

1.1 RELATED REQUIREMENTS

Section 31 23 10 – Excavation and Backfill

1.2 MEASUREMENT PROCEDURES

- .1 Measure excavation and backfill in accordance with Section 31 23 10 – Excavation and Backfill.
- .2 Measure manholes in units installed of the appropriate size.
- .3 Payment includes supply and transportation of all labour, equipment and material, excavation, installation, manhole, frame and cover, cutting of pipes, gaskets, couplings, fittings including plugs and caps, grout, connections, dewatering, bedding, compaction, backfilling, leakage testing, adjustments, trench restoration and maintenance, environmental protection, clean-up and all work incidental thereto, all as specified or as shown on the drawings, or as laid out by the Engineer-Architect. For manholes installed, this shall also include stand-by equipment and personnel, and all other related work and services.

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A48/A48M-03(2012), Standard Specification for Gray Iron Castings.
 - .2 ASTM A123/A123M-2012, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM C117-13, Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C139-11, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .6 ASTM C478M-13, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
 - .7 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 CSA Group
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A165 Series-04(R2009), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
 - .3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

- .4 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for manholes structures and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 - Quality Control.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store in accordance with manufacturer's recommendations.
 - .2 Store and protect manholes and catch basin structures from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .3 Packaging Waste Management: remove for reuse and return packaging materials as specified in Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Precast manhole units: to ASTM C478M, circular or oval.
 - .1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
 - .2 Precast base sections with reinforced concrete slab within:
 - .1 Rubber gaskets to suit the inlet and outlet pipes and factory installed benching.
 - .3 Approved product: L.E. Shaw Ltd., Strescon or approved equal.
- .2 Joints between sections: rubber gasket and Ram-Nek gasket and meeting the requirements of the latest CSA A257.3.
- .3 Frames, gratings, covers to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames.
 - .1 Frame with grating or cover to constitute one unit.
 - .2 Assemble and mark unit components before shipment.

- .3 All castings must have a permanent marking, identifying the manufacturer and make or model number of the casting, and coated with two applications of asphalt varnish.
- .2 Standard manhole frames and covers: 411W cast iron meeting the requirements of the latest ASTM Standard A-48, Class 30. Covers: snug fit and rattle free.
 - .1 Manhole 411W frame outside flange to be 870mm dia., with a 580mm cover opening, and a min. weight of 95.3 kg.
 - .2 Manhole 411W solid cover to be 575mm dia., with a min. of four ribs, two - 25mm lift holes, and a min. weight of 43.1 kg.
 - .3 Manhole 411W perforated cover to be 575mm dia., with 95mm x 30mm perforations, two – 25mm lift holes, and a min. weight of 52.2 kg.
- .4 Granular bedding and backfill: in accordance with Section 31 23 10 – Excavation and Backfill.
- .5 Backfill material: in accordance with Section 31 23 10 – Excavation and Backfill.
- .6 Pipe perforations:
 - .1 All pipe perforations through the concrete floor be sealed with a watertight seal. Standard or acceptance: Link-Seal, Proco Pen-Seal or approved equal.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for manholes installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Engineer-Architect.
 - .2 Inform Engineer-Architect of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer-Architect.

3.2 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 10 – Excavation and Backfill.

3.3 INSTALLATION

- .1 Construct manholes of pre-cast concrete sections according to drawing details.
- .2 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .3 Complete units as pipe laying progresses.
- .4 Dewater excavation to approval of Engineer-Architect and remove soft and foreign material before placing concrete base.

- .5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 95% maximum density to ASTM D698.
- .6 Compact granular backfill to 95% maximum density to ASTM D698.
- .7 Set frame and cover on top section to elevation as indicated.
 - .1 Paved roadways: 10 mm below finished grade and conforming to crown of road.
 - .2 Gavel roadways: 25 mm below finished grade.
 - .3 Off traveled roadways: 50 to 100 mm above finished grade.
 - .1 Include lock-down frame and cover.
 - .1 Approved product: R12S or approved equal.
 - .4 If adjustment required use concrete ring.
- .8 Clean units of debris and foreign materials.
 - .1 Remove fins and sharp projections.
 - .2 Prevent debris from entering system.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 20 00 - Concrete Reinforcing
- .2 Section 31 23 10 – Excavation and Backfill

