
# THE CITY OF WINNIPEG

# BID OPPORTUNITY

**BID OPPORTUNITY NO. 650-2005**

**WINNIPEG WATER TREATMENT PROGRAM – RAW WATER PUMPING STATION FOUNDATIONS AND CONCRETE STRUCTURES**

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# PART B - BIDDING PROCEDURES

## B1. PROJECT TITLE

B1.1 WINNIPEG WATER TREATMENT PROGRAM – RAW WATER PUMPING STATION FOUNDATIONS AND CONCRETE STRUCTURES

## B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, November 23, 2005.

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

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

## B3. SITE INVESTIGATION

B3.1 Further to GC:3.1, the Contract Administrator or an authorized representative will be available at the Site from 10:30 a.m. to 12:00 p.m. on November 9, 2005 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 and Unit Prices in Canadian funds for the Work on Form B: Prices.

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

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

## B10. QUALIFICATION

B10.1 The Bidder shall:

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

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

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

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

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

(f) employ only Subcontractors who:

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

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

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

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

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

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

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

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

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

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

## B11. BID SECURITY

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

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

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

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

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

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

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

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

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

**B12. OPENING OF BIDS AND RELEASE OF INFORMATION**

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

B12.1.1 Bidders or their representatives may attend.

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

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

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

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

**B13. IRREVOCABLE BID**

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

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

**B14. WITHDRAWAL OF BIDS**

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

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

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

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

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

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

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

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

## B15. EVALUATION OF BIDS

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

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

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

(c) Total Bid Price;

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

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

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

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

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

## B16. AWARD OF CONTRACT

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

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

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

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

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

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

(d) only one Bid is received; or

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

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

# PART C - GENERAL CONDITIONS

## C1. GENERAL CONDITIONS

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

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

# PART D - SUPPLEMENTAL CONDITIONS

## GENERAL

### D1. GENERAL CONDITIONS

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

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

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

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

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

### D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of construction of a reinforced concrete Raw Water Pumping Station structure including installation of prestressed concrete piles and other components as listed below or as detailed in the Drawings and Specifications.

D2.2 The major components of the Work are:

(a) Shoring or sheet piling required for the work. Design shall account for the requirement for the yard piping to be installed prior to removal of the shoring or sheet piling.

(b) Excavation and backfilling as specified in Section 02223 Excavation and Backfilling for Structures, clause 1.1.

(c) Construction of cast-in-place concrete components as defined in the Contract documents including footings, foundations, slabs, columns, beams, walls, sumps, pads and concrete pipe supports and benching.

(d) Construction of foundation drainage around the perimeter including geotextile.

(e) Delivery from Lafarge Canada's plant located on Dawson Road in Winnipeg to the Site and installation of two hundred and seven (207) owner purchased, 406mm precast concrete piles 13m to 14m in length.

(f) Form around and cast into Raw Water Pumping Station valve chamber walls four (4) 2100mm wall components supplied and set in place by the yard piping contractor (Bid Opportunity 153-2005).

(g) Supply and installation of mechanical and electrical rough-in and installations, including piping, sleeves and embeds as shown and noted on the Contract documents.

*(h)* Supply and installation of stainless steel watertight embedded frame as shown on the Drawings.

(i) Supply and installation of aluminum fabrications as specified in Section 05530 Aluminum Fabrications, clause 1.1.

(j) Supply and installation of all sleeves, blockouts (including removal as applicable) including blockouts for door frames, louvers, piping and all other penetrations through walls and slabs as shown and noted in the Contract documents.

D2.3 The Site is located on Provincial Road 207, 3 km north of Highway 1 in the Rural Municipality of Springfield, Manitoba.

D2.3.1 The Site address is 57082 PR #207, Rural Municipality of Springfield, Manitoba

D2.3.2 Provincial Road 207 is a class B1 road and is subject to load restrictions including seasonal restrictions which will affect the maximum weight of individual deliveries. The Contractor shall be responsible for the payment of all fees and acquire all permits, if available, from the authority having jurisdiction as required by GC:6.11 – GC:6.15

## D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

(a) **Business Day** means any Calendar Day, other than a Saturday, Sunday, or a Statutory or Civic Holiday;

(b) **Submission Deadline** and **Time and Date Set for the Final Receipt of Bids** mean the time and date set out in the Bidding Procedures for final receipt of Bids;

(c) **Installation Contractor and/or Installer** means the General Contractor retained by the City, under a separate contract, to install the equipment supplied under this contract;

(d) **Substantial Performance** shall have the meaning attributed to it in the Builders' Lien Act (Manitoba), or any successor legislation thereto.

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

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

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

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

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

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

(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

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

(q) **CEC** means Canadian Electrical Code

(r) **LOX** means liquid oxygen

(s) **Manufacturer** means the person, partnership or corporation responsible for the manufacture and fabrication of equipment provided to the City for the completion of the work.

(t) **Manufacturer's Representative** means a trained serviceman empowered by the manufacturer to provide installation, testing, and commissioning assistance to the City in his performance of those functions.

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

(v) **Furnish** means supply

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

(x) **Total Performance** means that the entire Work, except those items arising from the Provision of GC.10.01 have been performed in accordance with this Contract

(y) **AGMA** means American Gear Manufacturer's Association.

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

(aa) **EEMAC** means Electrical and Electronic Manufacturer of Canada

(bb) **VFD** means Variable Frequency Drive

(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) **Certified Shop Drawings** means Shop Drawings prepared by the Contractor after all required Shop Drawings have been "reviewed" or "reviewed as modified" in accordance with Clause E10 of this Bid Opportunity and which incorporate all modifications to the Shop Drawings, comments and notations made by the Contract Administrator in the course of the review.

(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 Clause E10 of this Bid Opportunity

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

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.

(a) "**SAE**" means Society of Automotive Engineer

## D4. CONTRACT ADMINISTRATOR

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

Mr. Larry Smith, C.E.T.
Contract Administrator
1479 Buffalo Place
Winnipeg, MB, R3T 1L7

Telephone No. (204) 986-7635
Facsimile No. (204) 986-8393

D4.2 At the pre-construction meeting, Larry Smith 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 attention of the Chief Financial Officer at the following address or facsimile number:

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

Facsimile No.: (204) 949-1174

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 five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

**SUBMISSIONS**

**D8. 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 shall 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; amount of the deductibles is $10,000 per claim.

(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; amount of the deductibles is $10,000 per claim.

(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 Deductibles shall be borne by the Contractor.

D9.3 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 wit 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.

## 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. SUBCONTRACTOR LIST

D11.1 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.

## D12. DETAILED WORK SCHEDULE

D12.1 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.

D12.2 The Contractor shall, within 5 business days of award of contract, prepare a detailed Contract Work Schedule for his work based on a critical path method (CPM) approach.

D12.3 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.

D12.4 Upon acceptance by the Contract Administrator, distribute copies of the revised schedule to Subcontractors and other concerned parties.

D12.5 The Contract Work Schedule shall be updated as the work requires and submitted to the Contract Administrator.

D12.6 The Contractor shall instruct recipients to report to the Contractor immediately any problems anticipated by the timetable shown in the Contract Work Schedule.

D12.7 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.

D12.8 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.

D12.9 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.

D12.10 The Contractor shall be familiar with all other Contract Work Schedules as contracted by the City with other Contractors and the critical path of the Project Master Schedule.

## SCHEDULE OF WORK

## D13. COMMENCEMENT

D13.1 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.

D13.2 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 Subcontractor list specified in D11;

(vii) the detailed work schedule specified in D12;

(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.

