Ozone Contactor Process Drain	DRN	6, 12, 50, 200	EXP	SST	15200-09	H, 800	
Gaseous Oxygen	GOX	19, 50, 75, 100	EXP	SST	15200-09	P, 800	
Hydrogen Peroxide	HP	25	EXP	SST	15200-09	H, 800	
Ozone Gas	OZG	6, 50, 64, 75, 100	EXP	SST	15200-09	P, 850	
Ozonated Oxygen	OZO	50, 75	EXP	SST	15200-09	P, 850	
Polymer	PLS	25	EXP	PVC	15200-10	H, 800	
Sodium Bisulphite	SBS	25	EXP	SST	15200-10	H, 800	
Vent	VTA	19, 50, 100, 150, 200	EXP	SST	15200-09	P, 500	
FILTRATION AREA							
Air Scour Supply	AS	300	EXP / SUB	SST	15200-09	H, 350	Test with piping / tanks
Backwash Supply	BWS	600, 750, 900	EXP/ Concrete ENC / SUB	Epoxy coated/lined steel	15200-04	H, 350	Test prior to concrete encasement with blind flanges. Test connections with piping / tanks

Service	Commodity Abbreviation	Nominal Size(s) (mm)	Exposure[2]	Piping Material[2]	Specification Section	Test Type and Pressure (kPa)[1]	Remarks
FILTRATION AREA							
Backwash Waste Water	BWW	900	SUB	Epoxy coated/lined steel	15200-04	H, 170	Test with piping / tanks
Cooling Water Supply	CWS	100, 150	EXP	SST	15200-09	H, 170	Test with piping / tanks
Chilled Water Supply	CHS	100, 150	EXP	SST	15200-09	H, 170	Test with piping / tanks
Drain for Process water	DRN	25, 50, 75, 100, 150, 200	EXP / Concrete ENC	SST	15200-09	H, 170	Test with piping / tanks
Filter Media Eductor System	FED	100	EXP	SST	15200-09	H, 170	Test with piping / tanks
Filter Media Eductor System	FED	200	EXP	SST	15200-09	H, 170	Test with piping / tanks. Provide STEEL BLIND FLANGES with SST bolts/nuts.
Filter Influent	FIN	12, 25, 50,75,100	EXP	SST	15200-09	H, 170	Test with piping / tanks
Filter Influent	FIN	900	SUB	Epoxy coated/lined steel	15200-04	H, 170	Test with piping / tanks
Filter to Recycle	FTR	600, 750	EXP	Epoxy coated/lined steel	15200-04	H, 170	Test with piping / tanks
Filtered Water	FW	12, 25, 50,75,100	EXP	SST	15200-09	H, 170	Test with piping / tanks
Filtered Water	FW	600, 900	EXP	Epoxy coated/lined steel	15200-04	H, 170	Test with piping / tanks
Filtered Water	FW	1350	Concrete ENC /EXP	Epoxy coated/lined steel	15200-04	H, 170	Test prior to concrete encasement with blind flanges. Test connections with piping / tanks
Filtered Water	FW	2100	BURIED / SUB	Epoxy coated/lined steel	15200-04	H, 170	Test with piping / tanks. For Future connections, buried outside building, sealed with Denso tape. PROVIDE STEEL BLIND FLANGES (2) with SST bolts/nuts.
Level Transmitter Sleeve	LT	100	EXP	SST	15200-09	H, 170	Test with piping / tanks
Manway	MANWAY	900	EXP	Epoxy coated/lined steel	15200-04	H, 170	Test with piping / tanks. PROVIDE STEEL BLIND FLANGES (12) with SST bolts/nuts, and davits as per Detail 1 WB-M9454.
Manway	MANWAY	1200	EXP	Epoxy coated/lined steel	15200-04	H, 170	Test with piping / tanks. PROVIDE STEEL BLIND FLANGES (2) with SST bolts/nuts, as per Detail 5 WB-M9454.
Overflow	OF	150,400	EXP	Epoxy coated/lined steel	15200-03	H, 170	Test with piping / tanks
Overflow	OF	600	EXP	Epoxy coated/lined steel	15200-04	H, 170	Test with piping / tanks
Overflow	OF	600	SUB	SST	15200-09	H, 170	Test with piping / tanks
Pressure Transmitter Tube/Sleeve	PT	12, 25, 50	EXP	SST	15200-09	H, 170	Test with piping / tanks
Sample	SAM	12,25	EXP	SST	15200-09	H, 170	Test with piping / tanks
Vent Air	VTA	12, 25, 50, 75, 100, 150, 200, 300	EXP	SST	15200-09	H, 170	Test with piping / tanks

Service	Commodity Abbreviation	Nominal Size(s) (mm)	Exposure[2]	Piping Material[2]	Specification Section	Test Type and Pressure (kPa)[1]	Remarks
RESIDUAL AREA							
DAF Float	DF	200	EXP	FRP1	15200-12	H,100	
Ozone Contactor Process Drain	DRN	150	EXP	SST	15200-09	H, 800	
Surge Relief Discharge	DRN	100	EXP	Epoxy coated/lined steel	15100-03	P,800	
Surge Relief Discharge	DRN	300	EXP	Epoxy coated liner	15200-03	H,800	
Pilot Plant Effluent	DRN	250	EXP	Epoxy coated/lined steel	15200-03	H,100	Complete pipe within the weir wall and 239.41 slab
Backwash Supply Tank Overflow	OF	600	SUB	SST	15200-09	H,170	Backwash tank O/F within the WRT area.
TSET Overflow	OF	200	SUB	Epoxy coated/lined steel	15200-03	H,200	
Flocculation Chamber	OF	200	SUB	Epoxy coated/lined steel	15200-03	H,200	Flocculated sludge chamber overflow to gravity thickener.
Polymer Feed Pipe	PLS	25	EXP	PVC	15200-10	H, 800	
Thickener Floc Tank Overflow	SLU	200	SUB/ EXP	Epoxy coated/lined steel	15200-03	H,100	One penetration is immersed other two could be exposed or immersed
Thickener Floc Tank Discharge	SLU	200	EXP	Epoxy coated/lined steel	15200-03	H,100	Flocculated sludge feed to gravity thickeners
Thickener Sludge Extraction	SLU	200	Concrete ENC	Epoxy coated/lined steel	15200-03	H,200	Concrete-encased. Refer to enc.
Thickened Sludge Individual Discharge	SLU	100	EXP	Epoxy coated/lined steel	15200-03	H,200	
Thickened Sludge Discharge Header	SLU	150	EXP/ Concrete ENC	Epoxy coated/lined steel	15200-03	H,200	Embed under DAF galery to 1m beyond electrical room slab.
TSET Intercell Isolation	SLU	300	SUB	Epoxy coated/lined steel	15200-03	H,200	TSET Tank1 and 2 wall
Washwater Recovery Tank (WRT) Sludge Extraction	SLU	200	EXP	Epoxy coated/lined steel	15200-03	H,100	WRT sludge discharge pipe to flocculation tank
Gravity Thickener Supernatant Discharge	SUP	200	EXP/ Concrete ENC	Epoxy coated/lined steel	15200-03	H,100	
Washwater Tank Supernatant (Decant)	SUP	750	SUB	Epoxy coated/lined steel	15200-04	H,800	Within WRTs' walls and supernatant pump station wall.
Supernatant Discharge Pipe	SUP	750	EXP/ Concrete ENC	Epoxy coated/lined steel	15200-04	H, 800	Embed under DAF gallery to 1m beyond electrical room slab.