1.2 MEASUREMENT AND PAYMENT

- .1 Measure excavation and backfill in accordance with Section 31 23 10 – Excavation and Backfill.
- .2 Measure water main in metres of each size of pipe installed.
 - .1 Horizontal measurement will be made over surface, through valves and fittings, after work has been completed.
 - .2 Payment shall include the supply and transportation of all labour, equipment and materials, excavation, dewatering, supply and installation of all pipe and fittings including supply and installation of joint restraint systems, thrust blocks and anchors and all corrosion protection including poly wrap, bedding, backfilling, compaction, marker tape, protection of adjacent services and structure, traffic control, swabbing, chlorination disinfection points, testing, flushing and disinfection, removal and disposal of excess material, removal of disinfection points, shop drawings, clean-up, trench restoration and maintenance, and all work incidental thereto, all as specified or as shown on the Drawings or as laid out by the Engineer-Architect.
- .3 Measure valves in units installed.
 - .1 Payment includes supply and transportation of all equipment, labour and material, excavation, dewatering, installation, mechanical joint restraints, tee bolts and nuts, polyethylene wrap, valve, valve box and cover, valve box adjustments, valve box adaptor, stem extension as required, bedding, backfilling, compaction, trench restoration and maintenance, shop drawings, clean-up and all work incidental thereto, all as specified or as shown on the drawings or as laid out by the Engineer-Architect.

1.3 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-10, Standard for Hypochlorites.
 - .2 ANSI/AWWA B301-10, Standard for Liquid Chlorine.
 - .3 ANSI/AWWA B303-10, Standard for Sodium Chlorite.
 - .4 ANSI/AWWA C104/A21.4-08, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - .5 ANSI/AWWA C105/A21.5-10, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

- .6 ANSI/AWWA C111/A21.11-07, American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.
 - .7 ANSI/AWWA C110/A21.10-08, American National Standard for Ductile-Iron and Gray Iron Fittings for Water.
 - .8 ANSI/AWWA C150/A21.50-08, Standard for Thickness Design of Ductile-Iron Pipe.
 - .9 ANSI/AWWA C151/A21.51-09, Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - .10 ANSI/AWWA C153/A21.53-11, Standard for Ductile-Iron Compact Fittings.
 - .11 ANSI/AWWA C200-05, Standard for Steel Water Pipe - 6 Inch (150 mm) and Larger.
 - .12 ANSI/AWWA C203-08, Standard for Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 - .13 ANSI/AWWA C205-07, Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch (100 mm) and Larger - Shop Applied.
 - .14 ANSI/AWWA C206-11, Standard for Field Welding of Steel Water Pipe.
 - .15 ANSI/AWWA C207-07, Standard for Steel Pipe Flanges for Waterworks Service, 4 Inch through 144 Inch (100 mm through 3,600 mm).
 - .16 ANSI/AWWA C208-07, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
 - .17 ANSI/AWWA C300-11, Standard for Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
 - .18 ANSI/AWWA C301-07, Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
 - .19 ANSI/AWWA C303-08, Standard for Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
 - .20 ANSI/AWWA C500-09, Standard for Metal-Seated Gate Valves for Water Supply Service.
 - .21 ANSI/AWWA C504-10, Standard for Rubber-Seated Butterfly Valves.
 - .22 ANSI/AWWA C600-10, Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.
 - .23 ANSI/AWWA C602-11, Standard for Cement-Mortar Lining of Water Pipelines - 4 Inch (100 mm) and Larger.
 - .24 ANSI/AWWA C651-05, Standard for Disinfecting Water Mains.
 - .25 ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.
 - .26 ANSI/AWWA C900-07, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.
- .2 ASTM International
- .1 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

- .2 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- .4 ASTM B88M-05(2011), Standard Specification for Seamless Copper Water Tube Metric.
- .5 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .6 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .7 ASTM C478M-11, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
- .8 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .9 ASTM D2310-06, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
- .10 ASTM D2657-07, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
- .11 ASTM D2992-06, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.
- .12 ASTM D2996-01(2007)e1, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
- .13 ASTM F714-10, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .14 ASTM C618-08a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .3 CAN/CGSB-34.1-94, Pipe, Asbestos Cement, Pressure.
 - .4 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.
- .4 CSA International
 - .1 CAN/CSA-A257 Series-09, Standards for Concrete Pipe (Consists of A257.0, A257.1, A257.2, A257.3 and A257.4).
 - .2 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .3 CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CAN/CSA-B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.2 CAN/CSA-B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.4 CSA G30.18-09, Carbon and Steel Bars for Concrete Reinforcement.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Pipe certification to be on pipe.

.3 Samples:

.1 Inform Engineer-Architect of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.

.2 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 4 weeks minimum prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material.

.1 Include top of pipe, horizontal location of fittings and type, valves and valve boxes.