D13.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

## D14. SCHEDULE RESTRICTIONS

D14.1 The Contractor is required to complete the specific construction of the Raw Water Pumping Station (RWPS) as noted in section D15 – Critical Stages.

D14.2 Yard Piping components cast into RWPS walls: At the RWPS valve chamber, the yard piping contractor will set in place two (2) 2100 pipe sections into each of two walls immediately upon completion of the base slab. The pipe sections are to be in place by March 22, 2006.

D14.3 The Contractor is required to complete the construction of the Raw Water Pumping Station (RWPS) valve chamber by April 15, 2006. The yard piping contractor (Bid Opportunity 153-2005) will then install the yard piping from the valve chamber to the connection point for at cell 3 raw water outlet piping. To permit access for the yard piping contractor's activities and equipment, the Contractor may not have full and direct access to the area south of the RWPS from April 7 to June 1, 2006.

D14.4 In accordance with GC:5 of the General Conditions, should it become apparent, in the opinion of the Contract Administrator, that the Contractor will not meet the dates set out in section D15 – Critical Stages, the Contract Administrator may direct the Contractor to expedite the work or take such actions as are deemed necessary to meet the Critical Dates without additional compensation to the Contractor.

## D15. CRITICAL STAGES

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

(a) Submission of bona fide shoring drawings within two weeks of Contract award

(b) March 15, 2006 – Completion of the RWPS base slab and pipe supports ready for installation of Yard Piping components

(c) April 15, 2006 – Completion of the RWPS valve chamber

## D16. SUBSTANTIAL PERFORMANCE

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

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

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

## D17. TOTAL PERFORMANCE

D17.1 The Contractor shall achieve Total Performance by July 31, 2006.

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

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

## D18. LIQUIDATED DAMAGES

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

(a) Substantial Performance - two thousand, six hundred dollars ($2,600)

(b) Total Performance – six hundred dollars ($600)

D18.2 The amounts specified for liquidated damages in D18.4 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve Substantial Performance or Total Performance by the days fixed herein for same.

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

## CONTROL OF WORK

## D19. JOB MEETINGS

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

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

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

D20.1 Further to GC:6.26, 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).

D20.2 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 training and certification of all staff by the Prime Contractor’s Safety Officer will be required.

D20.3 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. This Plan may be periodically updated during the course of the Project.

## D21. COOPERATION WITH OTHERS

D21.1 The Contractor shall note that several other contracts will be underway at the time of construction, including, but not limited to;

(a) Bid Opportunity 32-2005 Winnipeg Water Treatment Program - Supply of Butterfly Valves for Yard Piping (Awarded)

(b) Bid Opportunity 70-2005 Winnipeg Water Treatment Program – Bulk Excavation for Clearwell and Water Treatment Plant Sites

(c) Bid Opportunity 101-2005 Winnipeg Water Treatment Program – Clearwell Piling Supply

(d) Bid Opportunity 102-2005 Winnipeg Water Treatment Program – Supply of Sluice Gates

(e) Bid Opportunity 153-2005 Winnipeg Water Treatment Program – Yard Piping and Valve Chambers

(f) Bid Opportunity 166-2005 Winnipeg Water Treatment Program – Clearwell Construction

(g) Bid Opportunity 515-2005 Winnipeg Water Treatment Program – Supply of Raw Water Pumps

(h) Bid Opportunity 561-2005 Winnipeg Water Treatment Program – Supply of Water Treatment Plant Sluice Gates

D21.2 Bid Opportunities for the above are available at the City of Winnipeg Materials Management website at http://www.winnipeg.ca/matmgt/bidopp.asp

D21.3 The Contractor will not have exclusive use of the site. The Contractor shall coordinate activities with others and minimize disruptions to others, where possible.

D21.4 Where site access requires relocation for installation of works, the Contractor shall construct suitable, all-weather detours, as required.

D21.5 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.

## D22. SECURITY CLEARANCE

D22.1 Each individual proposed to perform Work on the Site shall be required to obtain a Criminal Record Check Search Certificate from the Police Service having jurisdiction at his place of residence.

D22.2 Prior to the commencement of any Work, and during the term of the Contract if additional or replacement individuals are proposed to perform Work, the Contractor shall supply the Contract Administrator with a Criminal Record Search Certificate obtained not earlier than one (1) year prior to the Submission Deadline, or a certified true copy thereof, for each individual proposed to perform Work within City facilities or on private property.

D22.3 Any individual for whom a Criminal Record Search Certificate is not provided, or for whom a Criminal Record Search Certificate indicates any convictions or pending charges related to

property offences or crimes against another person, will not be permitted to perform any Work within City facilities or on private property.

D22.4 Any Criminal Record Search Certificate obtained thereby will be deemed valid for the duration of the Contract subject to a repeated records search as hereinafter specified.

D22.5 Notwithstanding the foregoing, at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated criminal records search. Any individual who fails to provide a satisfactory Criminal Record Search Certificate as a result of a repeated criminal records search will not be permitted to continue to perform Work under the Contract within City facilities or on private property.

## MEASUREMENT AND PAYMENT

### D23. PAYMENT SCHEDULE

D23.1 Further to GC:12, payment shall be in accordance with the following payment schedule:

(a) Eighty-seven percent (87.5%) of the Lump Sum Price listed in Form B: Prices will be paid on the basis of monthly progress estimates in accordance with GC:12.

(b) Five percent (5%) of the Lump Sum Price listed in Form B: Prices will be paid upon satisfactory completion of a water leakage test of each of the wet cells.

(c) Seven and one half percent (7.5%) of the Lump Sum Price listed in Form B: Prices will be paid upon Substantial Performance in accordance with the Lien Act of the Province of Manitoba.

**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. 650-2005 WINNIPEG WATER TREATMENT PROGRAM – RAW WATER PUMPING STATION 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. 650-2005

WINNIPEG WATER TREATMENT PROGRAM – RAW WATER PUMPING STATION
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 D11)

WINNIPEG WATER TREATMENT PROGRAM – RAW WATER PUMPING STATION FOUNDATIONS AND CONCRETE STRUCTURES

| Name | Address |
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# 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 |
|---|---|---|
| | | DRAWING COVER PAGE - WINNIPEG WATER TREATMENT PROGRAM -FOUNDATIONS AND CONCRETE STRUCTURES 1 - RAW WATER PUMP STATION AREA |
| WM-S9001 | 1-0601M-D-S9001-001-00D | STRUCTURAL – LEGEND- GENERAL NOTES AND ABBREVIATIONS |
| WB-F8105 | 1-0601B-B-F8105-001-00D | STRUCTURAL - OVERALL BUILDING PILING AND CONTRACT LIMIT PLAN |
| WB-S8100 | 1-0601B-A-S8100-001-00D | STRUCTURAL - OVERALL BUILDING LOWER LEVEL AND CONTRACT LIMIT PLAN |
| WB-S8110 | 1-0601B-A-S8110-001-00D | STRUCTURAL - OVERALL BUILDING FIRST FLOOR AND CONTRACT LIMIT PLAN |
| WB-S8130 | 1-0601B-A-S8130-001-00D | STRUCTURAL - OVERALL BUILDING THIRD FLOOR AND CONTRACT LIMIT PLAN |
| WB-S8140 | 1-0601B-A-S8140-001-00D | STRUCTURAL - OVERALL BUILDING ROOF FRAMING AND CONTRACT LIMIT PLAN |
| WI-F0105 | 1-0601I-B-F0105-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA - PILING PLAN |
| WI-S0101 | 1-0601I-A-S0101-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA - LOWER LEVEL PLAN |
| WI-S0111 | 1-0601I-A-S0111-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA - FIRST FLOOR PLAN |
| WI-S0131 | 1-0601I-A-S0131-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA - THIRD FLOOR PLAN |
| WI-S0141 | 1-0601I-A-S0141-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA - ROOF FRAMING PLAN |
| WI-S0201 | 1-0601I-A-S0201-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA – SECTION |
| WI-S0202 | 1-0601I-A-S0202-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA – SECTION |