Service	Commodity Abbreviation	Nominal Size(s) (mm)	Exposure[2]	Piping Material[2]	Specification Section	Test Type and Pressure (kPa)[1]	Remarks
CHEMICAL AREA							
Dry Polymer	PLD	50	Exposed	SST	15200-20	P, 250	
Hydrogen Peroxide - Vent	VTA	25, 150	Exposed	SST	15200-19	N/A	
Sodium Bisulphite - Vent	VTA	25, 150	Exposed	SST	15200-09	N/A	
Polymer - Vent	VTA	25, 100	Exposed	PVC	15200-10	N/A	
BUILDING SERVICES							
Sanitary Drain	DRA	All	EXP/ ENC	CI	15100-02	N/A	Test per requirement of Plumbing Code
Sump Pump Discharge	DRA	75 and smaller	EXP/ BUR	GSP	15200-07	H, 300	
Sump Pump Discharge	DRA	100 and larger	EXP/ BUR	Epoxy coated/lined steel	15200-03	H, 500	Sanitary lift station
Sump Pump Discharge	DRN	75 and smaller	EXP/ BUR	GSP	15200-07	H, 300	
Sump Pump Discharge	DRN	100 and larger	EXP/ BUR	Epoxy coated/lined steel	15200-03	H, 500	Sanitary lift station
Fire Pump Suction	FIR	450	EXP/ BUR	Epoxy coated/lined steel	15200-03	H, 1550	
Fire Water Header to Outside Hydrants	FIR	250	EXP/ BUR	Epoxy coated/lined steel	15200-03	H, 1550	
Plant Service Water (non-potable)	PSW	75 and smaller	EXP	COP	15200-13	H, 1000	
Plant Service Water (non-potable)	PSW	100 and larger	EXP	Epoxy coated/lined steel	15200-03	H, 1345	
Potable Water	PW	150, 200	ENC	Epoxy coated/lined steel	15200-03	H, 1345	
Sanitary Waste	SAN	All	EXP/ ENC	CI	15100-02	N/A	Test per requirement of Plumbing Code
Stormwater Drain	SWD	All	EXP	CI	15100-02	N/A	Test per requirement of Plumbing Code
Trap Primer	TP	All	EXP/ BUR	COP	15200-13	H, 1000	Test per requirement of Plumbing Code
Vent (Sanitary)	VTA	75 and smaller	EXP/ BUR	COP	15100-01	N/A	Test per requirement of Plumbing Code
Vent (Sanitary)	VTA	100 and larger	EXP/ BUR	CI	15100-02	N/A	Test per requirement of Plumbing Code

Notes
1) H-Hydraulic; P-Pneumatic
2) For pipe material and service exposure abbreviations, refer to Section 15200-00L.
3) Buried natural gas pipes shall be wrapped with corrosion protection material in accordance with Canadian Gas Code.

DATA SHEET – CARBON STEEL PIPE AND FITTINGS-GENERAL SERVICE

Item	Size	Description
Pipe	550 mm and smaller	Black carbon steel, ASTM A106, Grade B seamless or ASTM A53, Grade B, seamless or ERW. Threaded, butt-welded, grooved end, and flanged joints:
	Screwed:	
	50 mm & smaller	Schedule 80.
	Welded and Grooved:	
	50 mm thru 250 mm	Schedule 40.
	300 mm thru 400 mm	Schedule 30.
	450 mm thru 550 mm	Standard weight (9.5 mm min. wall thickness).
Linings (Note 2)	All	Shop-Applied Liquid Epoxy Lining: Apply in strict accordance with manufacturer's instructions and requirements of AWWA C210 and Section 09870, including surface cleaning and preparation. For pipe interior, follow System 1, as specified in Section 09870.
Coatings	All	For exposed piping, follow System 5, as specified in Section 09870.
	All	For immersed piping, follow System 1, as specified in Section 09870.
	All	For buried piping, apply coating in accordance with AWWA C214 consisting of at least four layers: 1. Primer layer. 2. Inner Layer Tape: Corrosion-protective tape, 0.5mm (20 mils), with black exterior. 3. Outer Layer Tape: Mechanical protective tape, 0.78mm (30 mils), with gray exterior. 4. Outer Layer Tape: Mechanical protective tape, 0.76mm (30 mils), with white exterior. Total tape thickness minimum 2.0mm (80 mils). Hold back minimum of 60mm from end of pipe for welded joints.
	All	For concrete encased piping, tape wrap as specified above for buried piping; or alternatively, follow System 5, as specified in Section 09870.
Joints	40 mm & smaller	Threaded or flanged at valves and equipment or grooved end meeting the requirements of AWWA C606. See Note 1.
	50 mm & larger	Butt-welded or flanged at valves and equipment, or grooved end meeting the requirements of AWWA C606.
Fittings	40 mm & smaller	Threaded: 680- or 2070 kPag malleable iron, ASTM A197 or

DATA SHEET – CARBON STEEL PIPE AND FITTINGS-GENERAL SERVICE

Item	Size	Description
	50 mm & larger	ASTM A47, dimensions in accordance with ANSI B16.3. Grooved End: Malleable iron ASTM A47 or ductile iron ASTM A536, grooved ends to accept couplings without field preparation, EPDM elastomers for potable water service, rigid style coupling or as otherwise noted. Victaulic; Grinnell. Butt Welded: Wrought carbon steel butt- welding, ASTM A234/A234M, Grade WPB meeting the requirements of ANSI B16.9; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise. Grooved End: Malleable iron ASTM A47 or ductile iron ASTM A536, grooved ends to accept couplings without field preparation, EPDM elastomers for potable water service, rigid style coupling or as otherwise noted. Victaulic; Grinnell. Victaulic Depend-O-Lok, AWWA C221, EPDM elastomer, epoxy coated steel or 316 stainless steel wetted parts, restrained or non-restrained coupling as indicated on Drawings.
Branch Connections	40 mm & smaller	Threaded, straight, or reducing tees in conformance with Fittings specified above. See Note 1.
	50 mm & larger	Butt-welding or grooved end tee in conformance with Fittings specified above.
Flanges	40 mm & smaller	Forged carbon steel, ASTM A105/A105M, Grade II, ANSI B16.5 Class 150 socket-weld or threaded, 1.5 mm raised face.
	50 mm & larger	Butt-Welded Systems: Forged carbon steel, ASTM A105/A105M or AWWA C207 Class D, ANSI B16.5 Class 150 slip-on or welding neck, 1.5 mm raised face; weld neck bore to match pipe internal diameter. Use weld neck flanges when abutting butt-weld fittings. As an alternative, flanges may be AWWA C207, Class D slip-on with serrated finish. Supply and install flat-faced flanges when mating with flat-faced valves and fittings. Grooved End Adapter Flange: Malleable iron ASTM A47 or ductile iron ASTM A536. Victaulic; Grinnell.
Blind Flanges	All	Steel, AWWA C207, thickness to suit Class D unless otherwise noted.
Unions	40 mm & smaller	Threaded malleable iron, ASTM A197 or A47, 1035- or 2070 kPag WOG, meeting the requirements of ANSI B16.3.
Couplings	50 mm & larger	Grooved End: Rigid joint malleable iron, ASTM A47 or ductile iron, ASTM A536. Victaulic; Grinnell. Screwed End: Malleable iron, ASTM A197 or A47. See Note 1.
Bolting	Exposed piping	Flanges: Carbon steel ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts. Use 3mm undersize bolting material for insulating flanges.

DATA SHEET – CARBON STEEL PIPE AND FITTINGS-GENERAL SERVICE

Item	Size	Description
		Grooved End Couplings: Carbon steel, ASTM A183 bolts and nuts, 760 MPa minimum tensile strength.
	Submerged and underground	General Conditions: Type 316, ASTM A193/A193M, Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts.
Gaskets	50 mm thru 250 mm	Black neoprene, 2 mm thick, ring type for RF flanges, full face for flat face flanges.
	300 mm and larger	Black neoprene, 3.2 mm thick, ring type for RF flanges, full face for flat face flanges.
		Grooved Couplings: EPDM per ASTM D2000 for water and air to 110°C.
Thread Lubricant	40 mm & smaller	General Service: Teflon tape.