.3 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, valve boxes and fittings for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect water distribution piping from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Engineer-Architect.

- .3 Notify Engineer-Architect minimum of 24 hours in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 hours local time unless otherwise authorized.
- .5 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .6 Provide and post "Out of Service" sign on hydrant not in use.
- .7 Advise local police department of anticipated interference with movement of traffic.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

- .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end, cast iron outside diameter.
 - .1 CAN/CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket coupling.
 - .2 End-caps: approved pipe up to and including 600 mm diameter is to arrive on site with factory-installed end-caps on both pipe ends and a "tamper evident seal" on the bell end only.
 - .1 Tamper-evident seals will display the manufacturer's name and/or logo. Seals will straddle the cap and/or tape and the pipe. Removal of the cap should render the tamper-evident seal unusable either by breaking the seal off or by leaving a message such as "Void" on the pipe.
 - .2 For pipes of diameters greater than 600 mm end-caps are optional.
 - .3 End-caps shall be installed at the factory and will be one of the following:
 - .1 White, clear or black plastic discs or cone shaped plugs fastened with tape.
 - .2 Closed cell polypropylene foam (Charma Caps).
 - .3 Polyethylene pipe plugs (manufactured by Taylor Made).
 - .4 Due to their length and accessibility for field cleaning, end-caps are not required for fittings and valves.
 - .3 Couplings: Star Pipe Products, Dresser, Smith-Blair or approved equal with minimum sleeve length of 250 mm. Couplings shall be epoxy coated, ductile iron or steel complete with high strength low alloy steel tee bolts and nuts tightened using a torque wrench to the manufacturer's specifications, completely wrapped with 8-Mil poly according AWWA C105.
 - .4 Ductile iron fittings: All fittings (tees, bends, sleeves and caps) shall be ductile-iron fittings meeting the requirements of AWWA C153, 2415 kPa Class.
 - .5 Joints: Joints for iron fittings will be a mechanical type, meeting the requirements of the latest AWWA Standard C111 for rubber-gasket joints for ductile-iron fittings. Fittings will be complete with component parts.

- .6 Joint Restraint: As shown on the drawings, all fittings for DR18 PVC pipe shall be restrained. Joint restraint system components are to be used on all fittings and valves. All iron fittings, joint restraint system components and couplings shall be ductile-iron with high strength low alloy steel tee bolts and nuts tightened using a torque wrench to the manufacturer's specifications, completely wrapped with 8-Mil poly according AWWA C105. Mechanical joint restraint for PVC pressure fittings shall be Star Grip 4000 by Star Pipe Products, One Lok SLC by Sigma, 1360 S by Uniflange or approved equal.

2.2 VALVES AND VALVE BOXES

- .1 Valves to open counter clockwise.
- .2 Gate valves: to ANSI/AWWA C509, standard iron body epoxy coated, brass mounted wedge valves with non-rising stems, suitable for 1 Pa with mechanical or flanged joints as per the drawings.
 - .1 Acceptable products:
 - .1 AVK;
 - .2 Mueller;
 - .3 Bibby;
 - .4 Clow; or approved equal.
- .3 Cast iron valve boxes: bituminous coated screw type or three piece sliding type adjustable over minimum of 450 mm complete with valve operating extension rod, of such length that when set on valve operating nut top of rod will not be more than 1.8 m below cover.
 - .1 Base to be large round type with minimum diameter of 300 mm.
 - .2 Top of box to be marked "WATER"/"EAU".

2.3 TAPPING SLEEVES

- .1 Tapping sleeves shall be stainless steel with full seals around the circumference of the pipe. Tapping sleeves shall be Mueller H304, Robar 6606, Smith Blair 662, Romac type SST or approved equal.
- .2 Tapping valves shall be resilient seat type, meeting the requirements of AWWA Standard C509 for gate valves. Tapping valves will be flanged to mechanical joint type.

2.4 CHLORINATION POINTS

- .1 Q-Line water service tubing meeting the latest CSA Standard B137.9 and ASTM Standard F1282 , size as shown on the drawings.
- .2 Blue Muncipex (PEXa) meeting the latest requirement of CSA Standard B137.5, and ASTM F877, size as shown on the Drawings.
- .3 Corporation main stops: Mueller, Ford, Cambridge or A. Y. MacDonald brass, meeting ASTM B62 with bronze ground key type with inlet end having the Standard Corporation Threads to AWWA C800 and outlet having copper or kitec compression type connection.