| CONSULTANT DRAWING NO. | CITY DRAWING NO. | TITLE |
|---|---|---|
| WI-S0203 | 1-0601I-A-S0203-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA – SECTION |
| WI-S0204 | 1-0601I-A-S0204-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA – SECTION |
| WB-S0441 | 1-0601B-D-S0441-001-00D | STRUCTURAL - STANDARD DETAILS |
| WB-S0442 | 1-0601B-D-S0442-001-00D | STRUCTURAL - STANDARD DETAILS |
| WB-S0443 | 1-0601B-D-S0443-001-00D | STRUCTURAL - STANDARD DETAILS |
| WB-S0444 | 1-0601B-D-S0444-001-00D | STRUCTURAL - STANDARD DETAILS |
| WB-S0445 | 1-0601B-D-S0445-001-00D | STRUCTURAL - STANDARD DETAILS |
| WB-S0446 | 1-0601B-D-S0446-001-00D | STRUCTURAL - STANDARD DETAILS |
| WB-S0447 | 1-0601B-D-S0447-001-00D | STRUCTURAL - STANDARD DETAILS |
| WB-S0448 | 1-0601B-D-S0448-001-00D | STRUCTURAL - STANDARD DETAILS |
| WI-S0505 | 1-0601I-D-S0505-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA - PILING SCHEDULE |
| WI-S0515 | 1-0601I-D-S0515-001-00D | STRUCTURAL - RAW WATER PUMP STATION AREA - COLUMN AND BEAM SCHEDULES |
| WB-M9441 | 1-0601B-D-M9441-001-00D | PROCESS MECHANICAL - STANDARD DETAILS |
| WI-H9122 | 1-0601I-A-H9122-001-00D | PLUMBING - PIPE EMBEDS - RAW WATER PUMP STATION AREA PLANS |
| WI-M9101 | 1-0601I-A-M9101-001-00D-R0 | PIPE EMBEDS - RAW WATER PUMP STATION AREA - LOWER LEVEL PLAN |
| WI-M9131 | 1-0601I-A-M9131-001-00D-R0 | PIPE EMBEDS - RAW WATER PUMP STATION AREA - THIRD FLOOR PLAN |
| WI-M9202 | 1-0601I-A-M9202-001-00D-R0 | PIPE EMBEDS - RAW WATER PUMP STATION AREA – SECTION |
| WM-C0165 | | CIVIL – EXISTING SITE PLAN AND SURVEY PLAN |

E1.3 The following Specifications are applicable to the Work:

| SPECIFICATION SECTION | TITLE | NO. OF PAGES |
|---|---|---|
| 02223 | Excavation and Backfilling for Structures | 8 |
| 02451 | Pile Foundations, General | 5 |
| 02468 | Precast Concrete Piles | 3 |
| 02620 | Sub-Drainage | 5 |
| 03100 | Concrete Formwork | 6 |
| 03200 | Concrete Reinforcement | 3 |
| 03250 | Concrete Accessories | 4 |
| 03300 | Cast-In-Place Concrete | 18 |
| 05530 | Aluminum Fabrications | 3 |
| 09870 | Coating Systems for Steel Tanks and Pipes | 13 |
| 15010 | General Mechanical Provisions | 5 |

| SPECIFICATION SECTION | TITLE | NO. OF PAGES |
|---|---|---|
| 15100-00 | Plumbing Piping | 6 |
| 15100-02 | Data Sheet – Cast Iron Soil Pipe (CISP) and Fittings | 1 |
| 15200-000 | Process Piping | 26 |
| 15200-00L | Piping Service Legend | 2 |
| 15200-00S | Piping Schedule | 1 |
| 15200-03 | Data Sheet – Carbon Steel Pipe and Fittings – General Service | 3 |
| 15200-04 | Data Sheet – Carbon Steel Pipe and Fittings – Large Diameter | 2 |
| 15200-13 | Data Sheet – Copper and Copper Alloy Pipe, Tubing and Fittings | 1 |
| 15410 | Plumbing Fixtures | 3 |

## 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 included in Test_Pile_Driving_Records-Set1.pdf at the internet site identified in E2.1 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 E2.1 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).

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 may 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 The City will provide to the Contractor without cost:

(a) Granular pad for office location

(b) Non-potable water supply

(c) Power supply for heating, lighting and office plugs

(d) Communications connections for telephone, facsimile and internet (high speed equivalent)

(e) Washroom and toilet facilities within the office compound, and

(f) 600 volt and 110/220 volt on-site power supply for construction purposes. Three (3) portable distribution panels for 125A. 110/220V power will be available at the site. Also, a 225A 3 phase 600V power supply suitable for tower crane will be available northeast of the clearwell near the south limit of the GWWD right-of-way (exact location has not been determined). Cables and installation by Contractor.

### E4. FIELD ENGINEERING

E4.1 The Contractor shall engage a qualified surveyor to layout the works and record as-constructed measurements for record drawings.

E4.2 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.

E4.3 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.

## E5. SITE DRAINAGE AND DEWATERING

E5.1 The Contractor shall take control of the Work area during winter months and shall be responsible for maintaining the Work area in an acceptable condition.

E5.2 Provision of adequate site drainage during the entire construction phase 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 construction phase.

E5.3 The Contractor shall be responsible for keeping the excavated areas dewatered at all times. The Contractor shall prepare and submit a plan to dewater the excavations at the pre-construction meeting. The plan will be reviewed and approved by the Contract Administrator prior to commencement of a construction. If at any time the Contract Administrator deems the dewater efforts to be insufficient, the Contract Administrator may order the Contractor to modify and/or increase efforts at the sole discretion of the Contract Administrator with no additional time or compensation. The Contractor shall maintain dewatering until final completion of the contract.

## E6. FOUNDATION FROST PROTECTION

E6.1 The exposed exterior perimeter footing shall be protected by one of the following methods:

a. A minimum of 1.2 metres of flax straw complete with the tops and outer sides covered with 0.250 millimetres thick polyethylene sheeting weighted down with sand bags or other suitable weighting system.

b. A system reviewed and acceptable to the Contract Administrator that provides frost protection equivalent to 1.2 metres of straw.

E6.2 The interior footings and base slabs shall be protected by one of the following methods:

a. If the wall construction permits, for the parts that are ready, frost protection shall consist of a minimum of 1.8 metres of water complete with a bubbler system to prevent ice pressures on the walls.

b. If the wall construction does not permit, for the parts that are not ready, frost protection shall consist of a minimum of 1.2 metres of flax straw complete with the top and outer sides covered with 0.250 millimetres thick polyethylene sheeting weighted down with sand bags or other suitable weighting system.

c. A system reviewed and acceptable to the Contract Administrator that provides frost protection equivalent to 1.2 metres of straw or 1.8 metres of water..

E6.3 Source of water for frost protection and disposal of water shall be as indicated in specification Section 03300, Clause 3.15, Watertightness Testing.

E6.4 Straw used for frost protection shall be thoroughly cleaned up and disposed of off site.

## E7. WASTE CONTAINER

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 incidental to the Work and included in the Contact Price.

## E8. CONDITION, PROTECTION OF, AND ACCESS TO THE AQUEDUCT

E8.1 Condition of the Aqueduct

E8.1.1 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.

E8.2 Protection of the Aqueduct

E8.2.1 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.