Notes:
1. Do not use threaded connections on epoxy coated pipe. For small tappings such as vents, drains and gauge connections, supply and install a 50mm flanged nozzle with a coated blind flange tapped to the size of the required connection.
2. Pipe epoxy lining is required only where indicated on the Piping Schedule 15200-00S.

END OF SECTION

DATA SHEET – CARBON STEEL PIPE AND FITTINGS – LARGE DIAMETER

Item	Size	Description
Pipe	All	Manufactured in accordance with AWWA C200, except as herein modified.
		Fabricated from carbon steel sheet ASTM A1011 (Grades 30, 33, 36 or 40), A907 (Grade 36), or from plate ASTM A36, A283 (Grades C or D), or coil ASTM A139 (Grades B or C).
		Maximum carbon content of 0.25 percent.
		Minimum elongation of 22 percent in a 50.4mm gauge length.
		Longitudinal and girth seams, whether straight or spiral, shall be butt welded using an approved electric-fusion-weld process.
	Welded and grooved:	
	600 mm	610 mm outside dia., 9.5 mm min. wall thickness
	900 mm	914 mm outside dia., 9.5 mm min. wall thickness
	1050 mm	1067 mm outside dia., 9.5 mm min. wall thickness
	1200 mm	1219 mm outside dia., 9.5 mm min. wall thickness
	1350 mm	1372 mm outside dia., 9.5 mm min. wall thickness
	1500 mm	1543 mm outside dia., 9.5 mm min. wall thickness
	1800 mm	1854 mm outside dia., 12.7 mm min. wall thickness
	2100 mm	2162 mm outside dia., 14.3 mm min. wall thickness
Linings	All	Shop-Applied Liquid Epoxy Lining: Apply in strict accordance with manufacturer's instructions and requirements of AWWA C210 and Section 09870, including surface cleaning and preparation.
		For pipe interior, follow System 1, as specified in Section 09870.
Coatings	All	For exposed piping, follow System 5, as specified in Section 09870.
	All	For immersed piping, follow System 1, as specified in Section 09870.
	All	For buried piping, apply coating in accordance with AWWA C214 consisting of at least four layers: 1. Primer layer. 2. Inner Layer Tape: Corrosion-protective tape, 0.5mm (20 mils), with black exterior. 3. Outer Layer Tape: Mechanical protective tape, 0.78mm (30 mils), with gray exterior.

DATA SHEET – CARBON STEEL PIPE AND FITTINGS – LARGE DIAMETER

Item	Size	Description
		4. Outer Layer Tape: Mechanical protective tape, 0.76mm (30 mils), with white exterior. Total tape thickness minimum 2.0mm (80 mils). Hold back minimum of 60mm from end of pipe for welded joints.
	All	For concrete encased piping, tape wrap as specified above for buried piping; or alternatively, follow System 5, as specified in Section 09870.
Joints	All	Exposed: Flanged, butt-welded or restrained flexible coupling. Where shown, provide grooved end meeting the requirements of AWWA C606. Buried or Concrete Encased: Field-welded butt strap or lap welded; AWWA C200, suitable for at least 700 kPa service and, regardless of type, shall be designed to be self-centering. Both bell and spigot ends shall be sized to provide a difference in circumferential measurement between the outside circumference of the spigot and the inside circumference of the bell of not less than 2.3mm and not more than 12.4mm.
Fittings	600 mm to 2100 mm	Fabricated: Carbon steel fabricated from pipe in accordance with AWWA C208; suitable for butt welding, elbows to have a 22.5-degree maximum mitre section angle, minimum of three sections; wyes, tees, crosses, and outlets to be reinforced in accordance with AWWA M11. Formed Fittings: Wrought carbon steel butt-welding type, ASTM A234/A234M, Grade WPB meeting the requirements of ANSI B16.9; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise. Grooved End: Malleable iron ASTM A47 or ductile iron ASTM A536, grooved ends to accept couplings without field preparation, EPDM elastomers for potable water service, rigid style coupling or as otherwise noted. Victaulic Style 44; Grinnell. Supply and install Type “D” Vic-ring. Coupling and “D” Vic-Ring shall be supplied by the manufacturer as a package. Victaulic Depend-O-Lok, AWWA C221, EPDM elastomer, epoxy coated steel or 316 stainless steel wetted parts, restrained or non-restrained coupling as indicated on Drawings.

DATA SHEET – CARBON STEEL PIPE AND FITTINGS – LARGE DIAMETER

Item	Size	Description
Flanges	600 mm to 2100 mm	Steel, AWWA C207, Class D, ANSI B16.5, Class 150, slip-on, flat faced, serrated finish. Cast Iron Mating Flange: AWWA C207, Class D, hub type, flat faced, ANSI B16.1, Class 150 drilling.
Blind Flanges	All	Steel, AWWA C207, thickness to suit Class D unless otherwise noted.
Bolting	Exposed piping	Flanges: Carbon steel ASTM A307, Grade B threaded studs, and ASTM A563, Grade A hex head nuts. Use 3mm undersize bolting material for insulating flanges. Grooved End Couplings: Carbon steel, ASTM A183 bolts and nuts, 760 MPa minimum tensile strength.
	Submerged and underground piping	General Conditions: Type 316, ASTM A193/A193M, Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts.
Gaskets	All flanges	Water Service: 3.2 mm thick, black neoprene, full face type. Grooved Couplings: EPDM per ASTM D2000 for water and air to 110°C.

Notes:
1. For piping 550 mm and smaller follow Specification 15200-03.
2. Do not use threaded connections on epoxy coated pipe. For small tappings such as vents, drains and gauge connections, supply and install a 50mm flanged nozzle with a coated blind flange tapped to the size of the required connection.
3. Design and install pipe in accordance with AWWA M11, Steel Pipe - A Guide for Design and Installation.

END OF SECTION

DATA SHEET – GALVANIZED STEEL PIPE AND FITTINGS-GENERAL SERVICE

Item	Size	Description
Pipe	All	Galvanized carbon steel, ASTM A106, Grade B seamless or ASTM A53, Grade B seamless or ERW.
	50 mm & smaller	Schedule 80.
	60 mm to 150 mm	Schedule 40.
	200 mm to 300 mm	Schedule 30.
	350 mm	Standard weight.
Joints	50mm & smaller	Threaded or flanged at valves and equipment, or grooved end meeting requirements of AWWA C606.
	60 mm & larger	Flanged at valves and equipment, or grooved end meeting requirements of AWWA C606.
Fittings		Threaded: 1035- or 2070 kPag malleable iron, ASTM A197 or ASTM A47, dimensions in accordance with ANSI B16.3. Grooved End: Malleable iron ASTM A47 or ductile iron ASTM A536, 1250 kPa working pressure, grooved ends to accept couplings without field preparation. Victaulic; Grinnell.
Branch Connections	50 mm & smaller	Tee or reducing tee in conformance with Fittings above, galvanized 910 kg WOG thredolet or welding boss; galvanize after welding.
	60 mm & larger	Branch Same Size as Run: Grooved end tee in accordance with Fittings above. Branch One or More Sizes Smaller Than Run: grooved end reducing tee in accordance with Fittings above.
Flanges		Galvanized forged carbon steel, ASTM A105/A105M, ANSI B16.5 Class 150 or Class 300, threaded, 1.5 mm raised face. Grooved end adapter flange, malleable iron ASTM A47 or ductile iron ASTM A536. Victaulic; Grinnell.
Unions		Threaded malleable iron, ASTM A197 or A47, 2070kpag WOG, brass to iron seat, meeting the requirements of ANSI B16.3.
Couplings		Grooved End: Rigid joint malleable iron, ASTM A47 or ductile iron, ASTM A536, 1750 kPa working pressure. Victaulic; Grinnell.
Plugs		Forged carbon steel, ASTM A181/A181M, Grade II, round head, threaded, galvanized.
Bolting		Grooved End Couplings: Carbon steel, ASTM A183 bolts and nuts, 759,000 kPa minimum tensile strength. Flanges: Carbon steel ASTM A307, Grade A hex head

DATA SHEET – GALVANIZED STEEL PIPE AND FITTINGS-GENERAL SERVICE

Item	Size	Description
		bolts and ASTM A563, Grade A hex head nuts.
Gaskets	All flanges	Flanged, Water and Sewage Service: 3 mm thick, red rubber (SBR), hardness 80 (Shore A), rated to 93 degrees C, conforming to ANSI B16.21, AWWA C207, and ASTM D1330, Grades 1 and 2. Blind flanges shall be gasketed covering entire inside face with gasket cemented to blind flange.
	Grooved end couplings	EPDM or chlorinated butyl per ASTM D2000 for water, and air to 110°C, dimensions conforming to AWWA C606.
Thread Lubricant	50 mm & smaller	Teflon tape or joint compound that is insoluble in water.

END OF SECTION

DATA SHEET – STAINLESS STEEL PIPE AND FITTINGS-GENERAL SERVICE

Item	Size	Description
Pipe	50 mm & smaller	Schedule 40S: ASTM A312/A312M, Type 304 seamless, pickled and passivated.
	60 mm to 150 mm	Schedule 10S: ASTM A778, "as-welded" grade, Type 304L.
	200 mm & larger	Schedule 5S: ASTM A778, "as-welded" grade, Type 304L.
Joints	50 mm & smaller	Threaded or flanged at equipment as required or shown.
	60 mm & larger	Butt-welded or flanged at valves and equipment.
Fittings	50 mm & smaller	Threaded Forged: 1,000 CWP, ASTM A182/A182M, Grade F304L.
	60 mm & larger	Butt-Welded: ASTM A774/A774M Grade 304L conforming to MSS SP 43, "as-welded" grade, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise.
Branch Connections	50 mm & smaller	Tee or reducing tee in conformance with Fittings above.
	60 mm & larger	Butt-welding tee or reducing tee in accordance with Fittings above.
Flanges	All	Forged Stainless Steel: ASTM A182/A182M, Grade F304L, ANSI B16.5 Class 150 or Class 300, slip-on weld neck or raised face. Cast Carbon Steel: ASTM A216/A216M Grade WCA, drilled, ANSI B16.5 Class 150 or Class 300 Van Stone Type with stainless steel stub ends, ASTM A240 Type 304L "as-welded grade", conforming to MSS-SP43, wall thickness same as pipe.
Unions	50 mm & smaller	Threaded Forged: ASTM A182/A182M, Grade F304, 13800 or 20700 kPag WOG, integral ground seats, AAR design meeting the requirements of ANSI B16.11, bore to match pipe.
Bolting	All	Forged Flanges: Type 304 stainless steel, ASTM A320/A320M Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts. Van Stone Flanges: Carbon steel ASTM A307 Grade B hex head bolts and ASTM A563 Grade A hex head nuts. Supply and install same on mating cast iron flange on valve or equipment with flat ring gasket.

DATA SHEET – STAINLESS STEEL PIPE AND FITTINGS-GENERAL SERVICE

Item	Size	Description
Gaskets	All Flanges	Flanged, Water and Sewage Service: 5 mm thick, unless otherwise specified, red rubber (SBR), hardness 80 (Shore A), rated to 93 degrees C, conforming to ANSI B16.21, AWWA C207, and ASTM D1330, Grades 1 and 2. Flanged, Hot Air and Fuel Gas Service: 3 mm thick, unless otherwise specified, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 150°C, conforming to ANSI B16.21 and ASTM D1330 Steam Grade. Blind flanges shall be gasketed covering entire inside face with gasket cemented to blind flange.
Thread Lubricant	50 mm & smaller	Teflon tape.

END OF SECTION

DATA SHEET – STAINLESS STEEL PIPE AND FITTINGS-SPECIAL SERVICE 1

Item	Size	Description
Pipe	All	ASTM A312/312M Type 316 welded annealed, pickled and passivated. Use Type 316L for welded joints.
	50 mm & smaller	Schedule 40S.
	60 mm to 200 mm	Schedule 10S.
	250 mm & larger	Schedule 5S and/or Schedule 10S
Tubing	19 mm OD & smaller	ASTM A312/A312M Type 316 seamless, soft annealed, 2 mm wall thickness minimum.
Pipe Joints	19 mm & smaller	Threaded or flanged at equipment as required or shown.
	25 mm & 40 mm	Socket weld or flanged at equipment as required or shown.
	50 mm & larger	Butt-welded or flanged at valves and equipment as required or shown.
Tubing Joints	All	Flareless compression fitting or socket-weld.
Pipe Fittings	19 mm & smaller	Threaded Forged: ASTM A182/A182M, Grade F316, 20700 kPag WOG.
	25 mm and 40 mm	Socket Weld Forged: ASTM A182/A182M, Grade F316L, 13800 kPag WOG.
	50 mm & larger	Butt Welded: ASTM A403/A403M, Grade WP316L conforming to ANSI B16.9 and MSS SP 43, annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise.
Tubing Fittings	All	Flareless Compression Type Forged: ASTM A182/A182M, Grade F304 or F316, Parker-Hannifin Ferulok, Flodar BA Series.
		Socket Welded: ASTM A182/A182M, Grade F316L, Cajon, Swagelok.
Pipe Branch Connections	19 mm & smaller	Tee or reducing tee in conformance with Fittings above.
	50 mm & smaller	40 mm and smaller branch: Forged Sockolet or half coupling, 13800kPag WOG ASTM A182/A182M, Grade F316L.
	60 mm & larger	Butt-Welded Tee or Reducing Tee: In accordance with Fittings above Forged Weldolet, 13800 kPag WOG ASTM A182/A182M, Grade F316L same inside diameter as branch pipe.
Tubing Branch Connections	All	Compression type or socket-weld tees or reducing tees in accordance with Tubing Fittings above.
Flanges	All	Forged: ASTM A182/A182M Rev C Grade F316L, Class 150 or Class 300, slip-on welding neck, 1.5 mm raised face, ANSI B16.5 standard.

DATA SHEET – STAINLESS STEEL PIPE AND FITTINGS-SPECIAL SERVICE 1

Item	Size	Description
Unions	19 mm & smaller	Threaded Forged: ASTM A182/A182M, Grade F316, 910 kg- or 1363 kg WOG, integral ground seats, AAR design meeting the requirements of ANSI B16.11, bore to match pipe.
	25 mm & 40 mm	Socket Weld Forged: ASTM A182/A182M Rev C Grade F316L, 910 kg- or 1363 kg WOG, integral ground seats, AAR design meeting the requirements of ANSI B16.11, bore to match pipe.
Bolting	All	Type 316, ASTM A193/A193M, Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts.
Gaskets	All Flanges	3.0 mm thick Gore-Tex flat ring type for raised face flanges and full face type for flat face flanges, Garlock, Chesterton. Use 2.0 mm EPDM gaskets for sodium bisulphate service.
Thread Lubricant	50 mm & smaller	Teflon tape or Oxyseal; Fleet Supplies, Inc.

Notes:

1. Refer to Section 15200-000 for special cleaning requirements for oxygen and ozone piping.

END OF SECTION

DATA SHEET – POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

Item	Size	Description
Pipe	12 to 60	Schedule 80 PVC: Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Threaded Nipples: Schedule 80 PVC.
	75 and larger	Schedule 40 PVC: Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Threaded Nipples: Schedule 80 PVC.
Fittings	All	Schedule to Match Pipe Above: ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type.
Joints	All	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	All	One piece, molded hub type PVC flat face flange in accordance with Fittings above, 57 kg ANSI B16.1 drilling
Bolting	All	Flat Face Mating Flange and In Corrosive Areas: ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts. With Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts and ASTM A563 Grade A heavy hex head nuts.
Gaskets	All	Flat Face Mating Flange: Full faced 3 mm thick ethylene propylene (EPR) rubber. Raised Face Mating Flange: Flat ring 3 mm ethylene propylene (EPR) rubber, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.
Solvent Cement	All	As recommended by the pipe and fitting manufacturer conforming to ASTM D2564, except solvent weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service. Certification shall be submitted.
Thread Lubricant	All	Teflon Tape.

END OF SECTION

DATA SHEET – FIBREGLASS REINFORCED PLASTIC (FRP) PIPE AND FITTINGS

Item	Size	Description
General	All	Materials in contact with potable water shall conform to NSF 61 acceptance.
Pipe	All	Fibreglass reinforced plastic, helically-wound, conforming to ASTM D2310 Type 1, vinyl ester resin, Derakane 411-45 (Dow Chemical Company) or approved equal, Type C glass monofilament surfacing mat and/or Dynel organic fibre synthetic surfacing veil or approved equal. Constructed in conformance with ASTM D2996. UV Protection: Add to the wax coat Cyabsorb UV-9, as manufactured by American Cyanamid Company.
Fabrication		Interior surfacing veil shall be 10 to 20 mils thick. Mat layers shall be resin-rich, fully wetted, 50 mils minimum thickness.
	FRP-1 (pipe)	1 layer C-Glass veil 2 mat layers bell-and-spigot or flanged
	FRP-2 (pipe)	1 layer Dynel veil 2 mat layers bell-and-spigot or flanged
	FRP-3 (pipe)	1 layer Dynel veil & 2 mat layers flanged
		1 layer C-Glass veil only
		Cut edges of laminates shall be fully wetted and cured with thinned resin, allowed to cure, then coated with surfacing resin to a DFT of 10 to 15 mils.
Gaskets	All	1.5 mm thick non-asbestos compression type, full-face, Cranite, Johns Manville.
Special Conditions	FRP-3 (pipe)	Interior layer and inner surfaces shall be free of fillers and thixotropic agents. Completed assemblies shall be post-cured for 2 hours @ 93°C, 6 hours @ 88°C or 16 hours @ 71°C. Field welded joints shall be coated with resin paste before joining.
Ratings		Fibreglass reinforced pipe, fittings and flanges shall be rated 690 kPa as specified in ASTM D2310. Minimum continuous strand glass filament (coated with resin) wall thickness for pipe are as follows:
	50 thru 150 mm	4.7 mm
	200 mm	6.4 mm
	250 thru 300 mm	7.9 mm
	350 mm	9.5 mm
	400, 450 mm	11.1 mm
	500 mm	12.7 mm
	600 mm	14.2 mm

DATA SHEET – FIBREGLASS REINFORCED PLASTIC (FRP) PIPE AND FITTINGS

Item	Size	Description
Fittings	All sizes	Fittings: ASTM C582 and D2996. Surface veil and mat layers same as specified above under Ratings. Bends shall be long radius. Structural body of fittings shall be filament wound or built-up with alternate layers of woven roving and chopped stand mat. Filament wound fittings shall be same thickness as specified above under Fabrication.
Flanges		Fibreglass reinforced plastic, faced and drilled 125-pound, ANSI B16.1 standard. Flanges mating with plastic lined steel pipe shall be Van Stone type, ductile iron ASTM A395 or cast steel ASTM A216/A216M Grace WCB, 150-pound standard per ANSI B16.5.
Bolting		Raised Face Flanges: Carbon steel, ASTM A307 Grade B square head bolts and ASTM A563 Grade A heavy hex head nuts. Flat Face Flanges in Corrosive Conditions: Stainless steel Type 316, ASTM A193/A193M, Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts.
Gaskets		Flat Face Flanges: Ethylene propylene rubber (EPR), 3 mm thick, full faced. Raised Face Mating Flange: Ring gasket same material as full face, with filler gasket between OD of raised face and flange OD, thickness same as raised face lip. Van Stone Mating Flange: Tetrafluoroethylene (TFE) envelope type, flat ring gasket.
Colour		Add pigment to the final layer only of exterior surfacing resin to lightly tint the surface, but not obliterate laminate quality. Colors are as follows: FRP-1 Red FRP-2 Green FRP-3 Yellow

Notes:

1. FRP1 pipe and fitting materials shall be suitable for float sludge material from a dissolved air flotation process used in potable water treatment with a max temperature of 25 deg C, addition of ferric chloride and sulphuric acid upstream process resulting in pH range of 5.5 to 7, and system design pressure of 120 kPa.

END OF SECTION

DATA SHEET – COPPER AND COPPER ALLOY PIPE, TUBING AND FITTINGS

Item	Size	Description
General		Materials in contact with potable water shall conform to NSF 61 acceptance.
Pipe	All	Oxygen Service: Red brass, seamless, standard wall thickness, conforming to ASTM B43.
Tubing	75 mm and smaller	Seamless, conforming to ASTM B88 as follows: Oxygen service.....Type K, hard drawn Water (buried) .....Type K, soft or hard temper Water (exposed) .....Type L, hard drawn Domestic hot water.....Type L, hard drawn Compressed air service.....Type L, hard drawn Refrigerant service .....Type L, hard drawn P-Trap priming service.....Type L, soft temper P-Trap priming service (buried).....Type K, soft or hard temper Sample line service.....Type L, hard drawn Laboratory gas service .....Type L, hard drawn
Fittings	75 mm and smaller	Oxygen Service: Bronze, screwed, 250-pound conforming to ASTM B62, dimensions conforming to ANSI B16.15 or wrought copper, socket joint, conforming to ASTM B75, dimensions conforming to ANSI B16.22. Other Services: Commercially pure wrought copper, socket joint, conforming to ASTM B75, dimensions conforming to ASME B16.22.
Flanges	All	Oxygen Service: Bronze, screwed, conforming to ASTM B61, faced and drilled 150-pound ANSI B16.24 standard. Other Services: Commercially pure wrought copper, socket joint, conforming to ASTM B75, faced and drilled 150-pound ASME B16.24 standard.
Bolting	All	Oxygen Service: ASTM A320/A320M, stainless steel Type 304, Grade B8 bolts with copper silicon hex nuts conforming to ASTM B98 Grade A hard. Other Services: ASTM A307, carbon steel, Grade A hex head bolts, and ASTM A563 Grade A hex head nuts.
Gaskets	All	1.5 mm thick non-asbestos compression type, full-face, Cranite, Johns Manville.
Solder	All 75 mm and smaller	Oxygen Service: Silver brazing alloy, 15 percent silver content, 640 degrees C to 700 degrees C melting range, conforming to AWS A5.8. Other Services: Wire solder (95% tin), conforming to ASTM B32 Alloy Grade Sn95. Do not use cored solder. Solder joints in accordance with ANSI B16.22.

Notes:

1. Refer to Section 15200-000 for special cleaning requirements for oxygen and ozone piping.

END OF SECTION

DATA SHEET – STAINLESS STEEL PIPE AND FITTINGS-SPECIAL SERVICE 2

Item	Size	Description
Pipe	All	ASTM A312/312M Type 316 welded annealed, pickled and passivated. Use Type 316L for welded joints.
	100 mm & smaller	Schedule 40S.
	125 mm thru 200 mm	Schedule 10S.
Pipe Joints	25 thru 50 mm	Butt-welded or flanged at valves and equipment as required or shown.
Pipe Fittings	25 thru 50 mm	Butt Welded: ASTM A403/A403M, Grade WP316L conforming to ANSI B16.9 and MSS SP 43, annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise.
Pipe Branch Connections	50mm & smaller	Tee or reducing tee in conformance with Fittings above.
	60 mm & larger	Butt-Welded Tee or Reducing Tee: In accordance with Fittings above Forged Weldolet, 13800 kPag WOG ASTM A182/A182M, Grade F316L same inside diameter as branch pipe.
Flanges	All	Forged: ASTM A182/A182M Rev C Grade F316L, Class 150, slip-on welding neck, 1.5 mm raised face, ANSI B16.5 standard.
Bolting	All	General Conditions: Type 316, ASTM A193/A193M, Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts.
Gaskets	All Flanges	3.0 mm thick, 150# rating, Teflon ® or Viton ® flat ring type and full face type for flat face flanges.

END OF SECTION

DATA SHEET – STAINLESS STEEL PIPE AND FITTINGS-SPECIAL SERVICE 3

Item	Size	Description
Pipe	All	Seamless stainless steel mechanical tubing, to ASTM A511 Grade 316 Schedule 40S.
Pipe Joints	All	Cold mandrel drawn seamless to ASTM A511
Pipe Fittings	All	316 stainless steel Swagelok or Parker compression fittings

END OF SECTION

PLUMBING FIXTURES

1. GENERAL

1.1 Scope of Work

.1 Furnish and install plumbing fixtures including floor drains, traps encased in concrete, and cleanouts.

1.2 Work Under Separate Contract

.1 Trap priming valves will be installed under a separate contract.

1.3 References

.1 The following is a list of standards which may be referenced in this Section:

.1 ASME

.2 CSA/CSA Label on Fixtures

.3 PDI:

.1 Code Guide 302 and Glossary of Industry Terms

.4 UL

.5 ULC

1.4 Submittals

.1 Action Submittals:

.1 Shop Drawings: catalog information and rough-in dimensions for plumbing fixtures, products, and specialties.

1.5 Regulatory Requirements

.1 Comply with the Plumbing Code and the requirements of provincial and local authorities having jurisdiction.

2. PRODUCTS

2.1 Manufacturers

.1 Fixture Trim:

.1 Supply Stops and Traps:

.1 McGuire

.2 American Standard

.3 Kohler

.2 Drainage Products:

.1 General:

.1 Smith

.2 Watts

.3 Zurn

.2 Acid Resistant:

.1 Enfield

.2 Pegas

.3 Plumbing Specialties:

.1 Trap Primers:

.1 Precision Plumbing Products

.2 Smith

2.2 General

.1 Fixture Trim: supply and install plumbing fixture trim where applicable on fixtures

.2 Plumbing Fixtures: indicated by fixture number as shown on Drawings

.3 Drainage Products: indicated by fixture number as shown on Drawings

.4 Plumbing Specialties: indicated by fixture number as shown on Drawings

2.3 Materials

.1 Drainage Products:

PLUMBING FIXTURES

.1 CO, Floor Cleanout (Finished Areas):

.1 Service: floor drainage system – tiled floor

.2 Material: tapered thread, bronze plug with round adjustable scoriated secured nickel bronze top

.3 Manufacturer and Product: Zurn Model ZN1400-NH-HD or Jay R. Smith Mfg. Co.; Model 4103S

.2 CO, Floor Cleanout (Unfinished Areas):

.1 Service: floor drainage system – exposed concrete

.2 Material: tapered thread, bronze plug with round adjustable scoriated secured cast iron top

.3 Manufacturer and Product: Zurn Model Z-1406 or Jay R. Smith Mfg. Co.; Model 4243S

.3 FD-1, Floor Drain (Unfinished Areas, General Drainage):

.1 Materials: Dura-coated cast iron body and grate.

.2 305mm round grate, sediment bucket

.3 Manufacturer and Product: Zurn Model Z415N-P

.4 FD-2, Hub Drain

.1 Coated cast iron reducing hub adapter with standard cast iron hub.

.2 Hub: Two pipe sizes larger than outlet.

.3 Manufacturer and Product: Zurn Model Z-415-S-P

.5 FD-3, Floor Drain with Funnel:

.1 Materials: cast iron body and nickel bronze grate

.2 Option: oval funnel

.3 Manufacturers: Zurn ZN415-BF-P or Jay R. Smith Mfg. Co., Model 3510 F19-B-P.

.6 FD-4, Floor Drain (Gutter Drain):

.1 Material: Dura-Coated cast iron body with bottom 50 mm outlet and polished secured nickel bronze grate, 254 x 60mm.

.2 Manufacturer and Product: Zurn; Model Z573

.7 FD-5, Floor Drain (Gutter Drain):

.1 Materials: rectangular Dura-coated cast iron body and grate, bottom outlet, 318 x 143mm grate.

.2 Manufacturer and Product: Zurn; Model Z575

.8 FD-6, Floor Drain (Ozone Areas):

.1 Materials: 316 stainless steel body and 200 mm strainer with trap primer connection

.2 Manufacturer and Product: Zurn; Model ZM1726

.9 FD-7, Funnel Floor Drain (Fabricate Funnel):

.1 Materials: Schedule 10 steel, hot dip galvanized after fabrication. See standard details.

.10 FD-8, Floor Drain (Finished Areas):

.1 Materials: Dura-coated cast iron body, 134mm round adjustable nickel bronze strainer, membrane clamp, trap primer connection.

.2 Manufacturer and Product: Zurn Model Z415B-P

.2 Floor Drain Traps:

.1 Supply and install Dura-coated cast iron traps with floor drain fixtures, complete with trap primer connection, as required, Zurn Z1000.

.2 Provide 316 stainless steel traps for type FD-6 stainless steel floor drains.

3. EXECUTION

3.1 Preparation

.1 Drawings do not attempt to show exact details of fixtures. Where diagrams show fixture locations, Contractor is cautioned that these diagrams must not be used for obtaining material quantities. Changes in locations of fixtures, advisable in opinion of Contractor, shall be submitted to Contract Administrator for review before proceeding with the Work.

3.2 Installation

.1 Fixture Trim: install fixture trim where applicable on fixtures.

.2 Plumbing Fixtures, Mounting Heights:

.1 Standard rough-in catalogued heights, unless shown otherwise on Drawings.

.3 Drainage Products:

.1 Floor Drains: set top flush with floor. Supply and install membrane clamps where required.

.2 Cleanouts: install where shown or required for purposes intended. Set cover flush with finished floor.

3.3 Field Quality Control

.1 Perform visual inspection for physical damage, blocked access, cleanliness, and missing items.

.2 Cover concealed or insulated work only after testing has been successfully completed.

END OF SECTION

APPENDIX A

FORMS

CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least five (5) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

_____ _____
(Authorized Signing Representative of the Installer) Date

_____ _____
(Authorized Signing Representative of the Contract Administrator) Date

1. Acknowledgement of Receipt of O&M Manuals.

_____ _____
(Authorized Signing Representative of the City) Date

APPENDIX B

EMBEDMENT AND BLOCKOUT LIST

EMBEDMENT AND BLOCKOUT LIST (SEE E16)

Type	Piping Nominal Size (mm) Note 1	Sleeve Outside Dia. (mm) or Opening Size	Standard Detail Reference	Detail Drawing Reference	Service (Commodity)	Plant Area	Piping Specification Reference	Piping Material	Sleeve Material	Quantity	Remarks
Conduit embed	78 / L=20m	---	---	---	electrical conduit	Electrical Room, First Floor Plan	---	---	---	2	Fire Pumps supply
Conduit embed	25	---	---	---	electrical conduits	Filtration, Lower Floor, Backwash area	---	---	---	3	Sump pump power and control
Conduit embed	25	---	---	---	electrical conduits	Filtration, Lower Floor, Backwash area	---	---	---	3	Sump pumps power and control
Conduit embed	25	---	---	---	electrical conduits	Admin Area, Lower Floor Plan	---	---	---	1	Sump pump power and control
Conduit embed	25	---	---	---	electrical conduits	Admin Area, Lower Floor Plan	---	---	---	1	Sump pumps power and control
Conduit embed	16	---	---	---	electrical conduit	Main Builcing First Floor Exterior Doors	---	---	---	21	Door security -reader, door switch and strike
Conduit sleeve	21	---	---	---	electrical conduit	Stairwell Platforms floor penetration	---	---	---	49	Lighting
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Admin Area, First Floor Plan	---	---	PVC	2	Admin area to Elev. Mech. Room Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Admin Area, First Floor Plan	---	---	PVC	1	Elev. Mech. Room to Stairwell No.1 Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Admin Area, First Floor Plan	---	---	PVC	1	Lobby to Vest. No.1 Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Admin Area, First Floor Plan	---	---	PVC	1	Admin area to Lobby Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	SBS Room to Garbage Recycle Room Power, control
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Garbage Recycle Room to Hazardous Waste - Power, control
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Garbage Recycle Room to Hazardous Waste - Power, control
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	1	Access coridor to Stairwell No.8 Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Access coridor to Carpentry Shop Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Access coridor to Welding Shop Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	1	Access coridor to Washroom Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	1	Access coridor to Vest. No.2 Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	1	Access coridor to Platform 2nd Floor Power
Conduit sleeve	21	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	1	Access coridor to Washroom 2nd Floor Power
Conduit sleeve	25	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Polymer Preparation and Feed Room to Peroxide Storage Room Power, control
Conduit sleeve	25	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Polymer Preparation and Feed Room to Receiving Bay Power, control
Conduit sleeve	25	78	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Workshop to SBS Room Power, control

EMBEDMENT AND BLOCKOUT LIST (SEE E16)

Type	Piping Nominal Size (mm) Note 1	Sleeve Outside Dia. (mm) or Opening Size	Standard Detail Reference	Detail Drawing Reference	Service (Commodity)	Plant Area	Piping Specification Reference	Piping Material	Sleeve Material	Quantity	Remarks
Conduit sleeve	50	114	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Access coridor to Dry Polymer Power, control
Conduit sleeve	50	114	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Access coridor to Polymer Preparation and Feed Room Power, control
Conduit sleeve	50	114	STD-7	WB-M9452	electrical conduit	Chemical	---	---	PVC	2	Access coridor to Workshop Room Power, control
Conduit sleeve	50	114	---	---	electrical conduit	Chemical Area Floor Penetration	---	---	---	3	Fire Pumps supply
Conduit sleeve	50	114	---	---	electrical conduit	Chemical Area Roof Penetration	---	---	---	2	Roof Exhaust Fan Power/Control
Conduit sleeve	50	114	---	---	electrical conduit	Chemical Area Wall Penetration	---	---	---	3	Fire Pumps supply
Conduit sleeve	16	78	---	---	electrical conduit	Main Builcing 2nd Floor Exterior Doors	---	---	---	1	Door security -reader, door switch and strike
Conduit sleeve	50	114	---	---	electrical conduit	DAF Floor Penetration	---	---	---	4	
Conduit sleeve	50	114	---	---	electrical conduit	Mechanical Rooms 3rd Floor Area Roof Penetration	---	---	---	4	Roof Exhaust Fan Power/Control
Conduit sleeve	50	114	---	---	electrical conduit	Mechanical Rooms 1st Floor Area Roof Penetration	---	---	---	4	Penthouse Power/Control
Conduit sleeve	25	89	STD-7	WB-M9452	electrical conduit	Filtration, 2nd Floor, East	---	---	PVC	1	LOX control
Conduit sleeve	100	168	STD-7	WB-M9452	electrical conduit	Filtration, 2nd Floor, East	---	---	PVC	1	LOX power
Conduit sleeve	100	---	---	---	electrical conduits	Electrical Room floor penetrations for conduits	---	---	PVC	52	Power supply to equipment
Conduit sleeve	100	---	---	---	electrical conduits 9x100mm	Filtration, 2nd Floor, Stairway North wall	---	---	---	9	Lower floor power supply
Conduit sleeve	100	---	---	---	electrical conduits 9x100mm	Filtration, 2nd Floor, Stairway South wall	---	---	---	9	Lower floor power supply
Conduit sleeve	16	78	---	---	electrical conduit	Filtration, First Floor Plan	---	---	---	6	Door security
Conduit sleeve	25	89	STD-7	WB-M9452	electrical conduit	Filtration, Lower Level, Northeast	---	---	PVC	1	Fire barier - lighting
Conduit sleeve	25	89	STD-7	WB-M9452	electrical conduit	Filtration, Lower Level, West	---	---	PVC	1	Fire barier - lighting
Conduit sleeve	25	89	STD-7	WB-M9452	electrical conduit	Ozone Area, 3rd Floor, East	---	---	PVC	1	Ozone Sample Pumps located on first floor. Conduit Sleeve is located in the hallway.
Conduit sleeve	25	89	STD-7	WB-M9452	electrical conduit	Raw Water, 3rd Floor, East	---	---	PVC	1	Raw water - ltg. power/supply
Conduit sleeve	25	89	STD-7	WB-M9452	electrical conduit	Residuals, 2nd Floor, North	---	---	PVC	2	Filtration room - power/control
Conduit sleeve	50	114	STD-7	WB-M9452	electrical conduit	Residuals, 2nd Floor, North	---	---	PVC	4	Pilot, Filtration room - power/control
Conduit sleeve	50	114	---	---	electrical conduit	RWP Floor Penetration	---	---	---	2	
Conduit sleeve	50	114	---	---	electrical conduit	Admin Area Roof Penetration	---	---	---	2	Roof Mechanical Room Power/Control

EMBEDMENT AND BLOCKOUT LIST (SEE E16)

Type	Piping Nominal Size (mm) Note 1	Sleeve Outside Dia. (mm) or Opening Size	Standard Detail Reference	Detail Drawing Reference	Service (Commodity)	Plant Area	Piping Specification Reference	Piping Material	Sleeve Material	Quantity	Remarks
Lifting Eye	---	---	STD-3	WB-S0456	---	Inlet Works	---	---	---	3	Raw water sluice gate and future screen removal
Lifting Eye	---	---	STD-3	WB-S0456	---	Ozone	---	---	---	2	2 lifting eyes were requested for the flocculators by the chemical area
Pipe embed	25	---	STD-1	WB-M9451	Sludge Polymer (PLS)	Chemical (C)	15200-10	PVC	---	2	From Filter Pipe Gallery into northeast corner of Washwater Recovery Tank No. 4
Pipe embed	25	50	STD-1, with 1 flange	WB-M9451	Filtered water (FW)	Filtration	15200-09	SST	SST	12	South Wall Filter Box at elev. 237.5+/- (8), 236.6+/- (2), 235.9 +/- (2) for D/P transmitters
Pipe embed	65	---	STD-1, with 2 flanges	WB-M9451	Potable Water (PW)	Filtration	15200-13	Copper	---	2	External wall at elev. 238.0 +/- at east and west end of filter building
Pipe embed	100	---	STD-1, with 1 flange	WB-M9451	Filter Media Eductor (FED)	Filtration	15200-10	SST	---	16	South Wall Filter Box at elev. 237.5+/- (8), 235.2+/- (8)
Pipe sleeve	50	100	STD-11	WB-M9452	Sulphuric Acid	DAF (P)	---	Alloy 20	PVC	3	Floor Penetration
Pipe sleeve	50	100	STD-11	WB-M9452	Ferric Chloride	DAF (P)	---	Sched 80 PVC	PVC	3	Floor Penetration
Pipe sleeve	100	219	STD-5	WB-M9451	Gaseous Oxygen (GOX)	Filtration	---	SST 316L	Polyethylene	1	This pipe will bring the GOX from the LOX pad (located outside of the building, on the east side), to the Ozone room.
Pipe sleeve	32	89	STD-7	WB-M9452	Compressed Air	Mechanical Room	---	Carbon Steel	PVC	2	1 compressed air line to each receiver. Two receivers total
Pipe sleeve-floor	40	114	STD-9	WB-M9452	Plant Service Water	Filtration	---	Copper	PVC	4	
Pipe sleeve-floor	65	114	STD-9	WB-M9452	Plant Service Water	Filtration	---	Copper	PVC	2	
Pipe sleeve-floor	150	250	STD-9	WB-M9452	Fire Water		---	Carbon Steel	Carbon Steel	26	Standpipes in stairwells
Pipe sleeve-wall	150	250	STD-9	WB-M9452	Fire Water		---	Carbon Steel	Carbon Steel	8	Standpipes in stairwells
Pipe sleeve-wall	40	114	STD-7	WB-M9452	Plant Service Water	Filtration	---	Copper	PVC	1	
Pipe sleeve-wall	50	114	STD-7	WB-M9452	Plant Service Water	Filtration	---	Copper	PVC	4	
Pipe sleeve-wall	75	168	STD-7	WB-M9452	Potable Water	Filtration	---	Copper	PVC	2	
Pipe sleeve-wall	25	89	STD-7	WB-M9452	Hot Water	Residuals	---	Copper	PVC	2	
Pipe sleeve-wall	50	114	STD-7	WB-M9452	Potable Water	Residuals	---	Copper	PVC	2	
Pipe sleeve-wall	65	114	STD-7	WB-M9452	Plant Service Water	Residuals	---	Copper	PVC	3	
Pipe sleeve-floor	250	350	STD-9	WB-M9452	Fire Water		---	Carbon Steel	Carbon Steel	2	Fire water header
Pipe sleeve-wall	250	350	STD-9	WB-M9452	Fire Water		---	Carbon Steel	Carbon Steel	3	Fire water header
Rectangular boxout	---	0.1 m^2<= size < 0.3 m^2	---	---	Sodium Bisulphite (SBS)	Chemical (C)	---	---	---	3	From north wall of SBS Storage and Feed Room, west wall of Dry Polymer Chemical Storage Room into Access Corridor No. 2 and from Access Corridor No. 2 into Access Corridor No. 5 (Through floor)
Rectangular boxout	---	0.1 m^2<= size < 0.3 m^2	---	---	Hydrogen Peroxide (HP)	Chemical (C)	---	---	---	1	From Peroxide Storage and Feed Room into Polymer Preparation Room
Rectangular boxout	---	0.5 m^2<= size < 1.0 m^2	---	---	Hydrogen Peroxide (HP) Filter Aid Polymer (PLS) Sludge Polymer (PLS)	Chemical (C)	---	---	---	1	From Polymer Preparation into Access Corridor No. 2 (North Stairwell)

EMBEDMENT AND BLOCKOUT LIST (SEE E16)

Type	Piping Nominal Size (mm) Note 1	Sleeve Outside Dia. (mm) or Opening Size	Standard Detail Reference	Detail Drawing Reference	Service (Commodity)	Plant Area	Piping Specification Reference	Piping Material	Sleeve Material	Quantity	Remarks
Rectangular boxout	---	0.3 m^2<= size < 0.5 m^2	---	---	Hydrogen Peroxide (HP) Filter Aid Polymer (PLS)	Chemical (C)	---	---	---	1	From Access Corridor No. 2 (North Stairwell) into Access Corridor No. 5 (Through floor)
Rectangular boxout	---	< 0.1 m^2	---	---	Sludge Polymer (PLS)	Chemical (C)	---	---	---	1	From Access Corridor No. 2 (North Stairwell) into Filter Pipe Gallery
Rectangular boxout	---	0.1 m^2<= size < 0.3 m^2	---	---	Ferric Chloride (HP) Sulphuric Acid (SCA)	Chemical (C)	---	---	---	3	From Filter Pipe Gallery into Access Corridor No. 2 (North Stairwell), from Access Corridor No. 2 (North Stairwell) into main part of Access Corridor No. 2, from Access Corridor No. 2 into DAF Pump Gallery
Rectangular boxout wall penetration	---	0.3 m^2<= size < 0.5 m^2	---	---	cable trays	Raw Water, 3rd Floor, North	---	---	---	1	Raw water - power/control supply
Rectangular boxout wall penetration	---	0.1 m^2<= size < 0.3 m^2	---	---	cable trays	Daf Area Double T	---	---	---	4	DAF - Area Power/control
Rectangular boxout wall penetration	---	0.1 m^2<= size < 0.3 m^2	---	---	cable trays	Daf Area Double T	---	---	---	1	Admin Area Power/control
Rectangular boxout wall penetration	---	0.1 m^2<= size < 0.3 m^2	---	---	cable trays	Chemical Area 2nd Floor West	---	---	---	4	Fire barier - power to Electrical Room #2
Rectangular boxout floor penetration	---	0.7 m^2<= size < 1.00 m^2	---	---	cable trays	Electrical Room #1	---	---	---	1	Fire barier -Power feeds from Electrical Room
Rectangular boxout floor penetration	---	0.7 m^2<= size < 1.00 m^2	---	---	cable trays	Residuals Corridor	---	---	---	1	Fire barier -Power feeds from Electrical Room to Filter Pipe Gallery Area
Rectangular boxout wall penetration	---	0.5 m^2<= size < 0.7 m^2	---	---	cable trays	Chemical Area 1st Floor North West	---	---	---	1	Fire barier - Power/Control
Rectangular boxout wall penetration	---	0.5 m^2<= size < 0.7 m^2	---	---	cable trays	Filter Area 2nd Floor North West	---	---	---	1	Fire barier - power to Electrical Room #2
Rectangular boxout wall penetration	---	0.1 m^2<= size < 0.3 m^2	---	---	cable trays	Residuals, 2nd Floor, South	---	---	---	4	Fire barier - power/control residual, pilot, filtration room
Lifting Eye	---	---	STD-3	WB-S0456	---	Chemical (C)	---	---	---	8	4 lifting eyes to located over the 2 future and two existing poly prep units. 4 lifting eyes to be located over the 2 existing and two future poly feed tanks.

Notes
1. For conduit embedded in concrete, the length of the conduit is shown (metres).
2. Flanges to be ANSI 150# unless noted otherwise.

EMBEDMENT AND BLOCKOUT LIST (SEE E16)

Type	CMU Size (mm)	Reinforcement Size	Reinforcement Spacing	Concrete Curb Size (mm)	Plant Area	Total CMU Wall Length (m)	Remarks
Vertical Dowels for CMU Walls	240	15M	600 mm	See note 1	filter area	169 m	
	240	15M	400 mm	See note 1	mechanical room 2 and corridor	218 m	
	240	15M	400 mm	See note 1	ozone generator and destructor area	131 m	
	240	15M	400 mm	See note 1	pilot room	44 m	
	240	15M	400 mm	See note 1	blower room, electrical room, mechanical room	196 m	
	240	15M	600 mm	See note 1	electrical room, fire pump room	58 m	
	290	20M	400 mm EF	See note 2	DAF area	108 m	
	190	15M	400 mm	See note 3	workshop	7 m	
	240	15M	400 mm	See note 1	workshop	37 m	
	190	15M	400 mm	See note 3	instrumentation mezzanine	60 m	
	240	15M	400 mm	See note 1	instrumentation mezzanine	7 m	
	140	15M	400 mm	See note 4	administration area	72 m	
	190	15M	400 mm	See note 3	administration area	198 m	
	240	15M	400 mm	See note1	administration area	89 m	
	290	20M	400 mm EF	See note 2	administration area	35	

Note 1: 250 mm with 10 mm chamfer at the top of inside face for external walls, 260 with 10 mm chamfer at the top of each face
Note 2: 300 mm with 10 mm chamfer at top of inside face, see Standard Detail 5 on drawing WB-S0446
Note 3: 210 mm with 10 mm chamfer at top of each face, see Standard Detail 5 on drawing WB-S0446
Note 4: 160 mm with 10 mm chamfer at top of each face, see Standard Detail 5 on drawing WB-S0446