- .4 Service saddles for PVC pipe: Concord Clow D-71, Smith-Blair TaperSeal, Robar or Romac type, cast-iron body with wide flat stainless steel band and components. Service saddles must be used for all service connections on PVC pipe and all taps larger than 25 mm diameter. Service saddles for all services larger than 25 mm require two wide straps.
- .5 Corporation curb stops: Mueller, Ford, Cambridge, or A.Y. MacDonald brass, meeting ASTM B62 with bronze ground key type with both inlet and outlet ends having copper or kitem compression type connections. Stainless steel liners are to be inserted into the ends of Municipex tubing for all connections to compression service brass.
- .6 Service connections for PVC pipe:
 - .1 Service connections less than 100 mm: Corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.
 - .2 Service connections 100 mm and over: Use tee fitting or tapping valve and sleeve.
- .7 Bronze type service clamps: for PVC pipe service connections.
 - .1 Service clamps to be of strap-type, with confined "O" ring seal cemented in place.
 - .2 Clamps to be tapped with threads to ANSI/AWWA C800.
- .8 Tee connections: for services above NPS 1. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.
- .9 Stainless steel (size as per manufacturer's recommendations) liners for plastic pipe where pipe is used with compression fitting.

2.5 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular bedding and backfill: in accordance with Section 31 23 10 – Excavation and Backfill.
- .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

2.6 BACKFILL MATERIAL

- .1 In accordance with Section 31 23 10 – Excavation and Backfill.

2.7 PIPE DISINFECTION

- .1 Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.
- .2 Disinfect water mains in accordance with ANSI/AWWA C651.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Engineer-Architect.
 - .2 Inform Engineer-Architect of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer-Architect.

3.2 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
 - .1 Inspect materials for defects to approval of Engineer-Architect.
 - .2 Remove defective materials from site as directed by Engineer-Architect.

3.3 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 – Excavation and Backfill.
- .2 Ensure trench depth allows coverage over pipe of 2.1 m minimum from finished grade or as indicated.
- .3 Trench alignment and depth require Departmental Representative's DCC Representative's Consultant's approval prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to 95 % maximum density to ASTM D698.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10 – Excavation and Backfill.

3.5 PIPE INSTALLATION

- .1 Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipe fittings, etc., shall be carefully lowered into the trench in such a manner as to prevent damage to them. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

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- .2 All pipe and fittings shall be thoroughly inspected for defects before and after laying. Any defective or damaged pipe or accessory shall be removed from the site and replaced with sound material.
 - .3 All foreign matter shall be removed from the interior of the pipe before lowering it into the trench. Trenches shall be kept free of water. The pipe shall be installed without earth entering the main. When the work is not in progress trench water and other foreign matter shall be kept out of the pipe by inserting an acceptable test plug or night cap in the end line. If water has accumulated in the trench, the plugs shall remain in place until the trench is dry.
 - .4 Lay pipes to ANSI/AWWA C600 ANSI/AWWA M-9 M-11 manufacturer's standard instructions and specifications.
 - .1 Do not use blocks except as specified.
 - .5 Join pipes in accordance with ANSI/AWWA C600 ANSI/AWWA C602 ANSI/AWWA C206 AWWA M-9 M-11 manufacturer's recommendations.
 - .6 Bevel or taper ends of PVC pipe to match fittings.
 - .7 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
 - .8 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
 - .9 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
 - .10 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
 - .11 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .12 Position and join pipes with equipment and methods approved by Engineer-Architect.
 - .13 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .14 Align pipes before jointing.
 - .15 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .16 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.

- .2 Clean, lubricate and replace before jointing is attempted again.
- .17 Complete each joint before laying next length of pipe.
- .18 Minimize deflection after joint has been made.
- .19 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .20 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Engineer-Architect.
- .21 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .22 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .23 Do not lay pipe on frozen bedding.
- .24 Do hydrostatic and leakage test and have results approved by Engineer-Architect before surrounding and covering joints and fittings with granular material.
- .25 Backfill remainder of trench.
- .26 The pipe shall be laid to the grade as indicated on the drawings. Deviations from these grades shall be permitted only upon written approval by the Engineer. The pipe shall be laid with no reverse grades, humps or sags not indicated on the drawings.
- .27 Pipe shall be laid with bell ends facing in the direction of laying unless directed otherwise. If it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstruction or to plumb valve stems, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that recommended by the pipe manufacturer for the particular size and type of piping being laid. During installation, care must be taken to avoid over-insertion into the pipe bell beyond the spigot insertion line – it must still be visible when pipes are installed.
- .28 Mechanical joint connections and tightening and torquing of bolts shall be in accordance with the manufacturer's instructions and recognized good practice.
- .29 All tees, bends, valves and fittings on water mains shall be provided with joint restraints. Concrete thrust blocks in the locations and to the dimensions as indicated on the drawings. Thrust blocks shall extend to bear against undisturbed ground and shall be so placed that the pipe and fitting joints remain accessible.