E8.2.2 It is the Contractors' responsibility to ensure that all work crew members understand, observe, and work to the requirements of Specifications.

E8.3 Equipment Restrictions

E8.3.1 Equipment must cross the Aqueduct in a responsible and careful manner (i.e. slowly).

E8.3.2 Loads for PR 207 shall be limited to the weight restrictions in place for the road.

## E9. ENVIRONMENTAL PROTECTION

E9.1 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.

E9.2 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.

E9.3 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

E9.3.1 Federal

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

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

E9.3.2 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

E9.3.3 The Contractor is advised that the following environmental protection measures apply to the Work.

E9.3.4 Materials Handling and Storage

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

E9.3.5 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.

E9.3.6 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.

E9.3.7 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.

E9.3.8 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.

## E10. SHOP DRAWINGS AND PRODUCT DATA

Further to CW1110:

(a) 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.

(b) 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”.

(c) 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".

(d) 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.

(e) 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.

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

(g) 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.

(h) 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.

(i) 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.

(j) Shop Drawings will be returned to the Contractor with one of the following notations:

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

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

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

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

- 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.

(k) 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.

(l) 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.

(m) 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.

(n) 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.

(o) 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.

## E11. SITE RESTORATION

E11.1 The Contractor shall remove the temporary Site office and storage facilities prior to Total Performance being issued.

E11.2 The Contractor will be responsible for grounds restoration (seeding or sodding), as determined necessary by the Contract Administrator.

E11.3 The Contractor will be responsible for any damage caused by his forces on roadways or accesses.

# 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 require elevations for the base slab, slab thickenings and pile caps, void form and granular levelling pad.

.2 Supply and placement of 100 mm thick granular levelling material below the void form.

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

.4 Disposal of surplus excavated material.

.5 Dewatering of excavations.

### 1.2 Reference Standards

.1 Conform to requirements of the National Building Code (NBC) and the Canadian Construction Safety Code.

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

### 1.3 Shop Drawings

.1 Submit Shop Drawings in accordance with Specification E10.

.2 Submit Shop Drawings for shoring, bracing, and sheet piling required in connection with excavation for the Raw Water Pump Station (RWPS), in accordance with Specification E10, for review two (2) weeks prior to commencement of the Work.

.3 Employ a qualified Professional Engineer registered in the Province of Manitoba for the shoring, bracing, and sheet piling design and to prepare and seal the Shop Drawings.

### 1.4 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.

**1.5 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 American Society for Testing and Materials (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.

**1.6 Geotechnical Information**

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

.2 The Contractor should be aware that the surface soil condition in the excavations performed by the Bulk Excavation Contract, and subsequent contracts, may be soft.

**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 General

.1 Familiarization

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

.2 Review and understand the geotechnical information.

.2 Protection

.1 Before starting Work, locate all utilities crossing the Work Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.

.2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.

.3 During construction, maintain roadways in a clean and safe condition and, at the completion of the Contract, clean and restore all roads used to perform the Contract.

**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 registered surveyor. If displaced or lost, immediately replace to the acceptance of the Contract Administrator, at no additional cost to the City.

**3.3 Excavation**

.1 Submit excavation plan for the RWPS area sealed by qualified Professional Engineer registered in the Province of Manitoba to the Contract Administrator for review two (2) weeks prior to commencement of the Work.

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

.3 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 3.7 – Disposal.

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

.5 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.

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

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

.8 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.

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

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

**3.4 Shoring, Bracing, and Sheet Piling**

.1 Provide 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. The shoring, bracing, and sheet piling shall account for the yard piping to be connected to the RWPS Substructure.

.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.

**3.5 Dewatering**

.1 The Contractor shall be responsible for the control of surface drainage on the excavations completed by the Bulk Excavation Contract and subsequent contracts.

.2 Dewatering systems shall be designed to expeditiously remove water from the excavation until wall backfilling is completed.

.3 The dewatering systems must protect the subgrade soils from excessive softening and saturation. Perimeter slope cutoff ditching shall not extend beyond a 2 m distance from the edge of wall footings.

.4 All access roadways shall employ culverts as required for the Contractor's proposed excavation dewatering plan.

.5 The Contractor shall submit the proposed dewatering plan two (2) weeks prior to commencement of construction to the Contract Administrator for review and acceptance.

.6 All temporary ditching and water retention areas shall be lined with an impervious membrane to the satisfaction of the Contract Administrator.

.7 Discharge from pumps or other dewatering equipment shall be located and controlled such that loss, damage, nuisance, or injury to the Work does not result.

.8 Additional excavation made necessary by water in the excavation shall be at no additional cost to the City.

**3.6 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.**

## 3.7 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.

## 3.8 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 Coordinate delivery schedule of piles with the pile supplier (Lafarge Canada Inc.) and pick up and deliver piles from the pile supplier's yard to the Site to meet the Contractor's installation schedule. The Contract Administrator shall be the sole judge of the acceptability of supplied piles.

.2 Install precast concrete piles.

### 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 The Contractor should be aware that the surface soil condition in the excavations performed by the Bulk Excavation Contract may be soft.

.3 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 furnished under the Contract are full length piles as indicated, without cutting and splicing requirements. Contractor shall provide equipment to handle full length piles.

.2 The piles are fabricated and supplied as specified in **Section 02468 – Precast Concrete 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.

.4 Grout Seal: ENVIROPLUG No. 16 (No. 20) or accepted alternate, mixed in accordance with the Manufacturer's instructions.

## 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 Completely infill any air space between the wall of pre-bore hole and outside the pile for the full depth of pre-bore with grout seal. Application procedure for the grout seal shall be submitted to the Contract Administrator for review and acceptance prior to commencement of pile installation.

## 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 Re-strike already driven piles lifted during driving of adjacent piles to confirm and assure set.

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

.9 Cutoff 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:

.1 406 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 Pull out rejected piles and replace with new piles.

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

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

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

.5 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 Handling, transportation, and storage of 406 mm diameter precast concrete piles under this Contract.

.2 Piles have been fabricated by Lafarge Canada Inc. 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 E10.

.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 precast concrete piles to lengths determined in the fabrication schedule.

.2 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.

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

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

.5 Quantities and lengths of piles will be determined by Contract Administrator. Remove rejected piles from Site.

### 3.2 Handling and Storage

.1 Inspect the fabricated product 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.

.4 Provide lifting and handling equipment for loading of piles onto trucks for delivery to the Site.

**END OF SECTION**

**SUB-DRAINAGE**

## 1. GENERAL

### 1.1 Section Includes

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

### 1.2 Job Conditions

.1 Examination

.1 Visit the Site and note all characteristics and irregularities affecting the Work of this Specification.

.2 To proceed with the Work will mean acceptance of the conditions, and failure to comply with the above will in no way form the basis for any claim.

.2 Protection

.1 Use all means necessary to protect all materials of this Section before, during, and after installation.

.2 In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Contract Administrator and at no additional cost.

### 1.3 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.

### 1.4 Samples

.1 Submit samples in accordance with Specification E10.

.2 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.

.3 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.

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

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

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

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

**1.5 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 feet 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 offsite within the City limits 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 Structural Engineer, registered in the Province of Manitoba.

### 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 E10.

.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 Structural Engineer, registered in the Province of Manitoba.

.4 Formwork, falsework, and reshoring are to be reviewed by the same Professional Structural Engineer prior to each concrete pour.

.5 Professional Structural Engineer to report, in writing, that reviewed formwork, falsework, and reshoring are in accordance with the design prior to each concrete pour.

## 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 minimum of 2.4 kPa construction live load, until initial set. The installed thickness shall be 600 mm, the depth of collapse shall be a minimum of 250 mm. Acceptable product is Geospan by Plasti-Fab Ltd.