3.6 CONNECTING TO EXISTING DISTRIBUTION PIPING

- .1 Under no circumstances whatsoever shall the contractor operate existing water main valves or make connections to existing water mains without the prior approval of the Owner's Representative and Engineer-Architect.
- .2 It is the Contractor's responsibility to ensure that their operations do not contaminate the public water supply. If, at any time, the water in the existing system becomes contaminated through actions by the Contractor, whether or not due to negligence, they shall be held financially accountable for any corrective action taken by the Owner, as well as for the cost of defending any settlement of all claims resulting from their negligence, including, but not limited to, costs and attorneys' fees.

- .3 The Contractor shall make all arrangements with the Owner's Representative and Engineer-Architect at least one (1) full working day prior to connecting or locating existing water mains. The Contractor shall coordinate with the Municipality regarding schedules, methods and procedures to be followed for isolating sections of the water system and connecting to these mains.
- .4 All existing plugs and fittings shall, where possible (as determined by the Engineer-Architect), be salvaged, carefully stored and on completion of the works and delivered to the Owner (exact location to be determined during the construction within the Owner's boundaries). No such fittings shall be removed from the site without the permission of the Engineer-Architect. All salvaged materials shall be recorded by the Inspector during construction and if not returned, the amount shall be deducted from the first release of holdback. If materials are not salvageable, they are to be disposed of by the Contractor to an acceptable recycling site. There will be no separate payment for material to be salvaged or to be disposed of, but shall be considered incidental to the work.

3.7 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Gate valves shall be properly joined to the mains with mechanical joint connections according to the requirements of the manufacturer and recognized good practice. The valves shall be set so that the valve stems are vertical and plumb.
- .3 Gate valves will be installed level. The base of the valve box shall be set so as not to transmit stress to the valve and shall be accurately centered over the wrench nut of the valve, with the valve box set plumb. Boxes will not be required where valves are in chambers. Valve box can also be set on top of the valve using a rubber valve box adaptor to prevent transmission of road shocks and keep the valve box in a vertical position.
 - .1 Acceptable valve box adaptor: as manufactured by Carson Guard, or approved alternate.
- .4 The valve box must be set and maintained in a vertical position over the operating nut and must be properly supported in place with the cover flush with finished grade. Drainage from the valve box will be provided by placing crushed rock around the valve. Covers on valve boxes shall be set flush with the finish grade.
- .5 Covers on valve boxes shall be set flush with the finish grade on paved roadways. On gravel roadways, the valve boxes shall be screwed down 100 mm after final inspection.
- .6 Support valves located in valve boxes or valve chambers by means of bedding same as adjacent pipe. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.

3.8 CHLORINATION POINTS

- .1 The location of chlorination points shall be as per the construction drawings or as located in the field by the Engineer.
- .2 Tapping of water mains shall be with the use of proper tools and equipment and according to recognized good practice and in compliance with the pipe manufacturer's specifications. The water main shall be tapped at a 67½° angle from the top centerline of the pipe.

- .3 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.
- .4 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
- .5 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.
- .6 A "goose neck" shall be provided in service lateral piping as detailed on the construction drawings and shall have a maximum deflection of $22\frac{1}{2}^{\circ}$.
- .7 All connections on service laterals shall be of the Compression type.
- .8 The corporation curb stop and service box shall be installed at locations as indicated on drawings.
- .9 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
- .10 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
- .11 Install chlorination points in the locations as shown on the Drawings.
 - .1 Chlorination points shall be removed at the end of the disinfection period. Removal of chlorination points shall be done by removing the curb stop and crimping the line (20 mm diameter) or by capping the line (50 mm diameter). The main stop shall remain, but shall be closed after disinfection is complete.

3.9 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Engineer-Architect.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 For restrained joints: only use restrained joints approved by Engineer-Architect.

3.10 HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600.
- .2 Pressure and leakage tests shall be applied to all water mains including service laterals.
- .3 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .4 Notify Engineer-Architect at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of Engineer-Architect.

- .5 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
- .6 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Engineer-Architect.
- .7 Upon completion of pipe laying and after Engineer-Architect has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
- .8 When testing is done during freezing weather, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply leakage test pressure of 1000 kPa minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .14 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
- .15 Before applying the test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation stops at such points so the air can be expelled, then the corporation stops shall be closed and test pressure applied. The amount of water added shall be measured by a method acceptable to the Engineer. The leakage, as measured by the amount of water added during the test, shall not exceed the amount given by the formula:

$$Q = \frac{L * d * \sqrt{P}}{795,000}$$

Where:

- | | | |
|---|---|--------------------------------------|
| Q | = | allowable leakage in liters per hour |
| L | = | length of pipe tested, in m |
| d | = | nominal diameter of pipe in mm |
| P | = | test pressure in kPa |

- .16 Locate and repair defects if leakage is greater than amount specified.
- .17 Repeat test until leakage is within specified allowance for full length of water main.

3.11 PIPE SURROUND

- .1 Upon completion of pipe laying and after Engineer-Architect has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 300 m of pipe.

- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95 % maximum density to ASTM D698.

3.12 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698.
- .1 In other areas, compact to at least 95 % maximum density to ASTM D698.

3.13 FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations: under direct control of Departmental Representative.
 - .1 Notify Engineer-Architect at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150
- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Engineer-Architect approval, introduce strong solution of chlorine as approved by Engineer-Architect into water main and ensure that it is distributed throughout entire system.
- .7 Disinfect water mains.
- .8 Rate of chlorine application to be proportional to rate of water entering pipe.
- .9 Chlorine application to be close to point of filling water main and to occur at same time.
- .10 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .11 Flush line to remove chlorine solution after 24 hours.

- .12 Measure chlorine residuals at extreme end of pipe-line being tested.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
 - .1 Take samples daily for minimum of two days.
 - .2 At least one set of samples shall be collected from every 366 m (1200 ft) of the new water main, at every hydrant and at the beginning and end of new lines.
 - .3 Samples will be taken by the Contractor with the presence of the Owner's Representative and the Engineer-Architect. The Contractor shall notify the Engineer-Architect not less than forty-eight hours in advance of readiness to sample.
 - .4 Should contamination remain or recur during this period, repeat disinfecting procedure.
- .14 Take water samples at service connections, in suitable sequence, to test for chlorine residual.
- .15 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
 - .2 Total residual chlorine still present in the water used to disinfect the water main shall be reduced to a maximum of one part per million if released to an environment other than a sanitary or combined sewer pipe.

3.14 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Engineer-Architect.

3.15 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 10 - Excavation and Backfill

1.2 MEASUREMENT AND PAYMENT

- .1 Measure excavation and backfill in accordance with Section 31 23 10 – Excavation and Backfill.
- .2 Wharf water distribution piping will be paid by the lump sum.
 - .1 Payment shall include the supply and transportation of all labour, equipment and materials, excavation, dewatering, supply and installation of all pipe and fittings including supply and installation of joint restraint systems, thrust blocks and anchors, pipe supports, bedding, backfilling, compaction, protection of adjacent services and structure, testing, flushing and disinfection, removal and disposal of excess material, shop drawings, clean-up, and all work incidental thereto, all as specified or as shown on the Drawings or as laid out by the Engineer-Architect.

1.3 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-10, Standard for Hypochlorites.
 - .2 ANSI/AWWA B301-10, Standard for Liquid Chlorine.
 - .3 ANSI/AWWA B303-10, Standard for Sodium Chlorite.
 - .4 ANSI/AWWA C104/A21.4-08, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - .5 ANSI/AWWA C105/A21.5-10, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - .6 ANSI/AWWA C111/A21.11-07, American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.
 - .7 ANSI/AWWA C110/A21.10-08, American National Standard for Ductile-Iron and Gray Iron Fittings for Water.
 - .8 ANSI/AWWA C150/A21.50-08, Standard for Thickness Design of Ductile-Iron Pipe.
 - .9 ANSI/AWWA C151/A21.51-09, Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - .10 ANSI/AWWA C153/A21.53-11, Standard for Ductile-Iron Compact Fittings.
 - .11 ANSI/AWWA C200-05, Standard for Steel Water Pipe - 6 Inch (150 mm) and Larger.
 - .12 ANSI/AWWA C203-08, Standard for Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.