.2 Horizontal protection of void form shall be one (1) layer of 12.7 mm thick spruce plywood sheeting. 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: acceptable product is Zemdrain MD-2 by Dupont, complete with drainage profile on exterior surface of the form liner.

.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. 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 Examination**

.1 Before starting this Work, examine Work done by others which affects this Work.

.2 Notify the Contract Administrator of any conditions which would jeopardize proper completion of this Work.

.3 Commencement of Work implies acceptance of existing conditions.

**3.2 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.

## 3.3 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.

## 3.4 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.

## 3.5 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.

## 3.6 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 Structural 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.

## 3.7 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.

## 3.8 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.

## 3.9 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 wet with use of soaker hoses. Otherwise remove forms and start wet cure immediately by use of soaker hoses or accepted curing compound.

## 3.10 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 Structural 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 E10.

.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 Reinforcing Steel Institute of Ontario's (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: 400 R and 400 W 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 Examination**

.1 Before starting this Work, examine Work done by others which affects this Work.

.2 Notify the Contract Administrator of any conditions which would jeopardize proper completion of this Work.

.3 Commencement of Work implies acceptance of existing conditions.

**3.2 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.

## 3.3 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.

## 3.4 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 PVC 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 Neoprene waterstop expansion joint system

.13 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, edges wire looped for tying. Acceptable product is Wirestop CR-9380 by Paul Murphy.

.2 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) |

.3 All PVC waterstop material shall be Arctic Grade.

.4 PVC waterstop joints (tees, crosses, and L's) shall be mitered and welded.

.5 Expansive Waterstop: acceptable products are SikaSwell S Sealant by Sika and CS-231 Controlled Expansion Waterstop by ConSeal Concrete Sealants.

.6 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 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.

.10 Neoprene bearing pads and strips Grade 75 Durometer A.

.11 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 E10.

.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 wet cured in accordance with **Section 03300 – Cast-in-Place Concrete.**

.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 All joints other than straight butt joints shall be plant fabricated by the waterstop Supplier.

.3 Install waterstop continuous without displacing reinforcement. Butt weld splices to Manufacturer’s directions. Secure in place to prevent dislodgment during placing of concrete. All field splices to 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 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 Qualifications

.1 Concrete flatwork finishing is to be done by an established firm having at least five (5) years of proven, satisfactory experience in this trade and employing skilled personnel.

.2 Submit proof of qualifications in writing to the Contract Administrator.

### 1.4 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 Strengths

.1 Normal-density concrete:

.1 Type A: 35 MPa

.2 Type B: 30 MPa

.3 Type C: 15 MPa

.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.

## 1.5 Submittals

.1 Drying shrinkage Test

.1 Drying Shrinkage Tests:

.1 Perform laboratory trial mixes of concrete used on project. Make two (2) sets of three (3) specimens for each shrinkage test.

.2 Prism Specimen Size: 100 by 100 mm by approximately 280 mm with effective gauge length of 250 mm.

.3 Specimens: fabricate, cure, dry, and measure as specified in ASTM C157 modified as follows:

.1 Remove specimens from molds aged 23 hours, ± 1 hour after trial batching.

.2 Place immediately in water at 22.8° C ± 2° C for at least 30 minutes.

.3 Measure within 30 minutes thereafter to determine original length and then submerge in saturated limewater at 22.8° C, ± 2° C.

.4 Measure specimens at age seven (7) days to determine expansion expressed as percentage of original length. Length at age seven (7) days shall be base length for drying shrinkage calculations (zero days drying age).

.5 Store specimens immediately in humidity control room maintained at 22.8°C, ± 2° C and 50%, ± 4% relative humidity for remainder of test.

.6 Measure to determine shrinkage expressed as percentage of base length and report separately for 7, 14, 21, and 28 days of drying after seven (7) days of moist curing.

.4 Computing Drying Shrinkage Deformation: Deformation of Each Specimen:

.1 Difference between base length (at zero days-drying age) and length after drying at each test age.

.2 Compute average drying shrinkage deformation to nearest 0.001% at each test age.

.3 If drying shrinkage of any specimen departs from average of that test age by more than 0.004%, disregard results obtained from that specimen.

.2 Concrete Shrinkage at 28 Day Drying Age: 0.040% maximum for laboratory trial mixes of proposed concrete for construction. If shrinkage specimen tests for concrete exceed shrinkage limits modify concrete mix to reduce shrinkage.

.3 Carry out shrinkage test for each Type A concrete as follows as applicable:

.1 40 mm aggregate with or without superplasticizer (two (2) tests).

.2 20 mm aggregate with or without superplaticizer (two (2) tests).

.2 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.

## 1.6 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 will 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 and to the satisfaction of the Contract Administrator.

## 2. PRODUCTS

### 2.1 General

.1 All materials that will come in contact with potable water shall meet the requirements of National Sanitary Foundation (NSF) 60/61.

### 2.2 Materials

.1 Portland Cements/ Blended Hydraulic Cements

.1 Type: MSb: CSA A 3001. No flyash permitted.

.2 Aggregates

.1 Normal-density Concrete

.1 Coarse aggregate: CSA A23.1; rough and angular gravel or crushed stone.

.2 Fine aggregate: CSA A23.1; natural sand.

.3 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.

.3 Admixtures

.1 Compatible with each other and with other concrete materials.

.2 Use products that are certified for potable water in construction of potable water structures.

.3 Calcium chloride, thio-cyanates, or admixtures containing more than 0.05% chloride ions are not permitted.

.4 Air-entraining admixture: ASTM C260; non-detergent type.

.5 Water-reducing admixtures: ASTM C494; Type A.

.6 Set-retarding admixture: ASTM C494; Type B.

.7 Superplasticizing admixture: ASTM C494; Type F 1 or G 2 ASTM C1017, Type 1 or 2.

.8 Corrosion inhibitor: ASTM C494; Type C; DCI by:

.1 W.R. Grace Co. of Canada Ltd.

.2 Rheocrete CNI by Master Builders Technologies, Ltd..

.4 Water: CSA A23.1; clear and free from oil, acid, alkali, organic matter, or other deleterious substances with a maximum soluble chloride ion content of 0.10% by weight.

.5 Floor hardener

.1 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.

.6 Materials are to be obtained from the same source of supply or Manufacturer for the duration of the project.

## 2.3 Accessories

.1 Curing Sealer: sodium silicate, Miracle Kote or accepted alternate.

.2 Moisture Retention Film: Master Builders Confilm or accepted alternate.

## 2.4 Concrete Mixes

.1 General

.1 Establish proportions of cementing materials, aggregates, water, and admixtures required to produce consistent workable concrete that is watertight, durable concrete with strength and other properties specified. Comply with clause 14.6-CSA A23.1-00 Volume Stability Considerations.

.2 Use same type and brand of cement throughout.

.3 Comply with and allow for the supplier's Standard Deviation as specified in CSA A23.1, Clause 17.6 – Compressive Strength Requirements. If the concrete supplier has no established Standard Deviations for concrete of the specified strengths, use a value of 4 MPa minimum.

.4 Provide all concrete with types of cement – subjected to moderate degree of sulphate attack.

.5 Use high-slump concrete by addition of superplasticizing admixture for walls and columns.

.2 Types of Normal-density Concrete

.1 Type A: concrete for liquid holding/containment structures, containing reinforcing bars, unless specified otherwise.

.2 Type B: concrete for structures, containing reinforcing bars, unless specified otherwise.

.3 Type C: fill concrete unless specified otherwise.

.3 Mixes for Normal-density Concrete

.1 Cementing Materials Content

.1 Except where higher quantities are needed to meet strength or other requirements, provide the following minimum cementing materials contents

.1 Type A: 370 kg/$m^3$, for nominal 20 to 5 mm coarse aggregate

.2 Type A: 340 kg/$m^3$, for nominal 40 to 5 mm coarse aggregate

.3 Type B: 330 kg/$m^3$

.4 Type C: 180 kg/$m^3$

.2 Where higher quantity of cementing materials are provided, do not exceed the amount of cementing materials greater than 1.10 times the minimum quantity specified above.

.2 Coarse Aggregates

.1 Nominal size 40 to 5 mm, unless noted otherwise.

.2 Nominal size 20 to 5 mm, for walls less than 200 mm thick, slabs less than 150 mm thick, beams, slabs with monolithic beams, columns, and Type B and Type C concrete.

.3 Nominal size 10 to 2.5 mm, for concrete in steel pans.

.3 Water/Cementing Materials Ratio (W/C)

.1 Unless specified otherwise: 0.43 maximum

.2 High-slump concrete: 0.40 maximum

.3 Type C concrete: as required for strength and workability

.4 Slump

.1 Provide slump consistent with placement, consolidation methods equipment and site conditions. Ensure concrete do not segregate during placement. Comply with CSA A23.1-00.

.5 Air Content

.1 Comply with CSA A23.1-00, Table 10 – Requirements for the Air Content Categories Specified in Table 12 and 14.

.2 Provide air content category 2, unless noted otherwise.

.3 Provide air content category 1 for loading bays, parking areas, and liquid holding structures.

.4 Provide 3% maximum air content for concrete forming floors where floor hardener is used.

.6 Admixtures

.1 Use water-reducing admixture as necessary.

.2 Use superplasticizing admixture with a retarder when requirements of CSA A23.1-00, Clause 21.1.9.1 – Hot-Weather Curing are applicable.

.4 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 to cementitious materials ratio.

.5 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 batch.

.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.

.6 Self-compacting concrete mixes will not be permitted for use on this project.

## 3. EXECUTION

### 3.1 Examination

.1 Before starting this Work examine Work done by others that affects this Work.

.2 Notify the Contract Administrator of any conditions that would jeopardize proper completion of this Work.

.3 Commencement of Work implies acceptance of existing conditions.

## 3.2 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 Concrete shall be placed within one and a half (1.5) hours 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.

## 3.3 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.

## 3.4 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.

## 3.5 Concrete Protection for Reinforcement

.1 Ensure reinforcement is placed to provide minimum concrete cover in accordance with **Section 03200 – Concrete Reinforcement.**

## 3.6 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.

## 3.7 Finishing Slab Surfaces

.1 Finish all slab surfaces conforming to CAN/CSA-A23.1-00, Clause 22 and as specified below.

.2 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.

.3 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.

.4 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.

## 3.8 Floor Hardener

.1 Pump Room floor and Valve Chamber floor shall receive floor hardener:

.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.

## 3.9 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 wet with soaker hoses.

.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 Deacon Booster Pumping Station (DBPS).

## 3.10 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.

## 3.11 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.

## 3.12 Equipment Pads and Cast in Metal Frames

.1 Provide 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.

## 3.13 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.

## 3.14 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.

## 3.15 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.

## 3.16 Watertightness Testing

.1 All water retaining structures shall be watertight and all precautions shall be taken, especially joint treatment, to construct watertight structures.

.2 Notify the Contract Administrator at least two (2) working days before commencing the watertightness test.

.3 The structures, when full, shall be reviewed over a forty-eight (48) hour period for leakage including monitoring of visible leaks and testing for leaks by measurement. Each compartment or cell shall be tested independently.

.4 Filling the structures in preparation of the watertightness test shall be performed only after the wall concrete has attained 100% of the design strength and may be performed prior to roof construction. Fill the tanks with clean water forty-eight (48) hours prior to the watertightness test to allow for full saturation of the concrete.

.5 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 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 the watertightness testing will be supplied by the City, from the DBPS.

.6 The Contractor shall measure leakage during next forty-eight (48) hour period. The measurements shall be witnessed by the Contract Administrator. With the water at maximum operating level for forty-eight (48) hours, there shall be no visible moisture or wetness on areas that will be seen or backfilled and the leakage measured over a period of twenty-four (24) hours shall not exceed 0.10% of the water volume in the test period.

.7 Locate and repair all leaks until all leakage is remedied and repeat the forty-eight (48) hour watertightness test following each repair operation, at no additional cost to the City.

.8 All water used for retesting shall be supplied by the City as outlined in Paragraph 5 above. Disposal of the water for the initial test and all retests shall be overland on site as directed by the Contract Administrator and shall be at the Contractor's expense.

## 3.17 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.

## 3.18 Clean-Up

.1 As Work progresses and at the completion of Work, remove from Site all debris, excess materials, and equipment.

**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 Clause 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 E10.

.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 Fisholoid 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 Examination

.1 Before starting erection, examine Work done under other Sections which may affect the Work.

.2 Notify the Contract Administrator of any conditions which would jeopardize proper installation of the Work.

.3 Commencement of erection Work implies acceptance of existing conditions.

### 3.2 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 Provide two (2) hold-down clips at each end of the panels if not detailed on the Drawings.

.9 Provide 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**

**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 International (NSF): 61, Drinking Water System Components-Health Effects.

.2 Steel Structures Painting Council (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

### 1.2 Definitions

.1 Terms used in this Section:

.1 Coverage: total minimum dry film thickness in mils, or square metres per litre

.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 PSDS, and paint colours available (where applicable) for each product used in the paint system, except for products applied by equipment manufacturers. The PSDS form is appended to the end of this section.

.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 (1) 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 dew point of ambient air.

## 1.7 Special Guarantee

.1 Furnish Manufacturer's extended guarantee or warranty, with the City named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the City, removal and replacement of Work specified in this Specification section found defective during a period of two (2) years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the General Conditions.

## 2. PRODUCTS

### 2.1 Manufacturers

.1 Carboline Coatings Company, St. Louis, MO

.2 ICI Devoe, Louisville, KY

.3 Ameron Protective Coatings, Brea, CA

.4 Benjamin Moore Paints, New York, NY

.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

### 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 Preparation**

.1 Notify 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 Contract Administrator's 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.

## 3.2 Preparation of Surfaces

.1 Metal Surfaces:

.1 Meet requirements of the following SSPC Specifications:

.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 Brush-Off Blast Cleaning: SP 7

.6 Near-White Blast Cleaning: SP 10

.7 Power Tool Cleaning to Bare Metal: SP 11

.8 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.

## 3.3 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 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 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 mL 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 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 thickness 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 thickness. 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 Contract Administrator has inspected surface or coating. Replace staging removed prior to approval by Contract Administrator.

## 3.4 Field Quality Control

.1 Testing Gauges:

.1 Provide a magnetic type dry film thickness gauge to test coating thickness specified in mils, 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.

## 3.5 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 Site inspection visits, each for a minimum of four (4) hours, in order to provide Manufacturer's Certificate of Proper Installation.

.3 As required to resolve field problems attributable to, or associated with the Manufacturer's product.

## 3.6 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.

## 3.7 Protective Coatings Systems

.1 System No. 1 Submerged Metal-Potable Water:

| Surface Prep. | Paint Material | Min. Coats, Cover |
|---|---|---|
| Abrasive Blast | 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 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 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, 0.05mm MDFT (2 mils MDFT) |
| | Alkyd Enamel | 2 coats, 0.1mm 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, 0.01mm 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.

.6 Install control valves, control dampers, thermal wells, and other devices on piping and ducts, furnished by Controls Contractor.

.7 'Provide' shall mean; 'supply and install'.

### 1.2 Coordination of Work

.1 Cooperate and coordinate with other trades on the project.

.2 Make reference to electrical, mechanical, structural and architectural drawings when setting out Work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Jointly work out all conflicts on-site before fabricating or installing any materials or equipment.

.3 Where dimensional details are required, work with the applicable architectural and structural drawings.

.4 Full size and detailed drawings shall take precedence over scale measurements from Drawings. Drawings shall take precedence over Specifications.

.5 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, provide equivalent nominal Imperial sized pipe as indicated in the table, and provide at no extra cost adapters to ensure compatible connections to all metric sized fittings, equipment and piping.

.2 When CSA approved SI Metric pipes are provided, the Contractor shall provide 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 in.

## 1.4 Drawings and Specifications

.1 Drawings and Specifications are complementary each to the other, and what is called for by one (1) shall be binding as if called for by both.

.2 Should any discrepancy appear between Drawings and Specifications which leaves the Contractor in doubt as to the true intent and meaning of the plans and specifications, obtain a ruling from the Contract Administrator, before submitting a Tender. If this is not done, it will be assumed that the most expensive alternate had been included.

.3 Examine all Contract documents, including all Drawings and Specifications, and Work of other trades to ensure that Work is satisfactorily carried out without changes to building.

## 1.5 Shop Drawings

.1 Provide printed copies of Shop Drawing, in accordance with Contract Documents**,** 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. Operating and Maintenance (O&M) Manuals are not suitable submittal material.

.3 Clearly mark submittal material using arrows, underlining or circling to show differences from specified, i.e., 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.

## 1.6 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 Obtain written approval from the Contract Administrator before cutting or burning structural members.

.4 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).

.5 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.

## 1.7 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.

## 1.8 Miscellaneous Metals

.1 Provide all necessary miscellaneous 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.

## 1.9 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 – General**.

.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 – NOT APPLICABLE

## 3. EXECUTION – 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 American National Standards Institute (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 American Society for Testing and Materials (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 Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (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 American Water Works Association (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 Cast Iron Soil Pipe Institute (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 15100-02 – Data Sheet-Cast Iron Soil Pipe and Fittings**

.2 **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.

## 3.3 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 Provide cleanouts where shown and where required by code.

## 3.4 Interim Cleaning

.1 As specified in **Section 15200-000 – Process Piping—General.**

## 3.5 Testing

.1 As specified in **Section 15200-000 – Process Piping—General.**

## 3.6 Cleaning

.1 As specified in **Section 15200-000 – Process Piping—General**.

## 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 Completion.

**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**

**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 American National Standards Institute (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 American Society of Mechanical Engineers (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 American Society for Nondestructive Testing (ASNT): SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.

.4 American Society for Testing and Materials (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 Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (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 “Fiberglass” (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 "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

.53 D3222, Standard Specification for Unmodified Poly(Vinylidene 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 Polyethylene 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 American Water Works Association (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 C213, Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

.12 C606, Grooved and Shouldered Type Joints

.13 M11, Steel Pipe - A Guide for Design and Installation

.6 American Welding Society (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 National Fire Protection Association (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 Board of Labour Regulations

.2 Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

## 1.4 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 Thrust Blocks: concrete quantity, bearing area on pipe, and fitting joint locations

.4 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 Non-destructive 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 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 Thrust Tie-Rod Assemblies: NFPA 24: tie-rod attachments relying on clamp friction with pipe barrel to restrain thrust are unacceptable.

.5 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.

.6 Flexible Mechanical Compression Joint Coupling:

.1 Stainless steel, ASTM A276, Type 305 bands.

.2 Manufacturers:

.1 Pipeline Products Corp.

.2 Fernco Joint Sealer Co.

.7 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 Thrust Blocks

.1 Concrete: As specified in **Section 03300 – Cast-in-Place Concrete**.

## 2.6 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.

## 2.7 Finishes

.1 Factory prepare, prime, and finish coat in accordance with Pipe Data Sheet(s) and Piping Schedule.

.2 Galvanizing:

.1 Hot-dip applied, meeting requirements of ASTM A153.

.2 Electroplated zinc or cadmium plating is unacceptable.

# 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 1 inch, 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.

## 3.5 Pipe Coatings

.1 Provide internal epoxy coating and lining on piping when indicated on the piping data sheet(s).

.2 Coat the exterior of all carbon steel piping with an epoxy coating, except that exterior surfaces of steel piping that are fully encased in concrete do not require external coating.

.3 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.

.4 Before applying coatings and linings to metal piping, grind and round off all sharp edges, maximum radius of edges: 6mm.

.5 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**.

.6 Colour of top coat: white

## 3.6 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 Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other Work.

.3 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.

## 3.7 Installation-Buried Pipe

.1 Joints:

.1 Dissimilar Buried Pipes: provide 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, provide:

.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.

## 3.8 Installation – Concrete Encased

.1 Provide 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, provide flexible piping joints to coincide with structure joints to prevent excessive pipe stress and breakage.

## 3.9 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.

.4 Thrust Blocking:

.1 Place between undisturbed ground and fitting to be anchored.

.2 Quantity of Concrete: sufficient to cover bearing area on pipe and provide required soil bearing area as shown.

.3 Place blocking so that pipe and fitting joints will be accessible for repairs.

.4 Place concrete in accordance with **Section 03300 – Cast-In-Place Concrete**.

## 3.10 Pipe Sleeves

.1 Refer to **Section 15010 – General Mechanical Provisions**.

## 3.11 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 250 psi.

.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.

## 3.12 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 threadolet or half-coupling as specified on Piping Data Sheet.

.3 Limitations: threaded taps in pipe barrel are unacceptable.

## 3.13 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.

## 3.14 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.

## 3.15 Testing

.1 General:

.1 Conduct pressure and leakage tests on newly installed piping.

.2 Provide necessary equipment and material and make taps in pipe, 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 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.

.4 Hydrostatic Leak Tests:

.1 Equipment: Provide 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 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 Contract Administrator.

.3 Buried Water Lines:

.1 A limited amount of leakage is permissible according to the formula specified.

.2 Conduct hydrostatic testing as follows:

.1 Pipe with Concrete Thrust Blocking: Do not make the pressure test until a minimum of five (5) days after the thrust blocking is installed.

.2 If high-early strength cement is used for thrust blocking, the time may be reduced to two (2) days.

.3 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.

.4 Expel air from piping system prior to testing.

.5 Apply and maintain specified test pressure with hydraulic force pump.

.6 Valve off the piping system when test pressure is reached.

.7 Conduct pressure test for two (2) hours, reopening isolation valve only as necessary to restore test pressure.

.8 Accurately measure amount of water required to maintain test pressure by placing pump suction in a barrel or similar device, or by metering.

.9 The measurement represents leakage, defined as the quantity of water necessary to maintain the specified test pressure for the duration of the test period.

.10 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.

.11 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.

.5 Pneumatic Leak Tests:

.1 Perform on compressed air, natural gas, and vacuum piping.

.2 Equipment: Provide 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 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 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.

## 3.16 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.

## 3.17 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.

## 3.18 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 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 additional welds for each tracer examination found to be unsatisfactory.

## 3.19 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 |
| -13 | Copper and Copper Alloy Pipe, Tubing, and Fittings |

**END OF SECTION**

**PIPING SERVICE LEGEND**

**SERVICE**

| | |
|---|---|
| DRA | Drainage (Floors) |
| DRN | Drains (Clean Drains) |
| LTS | Level Transmitter Sleeve |
| RW | Raw Water |
| TP | Trap Primer |

**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 |
| FRPX | 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 |
| PSTL | PVDF-Lined Steel |
| PVC | Polyvinyl Chloride |
| PVDF | Polyvinylidene Fluoride |
| RCP | Reinforced Concrete Pipe |
| RSTL | Rubber-Lined Steel |

**PIPING SERVICE LEGEND**

| | |
|---|---|
| SST | Stainless Steel |
| STL | Steel |
| VC | Vitrified Clay Pipe |

**PRESSURE TEST**

| | |
|---|---|
| H | Hydrostatic |
| I | In Service |
| P | Pneumatic |
| NA | Not Applicable |

**END OF SECTION**

# PIPING SCHEDULE

| Service | Commodity Abbreviation | Nominal Size(s) (mm) | Exposure[2] | Piping Material[2] | Specification Section | Test Type and Pressure (kPa)[1] | Remarks |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Raw Water | RW | 300, 450, 900 | EXP | Epoxy coated/lined steel | 15200-03 | H, 500 | Raw water supply to the WTP. |
| Raw Water | RW | 1350 | EXP | Epoxy coated/lined steel | 15200-04 | H, 500 | Raw water supply to the WTP. |
| | | | | | | | |
| Sanitary Drain | DRA | 100 | EXP/ ENC | CI | 15100-02 | N/A | Test per requirement of Plumbing Code |
| Sump Pump Discharge | DRN | 75 | EXP/ BUR | Epoxy coated/lined steel | 15200-03 | H, 500 | RWPS Valve Chamber |
| Trap Primer | TP | All | EXP/ BUR | COP | 15200-13 | H, 1000 | 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.

**DATA SHEET – CARBON STEEL PIPE AND FITTINGS-GENERAL SERVICE**

| Item | Size | Description |
|---|---|---|
| Pipe | All | Black carbon steel, ASTM A106, Grade B seamless or ASTM A53, Grade B, or AWWA C200-91, 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 900 mm | Standard weight (9.5 mm min. wall thickness). |
| Joints | 40 mm & smaller | Threaded or flanged at valves and equipment or grooved end meeting the requirements of AWWA C606. |
| | 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: 68- or 2070 kPag malleable iron, ASTM A197 or ASTM A47, dimensions in accordance with ANSI B16.3.<br>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. |
| | 50 mm & larger | 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.<br>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.<br>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. |
| | 50 mm & larger | Butt-welding or grooved end tee in conformance with Fittings specified above. |

**DATA SHEET – CARBON STEEL PIPE AND FITTINGS-GENERAL SERVICE**

| Item | Size | Description |
|---|---|---|
| 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 AWAWA C207, Class D slip-on with serrated finish. Provide flat-faced flanges when mating with flat-faced valves and fittings.<br>Grooved End Adapter Flange: Malleable iron ASTM A47 or ductile iron ASTM A536. Victaulic; Grinnell. |
| Blind Flanges | All | |
| 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.<br>Screwed End: Malleable iron, ASTM A197 or A47. |
| Bolting | Exposed piping | Flanges: Carbon steel ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts. Use 3 mm undersize bolting material for insulating flanges.<br>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 thru 450 mm | Black neoprene, 3 mm thick, ring type for RF flanges, full face for flat face flanges. |
| | 500 mm and larger | Black neoprene, 6 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. |
| | All | Flange insulation gaskets …. |
| Thread Lubricant | 40 mm & smaller | General Service: Teflon tape. |

Notes:

1. When indicated in the Piping Schedule, provide internal/external epoxy coating as specified.
2. Do not use threaded connections on epoxy coated pipe. For small tappings such as vents, drains and gauge connections, provide a 50 mm flanged nozzle with a coated blind flange tapped to the size of the required connection.

**END OF SECTION**

**DATA SHEET – CARBON STEEL PIPE AND FITTINGS – LARGE DIAMETER**

| Item | Size | Description |
|---|---|---|
| Pipe | All | Black carbon steel, ASTM A139, Grade B; ASTM A283, Grade D; ASTM A570, Grade 33 or AWWA C200-91. |
| | Welded and grooved: | |
| | 1050 mm | 1067 mm outside diameter, 9.5 mm min. wall thickness |
| | 1200 mm | 1219 mm outside diameter, 9.5 mm min. wall thickness |
| | 1350 mm | 1391 mm outside diameter, 9.5 mm min. wall thickness |
| | 1500 mm | 1543 mm outside diameter, 9.5 mm min. wall thickness |
| | 1800 mm | 1854 mm outside diameter, 12.7 mm min. wall thickness |
| | 2100 mm | 2162 mm outside diameter, 14.3 mm min. wall thickness |
| Joints | All | Butt-welded or flanged at valves and equipment, or grooved end meeting the requirements of AWWA C606. |
| Fittings | 1050 mm to 2100 mm | 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.<br><br>As an alternative, mitred fittings may be used. Wall thickness, material and pipe outside diameter to equal pipe being joined. Reinforce fittings to match pressure rating of pipe being joined to ANSI B31.3 and AWWA M11.<br><br>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. Provide Type "D" Vic-ring.<br><br>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. |
| Flanges | 1050 mm to 2100 mm | Steel, AWWA C207, Class D, ANSI B16.5, Class 125, slip-on, flat faced, serrated finish.<br><br>Cast Iron Mating Flange: AWWA C207, Class D, hub type, flat faced, ANSI B16.1, Class 125 drilling. |
| Blind Flanges | All | |
| Bolting | Exposed piping | Flanges: Carbon steel ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts. Use 3 |

| Item | Size | Description |
|---|---|---|
| | | mm undersize bolting material for insulating flanges.<br><br>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: 6.4 mm thick, black neoprene, full face type.<br><br>Grooved Couplings: EPDM per ASTM D2000 for water and air to 110°C. |

Notes:

1. For piping 900 mm and smaller follow Specification 15200-03.
2. When indicated in the Piping Schedule, provide internal/external epoxy coating as specified.
3. Do not use threaded connections on epoxy coated pipe. For small tappings such as vents, drains and gauge connections, provide a 50 mm flanged nozzle with a coated blind flange tapped to the size of the required connection.
4. Design and install pipe in accordance with AWWA M11, Steel Pipe – A Guide for Design and Installation.

**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:<br>Oxygen service.....Type K, hard drawn<br>Water (buried) .....Type K, soft or hard temper<br>Water (exposed) .....Type L, hard drawn<br>Domestic hot water.....Type L, hard drawn<br>Compressed air service.....Type L, hard drawn<br>Refrigerant service .....Type L, hard drawn<br>P-Trap priming service.....Type L, soft temper<br>P-Trap priming service (buried).....Type K, soft or hard temper<br>Sample line service.....Type L, hard drawn<br>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.<br>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.<br>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.<br>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 | Oxygen Service: Silver brazing alloy, 15% silver content, 640°C to 700°C melting range, conforming to AWS A5.8. |
| | 75 mm and smaller | Other Services:<br>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**

**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 American Society of Mechanical Engineers (ASME)

.2 Canadian Standards Association CSA/CSA Label on Fixtures

.3 Plumbing and Drainage Institute (PDI):

.1 Code Guide 302 and Glossary of Industry Terms

.4 Underwriters Laboratories (UL)

.5 Underwriters Laboratories of Canada (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 Drainage Products:

.1 General:

.1 Smith

.2 Zurn

.3 Watts

## 2.2 General

.1 Fixture Trim: provide 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

## 2.3 Materials

.1 Drainage Products:

.1 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

.2 Floor Drain Traps:

.1 Provide Dura-coated cast iron traps with floor drain fixtures, complete with trap primer connection, as required, Zurn Z1000.

# 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 Drainage Products:

.1 Floor Drains: set top flush with floor. Provide 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**