- .13 ANSI/AWWA C205-07, Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch (100 mm) and Larger - Shop Applied.
- .14 ANSI/AWWA C206-11, Standard for Field Welding of Steel Water Pipe.
- .15 ANSI/AWWA C207-07, Standard for Steel Pipe Flanges for Waterworks Service, 4 Inch through 144 Inch (100 mm through 3,600 mm).
- .16 ANSI/AWWA C208-07, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
- .17 ANSI/AWWA C300-11, Standard for Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
- .18 ANSI/AWWA C301-07, Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
- .19 ANSI/AWWA C303-08, Standard for Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
- .20 ANSI/AWWA C500-09, Standard for Metal-Seated Gate Valves for Water Supply Service.
- .21 ANSI/AWWA C504-10, Standard for Rubber-Seated Butterfly Valves.
- .22 ANSI/AWWA C600-10, Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.
- .23 ANSI/AWWA C602-11, Standard for Cement-Mortar Lining of Water Pipelines - 4 Inch (100 mm) and Larger.
- .24 ANSI/AWWA C651-05, Standard for Disinfecting Water Mains.
- .25 ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.
- .26 ANSI/AWWA C900-07, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.
- .2 ASTM International
 - .1 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
 - .2 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .4 ASTM B88M-05(2011), Standard Specification for Seamless Copper Water Tube Metric.
 - .5 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .6 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .7 ASTM C478M-11, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .8 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

- .9 ASTM D2310-06, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
- .10 ASTM D2657-07, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
- .11 ASTM D2992-06, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.
- .12 ASTM D2996-01(2007)e1, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
- .13 ASTM F714-10, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .14 ASTM C618-08a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .3 CAN/CGSB-34.1-94, Pipe, Asbestos Cement, Pressure.
 - .4 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.
- .4 CSA International
 - .1 CAN/CSA-A257 Series-09, Standards for Concrete Pipe (Consists of A257.0, A257.1, A257.2, A257.3 and A257.4).
 - .2 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .3 CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CAN/CSA-B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 - .2 CAN/CSA-B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
 - .4 CSA G30.18-09, Carbon and Steel Bars for Concrete Reinforcement.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Pipe certification to be on pipe.
- .3 Samples:
 - .1 Inform Engineer-Architect of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.

- .2 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 4 weeks minimum prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material.
 - .1 Include top of pipe, horizontal location of fittings and type, valves and valve chambers.
- .3 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves and fittings for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect water distribution piping from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Engineer-Architect.
- .3 Notify Engineer-Architect minimum of 24 hours in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 hours local time unless otherwise authorized.
- .5 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .6 Provide and post "Out of Service" sign on hydrant not in use.
- .7 Advise local police department of anticipated interference with movement of traffic.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

- .1 Polyethylene pressure pipe:
 - .1 NPS 1/2 to NPS 6: to CAN/CSA-B137.1 type PE 3406 160 ASTM F714, type PE 3408 DR 11.
 - .2 90 mm to 1600 mm: to CGSB 41-GP-25M, type PE 1404, series 250.
 - .3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657.
 - .4 Polyethylene fittings: to CAN/CSA-B137.1.

2.2 STAINLESS STEEL BALL VALVES

- .1 Working pressure: 1500 PSI
- .2 Body and Ball: Stainless Steel 316
- .3 Handle and nut: Stainless Steel 304
- .4 Long cycle life.
- .5 Blow-out proof stem.
- .6 Locking device4.
- .7 ANSI B16.34 Class 900
- .8 Acceptable Product: Pinacle 1500 WOG Ball Valve or approved alternate.

2.3 PIPE SUPPORTS

- .1 Adjustable pipe roll support shall be supplied as shown on drawings c/w galvanized threaded rods, nuts and pipe saddle.
- .2 Material: Cast iron roll.
- .3 Finish: Galvanized.
- .4 Pipe supports shall be Anvil Fig 177 Adjustable Pipe Roll Support or approved equal.

2.4 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular bedding and backfill: in accordance with Section 31 23 10 – Excavation and Backfill.
- .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

2.5 BACKFILL MATERIAL

- .1 In accordance with Section 31 23 10 – Excavation and Backfill.

2.6 PIPE DISINFECTION

- .1 Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.

- .2 Disinfect water mains in accordance with ANSI/AWWA C651.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Engineer-Architect.
 - .2 Inform Engineer-Architect of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer-Architect.

3.2 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
 - .1 Inspect materials for defects to approval of Engineer-Architect.
 - .2 Remove defective materials from site as directed by Engineer-Architect.

3.3 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 – Excavation and Backfill.
- .2 Ensure trench depth allows coverage over pipe of 2.1 m minimum from finished grade or as indicated.
- .3 Trench alignment and depth require Departmental Representative's DCC Representative's Consultant's approval prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to 95 % minimum of corrected maximum dry density 95 % maximum density to ASTM D698.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10 – Excavation and Backfill.

3.5 PIPE INSTALLATION

- .1 Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipe fittings, etc., shall be carefully

-
- lowered into the trench in such a manner as to prevent damage to them. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
- .2 All pipe and fittings shall be thoroughly inspected for defects before and after laying. Any defective or damaged pipe or accessory shall be removed from the site and replaced with sound material.
 - .3 All foreign matter shall be removed from the interior of the pipe before lowering it into the trench. Trenches shall be kept free of water. The pipe shall be installed without earth entering the main. When the work is not in progress trench water and other foreign matter shall be kept out of the pipe by inserting an acceptable test plug or night cap in the end line. If water has accumulated in the trench, the plugs shall remain in place until the trench is dry.
 - .4 Lay pipes to ANSI/AWWA C600 ANSI/AWWA M-9 M-11 manufacturer's standard instructions and specifications.
 - .1 Do not use blocks except as specified.
 - .5 Join pipes in accordance with manufacturer's recommendations.
 - .6 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
 - .7 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
 - .8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
 - .9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .10 Position and join pipes with equipment and methods approved by Engineer-Architect.
 - .11 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .12 Align pipes before jointing.
 - .13 Minimize deflection after joint has been made.
 - .14 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Engineer-Architect.
 - .15 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
 - .16 Do not lay pipe on frozen bedding.

- .17 Do hydrostatic and leakage test and have results approved by Engineer-Architect before surrounding and covering joints and fittings with granular material.
- .18 Backfill remainder of trench.
- .19 The pipe shall be laid to the grade as indicated on the drawings. Deviations from these grades shall be permitted only upon written approval by the Engineer. The pipe shall be laid with no reverse grades, humps or sags not indicated on the drawings.

3.6 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated on drawings.
- .2 HDPE to Stainless Steel 316 threaded connection fittings shall be use to install ball valves on the HDPE Piping.

3.7 HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600.
- .2 Pressure and leakage tests shall be applied to all water mains including service laterals.
- .3 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .4 Notify Engineer-Architect at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of Engineer-Architect.
- .5 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
- .6 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Engineer-Architect.
- .7 Upon completion of pipe laying and after Engineer-Architect has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
- .8 When testing is done during freezing weather, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply leakage test pressure of 1000 kPa minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .14 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
- .15 Before applying the test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation stops at

such points so the air can be expelled, then the corporation stops shall be closed and test pressure applied. The amount of water added shall be measured by a method acceptable to the Engineer. The leakage, as measured by the amount of water added during the test, shall not exceed the amount given by the formula:

$$Q = \frac{L * d * \sqrt{P}}{795,000}$$

Where:

Q = allowable leakage in liters per hour
L = length of pipe tested, in m
d = nominal diameter of pipe in mm
P = test pressure in kPa

- .16 Locate and repair defects if leakage is greater than amount specified.
- .17 Repeat test until leakage is within specified allowance for full length of water main.

3.8 PIPE SURROUND

- .1 Upon completion of pipe laying and after Engineer-Architect has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 300 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95 % maximum density to ASTM D698.

3.9 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698.
 - .1 In other areas, compact to at least 95 % maximum density to ASTM D698.

3.10 FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations: under direct control of Consultant Departmental Representative DCC Representative and local water work department.
 - .1 Notify Engineer-Architect at least 4 days in advance of proposed date when disinfecting operations will begin.

- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150
- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Engineer-Architect approval, introduce strong solution of chlorine as approved by Engineer-Architect into water main and ensure that it is distributed throughout entire system.
- .7 Disinfect water mains.
- .8 Rate of chlorine application to be proportional to rate of water entering pipe.
- .9 Chlorine application to be close to point of filling water main and to occur at same time.
- .10 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .11 Flush line to remove chlorine solution after 24 hours.
- .12 Measure chlorine residuals at extreme end of pipe-line being tested.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
 - .1 Take samples daily for minimum of two days.
 - .2 At least one set of samples shall be collected from every 366 m (1200 ft) of the new water main, at every hydrant and at the beginning and end of new lines.
 - .3 Samples will be taken by the Contractor with the presence of the Owner's Representative and the Engineer-Architect. The Contractor shall notify the Engineer-Architect not less than forty-eight hours in advance of readiness to sample.
 - .4 Should contamination remain or recur during this period, repeat disinfecting procedure.
- .14 Take water samples at service connections, in suitable sequence, to test for chlorine residual.
- .15 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
 - .2 Total residual chlorine still present in the water used to disinfect the water main shall be reduced to a maximum of one part per million if released to an environment other than a sanitary or combined sewer pipe.

3.11 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Engineer-Architect.

3.12 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION