Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 Measure excavation and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

.2 Measure maintenance holes and catch basins in vertical meters installed, measured from top of cover (rim) or grating to lowest pipe invert of maintenance hole and catch basin as shown on the drawings

1.2 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit Schedule of interruptions for approval and adhere to approved schedule.

1.3 SUBMITTALS

.1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.

Part 2 Products

2.1 MATERIALS

.1 Precast maintenance hole units: to ASTM C 478M, circular or oval.

.1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.

.2 Monolithic bases to be approved by Departmental Representative and set on concrete slabs cast in place].

.2 Precast catch basin sections: to ASTM C478M.

.3 Joints: made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.

.4 Mortar:

.1 Aggregate: CSA A82.56.

.2 Masonry Cement: to CAN/CSA-A3002.

.5 Ladder rungs: to CSA G30.18, No.25M billet steel deformed bars, hot dipped galvanized to ASTM A 123/A 123M.

.6 Rungs to be safety pattern (drop step type).

.7 Adjusting rings: to ASTM C 478M.

.8 Concrete Brick: to CAN/CSA-A165 Series.

.9 Drop maintenance hole pipe: same as sewer pipe.

.10 Galvanized iron sheet: approximately 2 mm thick.

.11 Steel gratings, I-beams and fasteners: as indicated.

.12 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.

.2 Gray iron castings: to ASTM A 48/A 48M, strength class[30B].

.3 Castings: coated with two applications of asphalt varnish, sand blasted or cleaned and ground to eliminate surface imperfections.

.4 Maintenance hole frames and covers: cover cast with perforations and complete with two 25 mm square lifting holes

.5 Catch basin frames and covers to City of Lethbridge standards.

.6 Maintenance holes frames and covers to City of Lethbridge standards.

.13 Granular bedding and backfill: in accordance with Section [31 05 16 - Aggregate Materials and following requirements:

.1 Crushed Gravel.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117 . Sieve sizes to CAN/CGSB-8.1.

.3 Table:

Sieve Designation	% Passing
25mm	100
12.5mm	65-90
4.75mm	35-55
0.425mm	10-25
0.075mm	0-8

.4 Concrete mixes and materials: in accordance with Section 03 30 00.01 - Cast-in-Place Concrete.

.14 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

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 maintenance holes and catch basin structures installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative

.2 Inform Departmental Representative 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 Departmental Representative

3.2 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.

.2 Obtain approval of Departmental Representative before installing outfall structures, maintenance holes or catch basins.

3.3 CONCRETE WORK

.1 Use 25 MPa concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.

3.4 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses.

.1 Maximum of 3 units behind point of pipe laying will be allowed.

.3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.

.4 Cast bottom slabs directly on undisturbed ground.

.5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% corrected maximum dry density; maximum density to ASTM D 698.

.6 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.

.2 Make each successive joint watertight with Departmental Representative's approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.

.3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.4 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.7 For sewers:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Bench to provide smooth U-shaped channel.

.3 Side height of channel to be 0.75 times full diameter of sewer.

.4 Slope adjacent floor at 1 in 20.

.5 Curve channels smoothly.

.6 Slope invert to establish sewer grade.

.8 Compact granular backfill to 95% corrected maximum dry density; maximum density to ASTM D 698.

.9 Place frame and cover on top section to elevation as indicated.

.1 If adjustment required use concrete ring.

.10 Clean units of debris and foreign materials.

.1 Remove fins and sharp projections.

.2 Prevent debris from entering system.

3.5 LEAKAGE TEST

.1 Install watertight plugs or seals on inlets and outlets of each new sanitary sewer maintenance hole and fill maintenance hole with water.

.2 Leakage not to exceed 0.3% per hour of volume of maintenance hole.

.3 If permissible leakage is exceeded, correct defects.

.4 Repeat until approved by Departmental Representative.

.5 Departmental Representative will issue Test Certificate for each maintenance hole passing test.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 2 weeks prior to commencing work.

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

.4 Pipe certification to be on pipe.

1.2 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, location of air and vacuum release valves, hydrant details.

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

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

1.4 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 Departmental Representative.

.3 Notify Departmental Representative minimum of 24 hours in advance of interruption in service.

.4 Do not interrupt water service for more than 2 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.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

.1 Polyvinyl Chloride (PVC) Pressure Pipe

.1 For pipe sizes 150 mm to 300 mm in diameter, all pipes and joints shall be to the latest revision AWWA C900, CSA certified as meeting latest revision CSA 3-B137.3-M86, SDR 18, working pressure rating 235.

.2 For pipe sizes350 mm to 900 mm in diameter, all pip and joints shall be to the latest revision AWWA C905, CSA certified as meeting latest revision CSA 3-B137.3-M86, SDR 25, working pressure rating 165.

.3 All PVC pipe to be cast iron outside diameter, bell end, c/w SBR or NBR gaskets of a pressure actuated seal design.

.4 All PVC pipe to be capable of deflecting at a joint.

.5 All pipe shall be supplied with integral wall thickened bell ends and continuous gaskets.

.2 Polyvinyl Chloride (PVC) Fittings

.1 For main sizes 300 mm and smaller, PVC Fittings to the latest revision AWWA C-907, CSA certified as meeting latest revisions CSA 3-B137.2, SDR 18, pressure class 150, bell ends, c/w 1MPa elastomeric gasket push –on joint.

.2 For main sizes larger than 300mm, PVC Fittings to be latest revisions AWWA & CSA.

.3 Cast Iron Fittings

.1 Cast Iron Fittings to the latest revision AWWA C110-87 / ANSI A21.10, pressure class 150 minimum. Long body only. Exterior of fittings to be bituminous coated at factory.

.2 Joints for cast iron fittings to latest revision AWWA C111 / ANSI A21.11, pressure class 150 minimum, “Tyton Joint” or approved equal.

2.2 VALVES AND VALVE BOXES

.1 Gate Valves

.1 Valves sized 150 to 300 mm diameter shall be resilient wedge gate valves, conforming to latest revision AWWA C509, and c/w fully rubber encapsulated solid wedge, non-rising stem, suitable for direct bury.

.2 Valves to open counter clockwise (Turn left to open).

.3 Valve body to be constructed of cast iron, in accordance with ASTM A126, Class “B”. All nuts, bolts and washers to be stainless steel.

.4 Interior and exterior of valve to be epoxy coated, as per latest revision AWWA C550.

.5 Bronze valve stem to be operated by a 50 x 50 mm square operating nut. The valve stem (stuffing box) shall contain a double “O” ring seal.

.6 Valve ends to be push-on “Tyton Joint” conforming to latest revision of AWWA C111-85/ANSI A21.11.

2.3 SERVICE CONNECTIONS

.1 General

.1 For service connection sizes 20 mm to 50 mm diameter, pipe to be Copper Tubing, Municipex or IPEX Blue 904 Pex.

.2 For service connection sizes 100 mm to 300 mm diameter, pipe to be Polyvinyl Chloride (PVC) Pressure Pipe as specified in this Section.

.3 Fittings for service connection sizes 100 mm to 300 mm diameter to be as specified in this Section.

.4 Valves for service connection sizes 100 mm to 300 mm diameter to be as specified in this Section.

.2 Water Service Pipe

.1 For services 20 mm to 50 mm diameter, copper tubing conforming to latest revision ASTM B88M, type K, annealed.

.2 For services 20 mm to 50 mm diameter, cross-linked polyethylene pipe shall be manufactured in accordance with CSA B137.5 and ASTM F876 and shall comply with NSF 14. The pipe and resin (compound) shall be manufactured in an ISO 9001 certified production facility. The degree of cross linking for Municipex pipe shall not be less than 80% when tested in accordance to ASTM D2765 Method B. Municipex pipe shall have CSA / NSF approved pressure rating of:

160 psi @ 23 degree C / 73.4 degree F

100 psi @ 82 degree C / 180 degree F

80 psi @ 93 degree C / 200 degree F

The outside diameter of the pipe shall be copper tube size (CTS) and shall have a standard dimension ratio (SDR) 9.

The pipe shall carry the following marks every 5 feet minimum: manufacturers name, nominal size, ASTM, CSA 7 NSF designations, SDR, pressure/temperature rating, potable tubing, manufacturing date & Machine number and footage mark. The pipe shall have consecutive footage marks every 5 feet (minimum starting with 0 at the beginning of each coil). The pipe shall be shipped in protective cardboard boxes marked with the product name and size. When connecting Municipex or Blue 904 to main cocks and service valves, stainless steel inserts shall be used.

2.4 HYDRANTS

.1 Hydrants to be dry barrel, compression type, conforming to latest revision AWWA C502 designed for working pressure of 1,035 kPa (150 psi). Hydrants to close with pressure.

.2 The pumper and hoze nozzles shall be located a minimum of 460 mm above the ground flange. Nozzle threads to conform to the Alberta Mutual Aid Standard. No chains are required to secure the hydrant caps to the hydrant body. Nozzle sizes to be:

.1 Pumper Nozzle: 1-100 mm diameter

.2 Hose Nozzles: 2-65 mm diameter (at 90 degrees to pumper nozzle).

.3 Hydrant valve opening to be 133 mm. Both the valve seat and the valve body to be of bronze construction.

.4 Hydrant inlet to be 150 mm diameter push-on “Tyton Joint” c/w elastomeric gasket conforming to latest revision of AWWA C111 / ANSI A21.11.

.5 Hydrants shall be opened by turning the hydrant operating nut left (counter clockwise). The operating nut and nozzle caps to be three-sided, 38 mm on each side.

.6 Depth of bury to be 2.44 m (8’).

.7 Hydrant branch to be 150 mm diameter PVC pipe conforming to this Section c/w 150 mm connection at main.

.8 Hydrant bodies and bonnets to be painted with exterior enamel. After installation, paint pumper and hose nozzle caps using exterior enamel in accordance with the following colour code:

.1 100 mm diameter - Red

.2 150 mm diameter - Yellow

.3 200 mm diameter and larger – Black

.9 Hydrants to be constructed with Break-a-way Flange, complete with a safety stem (spindle). Coupling is to be located at ground level.

.10 All nuts, bolts and washers to be stainless steel.

2.5 PIPE BEDDING ABD SURROUND MATERIAL

.1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:

.1 25 mm minus washed drain rock.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

.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 As indicated. Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.7 PIPE DISINFECTION

.1 All new water mains shall be disinfected and flushed before being put into services in accordance with the latest edition of AWWA Standard C651 for Disinfecting Water Mains.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of Departmental Representative.

.2 Remove defective materials from site as directed by Departmental Representative.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Ensure trench depth allows coverage over pipe of 3 m minimum from finished grade or as indicated.

.3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.1 Place concrete to details as indicated.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hours after placing.

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.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.5 PIPE INSTALLATION

.1 Lay pipes to ANSI/AWWA C600 ANSI/AWWA M-9 M-11and manufacturer's standard instructions and specifications.

.1 Do not use blocks except as specified.

.2 Join pipes in accordance with ANSI/AWWA C600 ANSI/AWWA C602 ANSI/AWWA C206 AWWA M-9 M-11 and manufacturer's recommendations.

.3 Bevel or taper ends of PVC pipe to match fittings.

.4 Handle pipe by methods approved by Departmental Representative and recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.5 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.

.6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade

.7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.8 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.

.9 Position and join pipes with equipment and methods approved by Departmental Representative.

.10 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.

.11 Align pipes before jointing.

.12 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.

.13 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.

.14 Complete each joint before laying next length of pipe.

.15 Minimize deflection after joint has been made.

.16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.20 Do not lay pipe on frozen bedding.

.21 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.

.22 Backfill remainder of trench.

3.6 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 Valves not to be supported by pipe.

.3 Install underground post-type indicator valves as indicated.

3.7 SERVICE CONNECTIONS

.1 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.

.2 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops 300 mm inside roadway allowance.

.3 Tappings on PVC-C900 pipe, may be threaded without service clamps.

.1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.

.2 Tappings for PVC-C900 pipe to conform to following:

Pipe Diameter (mm)	Maximum Tap Without Clamp (mm)	Maximum Tap With Clamp (mm)
100	20	25
150	20	25
200	20	25

.4 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.

.5 Tappings for PE pipe: PE tapping tees or multi-saddle tees.

.6 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.7 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.

.8 Install multiple corporation stops, 30 degrees apart around circumference of pipe and minimum of 300 mm apart along pipe.

.9 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 minimum, whichever is greater.

.10 Leave corporation stop valves fully open.

.11 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

.12 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.

.13 Install curb stop with corporation box on services NPS 2 or less in diameter.

.1 Equip larger services with gate valve and cast iron box.

.2 Set box plumb over stop and adjust top flush with final grade elevation.

.3 Leave curb stop valves fully closed.

3.8 HYDRANTS

.1 Hydrants to be dry barrel, compression type, conforming to latest revision AWWA C502 designed for working pressure of 1,035 kPa (150 psi). Hydrants to close with pressure..

.2 Pumper and hose nozzles shall be located a minimum of 460 mm above ground flange. Nozzle threads to conform to Alberta Mutual Aid Standard.

.3 Hydrant valve opening to be 133 mm. Valve seat and valve body to be of bronze construction.

.4 Hydrant inlet to be 150 mm diameter push-on “Tyton Joint” c/a elastomeric gasket conforming to latest revision of AWWA C111 / ANSI A21.11.

.5 Hydrants shall be opened by turning hydrant operating nut left (counter clockwise). Operating nut and nozzle caps to be three-sided, 38 mm on each side.

.6 Depth of bury to be 2.44 m (8’).

.7 Hydrant branch to be 150 mm diameter PVC pipe conforming to this Section, c/w 150 mm connection at main.

.8 Hydrant bodies and bonnets to be painted with exterior enamel. After installation, paint pumper and hose nozzle caps using exterior enamel in accordance with following colour code:

Watermain Diameter	Colour
100 mm	Red
150 mm	Yellow
200 mm and larger	Black

.9 Hydrants to be constructed with break-a-way flange, c/w safety stem (spindle). Coupling is to be located at ground level.

.10 All nuts, bolts and washers to be stainless steel.

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 Departmental Representative.

.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 Departmental Representative.

3.10 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C600.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify Departmental Representative at least 24 hours in advance of proposed tests.

.1 Perform tests in presence of Departmental Representative.

.4 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.

.5 Test pipeline in sections not exceeding 100 m in length, unless otherwise authorized by Departmental Representative.

.6 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed as directed by Departmental Representative.

.7 Leave hydrants, valves, joints and fittings exposed.

.8 When testing is done during freezing weather, protect hydrants, 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.

.1 Install corporation stops at high points in main where no air-vacuum release valves are installed.

.2 Remove stops after satisfactory completion of test and seal holes with plugs.

.12 Thoroughly examine exposed parts and correct for leakage as necessary.

.13 Apply hydrostatic test pressure as directed by Departmental Representative based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.

.14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.16 Repeat hydrostatic test until defects have been corrected.

.17 Apply leakage test pressure as directed by Departmental Representative after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.

.18 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.

.19 Do not exceed allowable leakage of 0.03 L/mm of pipe, including lateral connections.

.20 Locate and repair defects if leakage is greater than amount specified.

.21 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 Departmental Representative 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 0.6 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% of corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% of corrected maximum dry density.

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% corrected maximum dry density.

.1 In other areas, compact to at least 90% corrected maximum dry density.

3.13 HYDRANT FLOW TESTS

.1 Conduct flow tests on every hydrant to determine fire flows prior to painting hydrant caps and ports.

3.14 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations: witnessed by Departmental Representative.

.1 Notify Departmental Representative 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 bleow	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 Departmental Representative approval, [introduce strong solution of chlorine as approved by Departmental Representative 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 2 days.

.2 Should contamination remain or recur during this period, repeat disinfecting procedure.

.14 Take water samples at hydrants and 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.

3.15 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

3.16 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.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Indicate on drawings proposed method for installing carrier pipe for undercrossings.

.3 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.4 Certification to be marked on pipe.

.5 Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

1.3 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services and maintain sewage flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.

.3 Notify Departmental Representative minimum of 24 hours in advance of interruption in service.

Part 2 Products

2.1 SMOOTH WALL POLYVINYL CHLORIDE (PVC) PIPE

.1 For pipe sizing 200 mm to 375 mm diameter, all pipe to be PVC gravity sewer pipe to latest revision ASTM D3034, SDR 35, CSA certified as meeting latest revision CSA B182.2-M, integral locked-in gasket bell and spigot system.

.2 For pipe sizing 450 mm to 900 mm diameter, all pipe to be PVC gravity sewer pipe to latest revision STM F679, SDR 35, CSA certified as meeting latest revision CSA B182.2-M, integral locked-in gasket bell and spigot systems.

.3 Polyethylene Pipe:

.1 Conform to CSA-B.137.1 and CGSB 41-GP-25M, PE 3408.

.2 Joint pipe using thermal butt fusion to AWWA C207.

.3 Fittings: 1) To be flanged to AWWA C207; 2) Fittings shall match the pipe supplied and shall be supplied by the manufacturer of the pipe or by suppliers approved by the pipe manufacturer; 3) All fittings to be compatible in materials and dimensions with the pipe.

.4 Tracer Wire to be an electric #14 AWG Solid SBC (1/64") polyethylene insulated wire or metal tape detectable to 3 m bury.

2.2 SERVICE CONNECTIONS

.1 Smooth Wall PolyVinyl Chloride (PVC) Pipe

.1 For PVC service connections 100 mm to 150 mm diameter, all pipe to be to latest revision ASTM D3034, CSA certified as meeting latest revision CSA B182.1-M, SDR 28, integral locked-in gasket bell and spigot joints.

.2 PolyVinyl Chloride (PVC) Fittings

.1 For PVC service connections 100 mm to 150 mm in diameter, all fittings to be to lastest revision ASTM D3034, CSA certified as meeting latest revision CSA B182.2-M, SDR 28, integral locked-in gasket bell and spigot joints.

.2 Connecting to Mains:

.1 PVC Tee Saddle c/w Rubber Gasket Joint: Saddles to be manufactured with integral centering ring of teeth to align saddle opening with hole in pipe. Saddle to be fastened to main by adjustable stainless steel straps. Screw mechanism on straps to be completely stainless steel.

.2 PVC Insert Type Fittings: Insert type fitting (“Inserta-Tee”) to be PVC PSM gasket joint stubs, c/w moulded rubber sleeve and adjustable stainless steel strap. Screw mechanism on straps to be completely stainless steel.

2.3 PIPE BEDDING AND SURROUND

.1 Granular material to Section 31 05 16 - Aggregate Materials and following requirements:

.1 25 mm minus washed drain rock.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117.

.1 Sieve sizes to CAN/CGSB-8.1.

.2 Concrete mixes and materials for cradles, encasement, supports: to Section 03 30 00 - Cast-in-Place Concrete.

2.4 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

.2 Clean and dry pipes and fittings before installation.

.3 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

3.2 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Protect trench from contents of sewer or sewer connection.

.3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.1 Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% corrected maximum dry density.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with common backfill.

3.4 INSTALLATION

.1 Lay and join pipes to: ASTM C 12.

.2 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.

.3 Handle pipe using methods approved by Departmental Representative.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.6 Joint deflection permitted within limits recommended by pipe manufacturer.

.7 Water not to flow through pipe during construction, unless permitted by Departmental Representative.

.8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Install plastic pipe and fittings in accordance with CSA B182.11.

.10 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's written recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and foreign material.

.5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install pipe joints not more than [1.2] m from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.11 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.

.12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.14 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.

.1 Joints to be structurally sound and watertight.

3.5 CONCRETE THRUST BLOCKING

.1 All plugs, caps, tees, crosses, reducers, hydrants, valves, and bends (deflecting 11¼ degrees or more) shall be anchored to prevent movement. Suitable reaction blocking shall be used for this purpose.

.2 Blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the pipe and on the ground in each instance shall be as determined by the Consultant. The blocking shall be so placed that the pipe and fitting joints will be accessible for repair. Typical thrust block locations are shown on the standard drawing.

3.6 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.1 Do not dump material within 10 m of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% corrected maximum dry density.

.7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.7 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density.

3.8 SERVICE CONNECTIONS

.1 Install pipe to CSA B182.11and manufacturer's instructions and specifications.

.2 Service connections to main sewer: Departmental Representative approved saddles.

.1 Do not use break-in and mortar patch-type joints.

.3 Service connection pipe: not to extend into interior of main sewer.

.4 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.

.1 Use long sweep bends where applicable.

.5 Plug service laterals with water tight caps or plugs as approved by Departmental Representative.

3.9 TRACE WIRE

.1 Tracer wire shall be installed simultaneously with the pipe on all mains and services. Splicing of the tracer wire can be done by soldering only. The connection shall be sealed with mastic and electrical tape. The Contractor shall be responsible for ensuring electrical continuity of the completed system.

.2 The tracer wire shall be brought above ground at every valve box riser, at every road crossing, at every facility location and at each end of every pipe section, It shall be brought above ground inside a rigid PVC conduit and looped inside a PVC junction box. The junction box shall be mounted to a marker post and be complete with a blank weatherproof cover. The wire shall be coiled inside these junction boxes. Rigid PVC conduit need only extend 1 m below grade at valve boxes and shall extend down to the waterline at all other locations.

.3 The tracer wire shall be installed on the top centreline of the pipe. Allowable tolerances will be a maximum of 25 mm clearance between the tracer wire and the pipe and 10o either side of the top of pipe. Tracer wire shall be attached to pipe in a manner acceptable to the Consultant.

3.10 MARKER POSTS

.1 Marker posts shall be installed at all valves and specials. Markers shall be 50 mm diameter steel posts painted blue.

3.11 WARNING SIGNS

.1 Warning signs and painted fence posts shall be installed at the edge of the road allowance where pipelines cross roadways and at the fence of every ¼ section line. The Contractor shall install warning signs as per detail drawings.

.2 Pipeline signs shall be 406 mm x 305 mm warning signs printed on 3M 3650 or 3690 Scotchicl in black ink. Mounted on 12 gauge high tensile aluminum (0.61) sign sheet. Sign holes to be drilled 11 m (7/16”) on 35 mm (14”) centres.

.3 Pipeline warning posts shall be 2.7 metres in length, hat section, galvanized sign post punched and complete with hardware recommended for pipeline crossing signs.

3.12 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

a) 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.

Part 4 Field Testing

4.1 GRAVITY SEWERS

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 Remove foreign material from sewers and related appurtenances by flushing with water.

.3 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.4 Do infiltration and exfiltration test to ASTM C 828.

.5 Do infiltration and exfiltration testing as specified herein and as directed by Departmental Representative.

.1 Perform tests in presence of Departmental Representative.

.2 Notify Departmental Representative 24 hours minimum in advance of proposed tests.

.6 Carry out tests on each section of sewer between successive manholes including service connections.

.7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.8 Exfiltration test:

.1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.

.2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.

.3 Duration of exfiltration test: 2 hours.

.4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.

.9 Infiltration test:

.1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used.

.2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.

.3 Install watertight plug at upstream end of pipeline test section.

.4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter.

.5 Prevent damage to pipe and bedding material due to flotation and erosion.

.6 Place 90 degrees V-notch weir, or other measuring device approved by Departmental Representative in invert of sewer at each manhole.

.7 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.

.10 Infiltration and exfiltration: not to exceed following limits in L per hour per 100 m of pipe, including service connections.

Nominal Pipe Diameter in mm	Asbestos-Cement or Plastic Pipe	Concrete or Vitrified Clay Pipe
100	3.88	25.5
125	4.62	30.0
150	5.51	34.0
200	7.45	41.5
250	9.39	49.5
300	11.33	56.5
350	13.27	63.5
400	14.91	70.0
450	16.84	76.0
500	18.78	81.5
550	20.72	87.0
600	22.80	92.5
700	26.53	102.0
800	30.11	110.5
900	33.69	118.0
1000	37.56	124.5
1100	41.29	130.0
1200	45.01	135.0

.11 Leakage: not to exceed following limits in litres per hour per mm of diameter per 100 m of sewer including service connections:

.1 Exfiltration, based on 600 mm head: 0.175 L.

.2 Infiltration: 0.150 L.

.12 Repair and retest sewer line as required, until test results are within limits specified.

.13 Repair visible leaks regardless of test results.

.14 Television and photographic inspections:

.1 Carry out inspection of installed sewers by video camera, digital camera or by other related means.

4.2 HDPE FORCE MAINS

.1 Before acceptance of the work, the entire system shall be subjected to a hydrostatic pressure test in the presence of the Consultant. Notify Consultant at least 48 hours in advance of all proposed tests. The Contractor shall provide all necessary labour, materials and equipment for the test including a suitable pump, measuring tank, pressure hoses, connections, plugs, caps, gauges and all other apparatus necessary for filling the main, pumping to the required test pressure and recording the pressure and leakage losses. The Contractor shall provide evidence that the gauges used are accurate.

.2 When the line has been filled and most of the air expelled, time should be allowed for the remaining air and water to reach a constant temperature.

.3 No test shall be applied until at least 7 days after the concrete thrust reaction block has been cast and plugged ends securely braced. In the case of high early strength concrete, allow a minimum of 3 days.

.4 The test section may be pressured through a hydrant or a tap may be installed in the line. After testing the pipe, the tap shall be plugged at the Contractor’s expense.

.5 Fill the force main at a velocity of less than 0.6 m/s.

.6 Each section between valves shall be brought to test pressure with the valves closed, to test the valves under pressure. Test pressure shall be held without loss for two (2) minutes before opening the valve and releasing the pressure into the next section.

.7 Mark the gauge and the level of water in the storage barrel at the beginning of the test.

.8 Maintain the test pressure within + 20 kPa of the specified test pressure for the duration of the test. Pump the test section back to the test pressure at the end of the first 30 minutes. If the allowable leakage is exceeded, air may be trapped. Remove trapped air and repeat the test.

.9 The test procedure consists of two steps. The initial expansion phase and the test period. In order to accommodate the initial expansion of the main under test, the following shall be done:

a) Fill the line with water and pressurize to 1.5 times the Standard Pressure Rating of the main. All air shall be expelled from the line during filling of the test section.

b) Add sufficient make-up water to the main at hourly intervals to return the main to the test pressure. The initial expansion shall be done for a 3 hour period so the main shall be repressurized 3 times during this phase.

c) After the third repressurization, the test period shall begin. No make-up water shall be added to the main until the end of the test period which shall be 1 to 3 hours long. At the end of the 3 hours, a measured quantity of make-up water shall be added to the main to repressurize it to the test pressure. The amount of make-up water shall not exceed the volume allowance for expansion given below

d) Allowance for expansion under test pressure in litres for each 100 metre of pipe at 23ºC.

Nominal Pipe Diameter in mm	1 Hour Test	2 Hour Test	3 Hour Test
75	1.2	1.9	3.1
100	1.6	3.1	5.0
150	3.7	7.5	11.2
200	6.2	12.5	18.7
250	8.7	16.2	26.2
300	13.7	28.7	42.4
350	17.4	33.7	52.4

e) The amount of make-up water shown in the table above should be multiplied by the appropriate correction factor taken from below for the pipe temperature at the time of testing:

Temperature (ºC)	Correction Factor
0	0.22
2	0.24
4	0.28
6	0.32
8	0.36
10	0.42
12	0.47
14	0.53
16	0.59
18	0.66
20	0.74
22	0.87
23	1.00
24	1.20

Under no circumstances should the total time under test exceed eight (8) hours at 1.5 times the pressure rating. If the test is not completed due to leakage, equipment failure or any other reason within this time period, the test section shall be permitted to "relax" for an additional eight hour period prior to starting the next testing sequence.

.10 If the test fails any section of the water main, the Contractor shall locate and repair the leaks at no extra cost. After such repairs, retesting of the repaired sections shall be conducted.

.11 Where connections are made to existing water mains, the pressure used to test sections of new mains which cannot be isolated from the existing mains shall be specified by the Consultant, or the leakage test may be waived by the Consultant. This shall not relieve the Contractor from his obligation to repair leaks or replace defective material.

.12 It is the responsibility of the Contractor to ensure that normal safety precautions are observed for hydrostatic pressure tests.

.13 Flush and clean out pipes after pressure tests.

a) Remove stops after satisfactory completion of test and seal holes with plugs, make repairs to insulation and external protective jacket as required.

b) Dispose of flushing water in a manner acceptable to the Consultant.

.14 Maintenance: If leaks develop in the work before the expiry of the maintenance period, the Contractor shall make the necessary repairs. The leaks shall be deemed repaired when the leakage is less than the allowable amount specified.

.15 Damages: Water introduced into the force mains by the Contractor shall be at his own risk. All damage to the pipe from freezing or other causes shall be repairs by the Contractor at his own expense

END OF SECTION

PART 1 GENERAL

1.1 Related sections but not necessarily limited to

.1 Division 03 – Concrete
Division 31 – Earthwork
Division 33 – Utilities

.2 Refer to the soil test pits report (TP15-06) for soil and water table information to design a concrete base for the lift station.

.3 Supply, deliver, install, test and adjust ready for operation of a new submersible sewage lift station, as specified herein, including pump motors, pump accessories, pump monitoring equipment, blower heater, level switches, level controller, control panel and instrumentation. All electrical equipment shall meet hazardous area classification requirements, if applicable.

1.2 References

.1 Alberta Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
.2 Aluminum work in compliance with CSA CAN3-S157
.3 Company Certification to CSA W 47.2
.4 Canadian Electrical Code

1.3 Fabrication Standards

.1 Amec 4S-10.01 Manufacture and Installation for FRP structures
.2 Amec 4S-10.02 FRP pressure pipe, fittings and flanges
.3 Flygt specification GE-1008-04 (Latest version)

1.4 Submittals

.1 Product Data: Provide manufacturer's technical data including operating characteristics. Include product data for covers, fiberglass cell, guide rail assembly, piping, valves, control panel, and accessories. Include product data for pumps. Include product data for control panel and panel wiring schematic.

.2 Pump Performance Curves: Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include net positive section head (NPSH) curve and total dynamic head calculations. Include performance chart for motor showing curves for torque, current, power, factor, input/output KW and efficiency. Include data on starting and no-load characteristics.

.3 Shop Drawings: Show fabrication and installation details for the station. Indicate dimensions of New Lift Station cell. Detail equipment assemblies and indicate dimensions; loads; required clearances; method of field assembly; components; electrical characteristics; and location and size of each field connection.

Pumps: Indicated pump type, capacity, and power requirements.
Wiring Diagrams: Power, signal, and control wiring.
Indicate requirements for guide rail and bracket fabrication based upon selected pump.

.4 Submit the following additional information:

.1 Dimensional drawings of each pump, including mass of major components.
.2 Dimensional drawings of specified pump equipment and accessories.
.3 Minimum submergence and impeller size.
.4 Pump cross-section with replacement parts list.
.5 List of recommended spare parts list.
.6 Proof of Pump/Motor CSA approval.
.7 Certificate signed by manufacture verifying lift station performance testing.
.8 Field testing report documenting lift station operational performance.
.9 Singed copy of manufacturer's warranty.
.10 Uplift calculations sealed by a P.Eng. registered with APEGA

1.5 Operations and Maintenance Data

.1 Submit Operation and Maintenance Data in accordance with Section 01 77 01 - Operations and Maintenance Manual.

.2 For sewage lift station equipment including control panel and ventilation unit provide:

.1 General overall layouts
.2 Detailed wiring schematics
.3 Provide single line diagram for each station identifying all electrical loads.
.4 Parts list complete with list of recommended spare parts
.5 Control narrative describing overall operation of station components
.6 Detailed instructions for adjustment of start-stop levels.
.7 Detailed maintenance and lubrication schedule, including daily, weekly, monthly, semi-annual and annual checks.
.8 Detail for each pump

PART 2 PRODUCTS

2.1 Fiberglass Reinforced Plastic (FRP) Lift Station

.1 Diameter (inside): 2.438 m (8 ft)

.2 Height: approximately 4.0 m (13.2 ft)

.3 The shell will have a sanitary white gelcoat finish on the interior, backed up with a standard corrosion liner which includes a surfacing veil and two layers of 1.5 oz. chopped strand mat. These reinforcements are wetted out with a premium grade isophthalic resin. The glass content of the corrosion liner shall be 20-30% with an overall thickness of .11". Shell structure shall be filament wound in a helical pattern with a winding angle of 60 -70 degrees from the horizontal axis, to a total thickness of .55". Glass content of this filament wound structure shall be between 60% and 70% by weight. External

reinforcing ribs shall also be installed using the filament winding process. These ribs are trapezoidal in shape with a 2" height with approximately 1/4" of thickness. Rib spacing shall be shown on shop drawings.

.4 The FRP base design and fabrication is critical in handling the uplift forces present and to provide adequate mounting for the discharge connections. The standard design for these bases incorporate the same corrosion liner as the shell, but uses a combination FRP/foam core composite for the structure. This base will have a total thickness of 3.75" to withstand a full hydrostatic head outside of station with no fluid inside. A minimum 16" x 16" square solid FRP pad will be provided in the base for bolting of each discharge connection. The 3/4" stainless steel base bolts are installed into these solid pads and glassed over from the back side to prevent any leakage. The base is to have a smooth radiused corner on the inside in order to eliminate benching. It should also be noted that this base gets installed to the corrosion liner before the filament winding process in order to wind past the knuckle radius of the base. This provides an integral base to shell joint and adds thickness to the radiused corner.

.5 An aluminium checker-plate cover with lip will be installed onto the top of the station, with Flygt hatches bolted into it for station access. All bolting hardware will be 304 stainless steel.

.6 A center mount sleeve for the safety davit shall be installed on the top of the Lift Station.

.7 A working floor or intermediate platform consists of aluminium angle or channel frame with wall clips made in aluminium with floor grating made of Safe-T-Grate fiberglass 1.5"x1.5"x1.5" deep. This particular station has a full platform. Hinged door sections are installed to accommodate removal of pumps.

.8 Station will include a full length ladder to the station floor. This is a marine grade aluminium industrial ladder with non-slip treads. Aluminium wall brackets are attached to this ladder approximately every 6' in length.

.9 Threaded PVC couplers are laminated to the station wall to provide sealed connections for electrical cables. 2” diameter couplers be installed at elevation and orientation required to connect to control and power panels.

.10 For handling and anchoring purposes a total of 2 lifting and 8 hold down lugs will be installed. These lugs are 4" wide by 1/2" thick mild steel coated with coal tar epoxy. Lugs are installed during the filament winding of the reinforcing ribs and are placed under the very bottom and top ribs.

2.2 Manufacturer

.1 The pump manufacturer shall have several units of similar type pumps installed and operating for no less than five years in Canada.

.2 The motor and pump shall be designed and assembled by the same manufacturer.

2.3 Performance Requirements

.1 Supply and install two submersible non-clog wastewater pumps each rated at 5 L/s at a TDH of 4.2 m. Pumps shall be Flygt or approved equal.

.2 Each pump shall be equipped with a 2.25 kW (3.0 hp), submersible electric motor connected for operation to 208 Volts, three (3) phases, 60 hertz, with sufficient length of submersible, SOW cable for removal and servicing of each pump.

.3 The neoprene or CPE jacketed cable shall be sized according to CSA standards and carry a CSA approval.

.4 The pumps shall be supplied with pump stands with 100 mm mating cast iron flange.

.5 Fit one of the pumping units with a Flygt hydraulic mix flush valve .

.6 Each pump shall be supplied with sufficient length of steel lifting chain for removal and servicing of each pump. The safe working load of the lifting chain shall be at least 40% greater than the pump weight. Sufficient chain shall be supplied to enable the chain to be threaded into the chain hoist with the pump removal hatch in an open position.

2.4 Pump Design

.1 The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well.

.2 Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal, watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

2.5 Impeller Design

.1 The impeller shall be of semi-open, multi-vane, backswept, non-clog design. The impeller vanes shall be self-cleaned upon each rotation as they pass across a relief groove(s) located in the pump housing (or in an insert ring in the pump housing) and shall keep the vane clear of debris, maintaining an unobstructed pumping.

.2 The impeller(s) shall have heavily back swept leading edges with a specific angle distribution enabling the capability of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Impellers shall be locked to the shaft. The clearance between the pump housing/insert ring and the impeller shall be adjustable. The impeller shall be of grey cast iron (ASTM A48 Class 35B) with hardened edges.

2.6 Pump Construction

.1 Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blowholes or other irregularities.

.2 All exposed nuts or bolts shall be of AISI type 304 stainless steel. An approved, sewage resistant coating shall protect all metal surfaces coming into contact with the pumpage, other than stainless steel or brass.

.3 Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings.

.4 Fittings shall be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

.5 Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

2.7 Mechanical Seals

.1 Each pump shall be provided with a tandem mechanical shaft seal system consisting of two, totally independent seal assemblies.

.2 The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate.

.3 The lower, primary seal unit, located between the pumped liquid and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-

carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary tungsten-carbide seal ring and one positively driven rotating carbon seal ring.

.4 Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing.

.5 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. The seal lubricant shall be non-toxic and FDA approved for potable water applications.

2.8 Bearings

.1 The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces.

2.9 Electric Motors

.1 The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, EEMAC B type. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (355°F). The stator shall be trickle impregnated using Class H resin and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.

.2 The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel.

.3 The motor and pump shall be designed and assembled by the same manufacturer.

.4 The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C (176°F).

.5 The power cable shall be sized according to the CEC and CSA standards and shall be of sufficient length to reach the junction box without the need of any splices. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 20 metres.

.6 The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

2.10 Protection

.1 All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm.

.2 A leakage sensor shall be included to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote.

.3 The thermal switches and FLS shall be connected to a Flygt MiniCAS II (Control & Status) monitoring unit to be supplied and mounted in the control panel.

2.11 Painting

.1 The exterior of the pump, including all metal surfaces coming into contact with the pumpage shall be protected by a factory-applied spray coating of acrylic dispersion zinc phosphate primer and finished with a polyester, epoxidized resin paint. Prior to the final paint finish being applied, the pump components shall be primed and washed. The components shall then be assembled and washed

a second time before the final topcoat is applied. The finish paint or top-coat shall be Flygt Duasolid, applied externally to a minimum dry film thickness of not less than 100 microns. The film thickness shall be consistent with ISO 2808, Method No. 6.

2.12 Station Equipment

.1 Supply and install guide bars for each pump including upper, lower and intermediate guide bar holders. Guide bars shall extend from the pump discharge assembly to the top of the station.

.2 Supply and install pump stands (anchor frame) for each pump. The pump stand shall be c/w 100 mm discharge flange.

.3 Supply and install external blower heater unit. Unit shall be DEXON Model MDH3 or approved equal. Unit shall be able to provide at 6 air changes per hour and shall be suitable to install within a Class 1, Division 2 location. Unit shall have a maximum heating capacity of 3 kW and shall operate with 208 volt, three phase power. Unit to be complete with alarm module to generate alarms for "No Air", "Low Temperature", or "Overheat" condition or any combination of the three.

.4 Supply lifting davit wall mounted support to suit Davit as specified in 2.10.3.

.5 Supply and install Davit Arm mounting plate as specified in Section 10.45.00.

2.13 Pump Lifting Davit

.1 Supply one lifting davit with a lifting capacity suitable for lifting the heaviest pumps, complete with chain hoist sized to allow removal of pumping units at each lift station.

2.14 Piping, Valves and Fittings

.1 All discharge piping will be 316SS SCH10 and all inlet stubs will be FRP 200 psi rated. Vent piping will consist of FRP ducting. Spools from the discharge connection and the valves on header shall use full face flanges. This discharge header shall be made removable by a set of flanges to the force main pipe. All inlet and outlet nozzles are to be FRP laminated inside and out to the tank wall with external gussets where required. Nozzles are machined to a precise O.D. as per your field requirements. Bolting for all flanges are to be 304 Stainless Steel. All interior piping is coated with a bright white gelcoat

.2 Supply and install 100 mm diameter flanged check valves (Flygt) for each pump.

.3 Supply and install 100 mm diameter flanged Non-Lubricated eccentric plug valves c/w manual gear operator for each pump, cast iron body, cast iron resilient coated plug, seat compatible with raw sewage.

.4 Supply and install 50 mm NPT air release valve.

.5 All submerged bolts and nuts shall be stainless steel.

.6 Couplings within the station shall be Victaulic Zero-Flex Style 07. Couplings shall be epoxy coated and shall be supplied with stainless steel bolting materials.

.7 Couplings for buried service shall be Dresser as shown on the drawings. Dresser couplings shall be Denso Paste and Denso tape wrapped. Bolting materials shall be stainless steel. Supply and install Dresser Style 440 joint harnesses as shown on the Drawings. Bolting materials for joint harnesses shall be stainless steel. Joint harness bolts shall be Denso paste and tape wrapped. Provide anodes for each coupling as shown on the Drawings.

2.15 Epoxy Pipe Coatings

.1 Piping shall be externally epoxy coated with Devoe Bar-Rust 235 or approved equal. Surface Preparation shall be commercial sandblast to SSPC SP10. Provide a prime coat of 150 micron (dry) and top coat of 150 micron (dry) for a total dry film thickness of 300 micron (12 mils).

.2 Pipes for buried service shall be epoxy coated and externally protected with yellow jacket.

2.16 Control Panels

.1 Supply and install PLC based control panels for each station complete with pump motor starters, ultrasonic level control system, float bulbs suitable for installation within a Class 1, Zone 2 environment, and other components to provide a complete operating station. The operational control system shall be as described below and in this section. The controller shall be Flygt Multi-Smart. Control panels shall be signed to accommodate the flow meters remote mounted electronics.

.2 Supply, install necessary communication hardware to facilitate telemetering of alarms via future wireless network. Controller must be capable of communicating with the central SCADA system via wireless internet connection.

The following alarms are to be programmed into the alarm dialer:

.1 Low Level Alarm
.2 High Level Alarm
.3 Pump 1 Fail
.4 Pump 2 Fail
.5 Pump 1 and Pump 2 Fail
.6 Common Station Alarm

.3 Supply and install breaker and starter in control panel to facilitate connection of Blower Heater.

4 Control/Power panel to be NEMA 4 lockable with handle and double doors. The inner door to be used to mount control devices and indicators. The outer door to be used to lock the panel.

.5 Power supply to the control panel will be 208 volt, 60 Hz, 3-phase.

.6 Panel shall provide for all loads as shown on the single line diagrams.

.7 Panels shall be provided with a thermostatically controlled interior heater.

.8 Each control panel shall be sized to provide a clear space of 300 mm x 300 mm for future communication devices.

2.17 Ultrasonic Level Sensor

.1 An ultrasonic level sensor shall be installed in the new wet well cell and can be submersible.
.1 Measuring range: min. 0.3m, max. 15 m
.1 Mounting thread and facing: 1" NPT ((Taper), ANSI/ASME B1.20.1)
.1 Cable length: 30 m (98.43 ft)
.1 Approvals: CSA Class 1 Div 1 (available only with Mounting Options)
.1 Echomax XPS-15 Transducer High-frequency ultrasonic transducer or approved equal.

2.18 Control and Instrumentation

.1 Provide one complete control package to integrate all aspects of the sewage pumping stations.

.2 Controls based on the manufacturer's standard PLC based control system. Controller must be capable of communicating with the central SCADA system via wireless internet connection. User program shall be provided on an optical disc.

.3 Systems to provide the control sequence for two pumps based on float switches. Level set points to be confirmed during shop drawing review stage.

.4 Level alarms for each station will be based on level detected by high level and low level float bulbs.

Control Level	Level Position	Control Point Function	Rising or Falling Condition
LAH	LS-5	Initiate high level alarm, start lead pump, delay 15 seconds and start lag pump	Rising
P2 Start	LS-4	Lag pump starts	Rising
P1 Start	LS-3	Lead pump starts	Rising
Stop	LS-2	Stop both pumps and switches the lead and lag roles for next cycle.	Falling
LAL	LS-1	Stop both pumps and initiate low level alarm, adjustable delay between 15 seconds to 120 seconds	Falling

.5 Pumping Control Philosophy

.1 Level bulbs and ultrasonic level transmitter provide input to controls for pump operation. Level bulbs installation shall utilize Xylem Vertical level Regulator Hanger Installation. Provide two

single hangers connected via galvanized chain. Unit shall be suitable for two level bulbs.

.2 Controls starts and stops pumps on rising and falling levels determined during shop drawing review stage. LS-1 and LS-5 (level bulbs) to be hard wired directly to pump motor starters.

.3 LS-2, LS-3 and LS-4 are from the ultrasonic level transmitter.

.4 The Control Panel to have red indicators for the following alarms:
- .1 Stator Leakage Pump 1, Pump 2.
- .2 Stator High Temperature Pump 1, Pump 2
- .3 Pump 1, Trip
- .4 Pump 2, Trip
- .5 LAL
- .6 LAH

.5 Alarm from stator leakage or high temperature will stop lead pump, start lag pump, and generate an alarm.

.6 Any alarm condition will cause the appropriate alarm indicator to flash. At the same time the alarm beacon will operate.

.7 The Alarm Acknowledge button will cause the flashing indicators to switch to steadily-lit and will shut off the beacon.

.8 The Alarm Reset button will clear the alarm condition in the controls and extinguish the indicator.

.9 If the alarm condition still exists the indicator will begin flashing again.

.10 The Lamp Test button will test all indicators and operate the beacon.

.11 The Control Panel to have red indicators for the following:

- .1 Pump 1 Running
- .2 Pump 2 Running

.12 Three hour meters, one for each pump, and one for when both pumps are operating together, record elapsed operating time.

.13 Alarm beacon to be Edwards 49CR N5, 120 VAC or approved alternative.

.14 Motor Starters:

.1 Submit shop drawings to show:
- .1 Mounting method and dimensions.
- .2 Starter size & type
- .3 Layout of identified internal & front panel components.
- .4 Enclosure types
- .5 Wiring diagram for each starter.
- .6 Interconnection diagrams.
- .7 Overload relay trip settings.

.2 Provide operation and maintenance data for motor starters.

.3 Include operation and maintenance data for each type and style of starter.

.4 Provide one spare set of load contacts and one spare set of auxiliary contacts for each starter.

.5 Provide two spare fuses of each type.

.6 Half-size starters not acceptable.

.7 Each starter to consist of:

.1 Control transformer with size and voltages as required.
.2 Solenoid-operated contacts, as indicated on single-line diagram by vendor.
.3 Overload relay sized as required for motor connected, manual reset via push-button.
.4 Power and control terminals.

PART 3 EXECUTION

3.1 Installation

.1 Install pumping equipment in the locations shown on the Drawings and in accordance with the recommendations of the manufacturer.

.2 Align equipment and pipe connections to avoid the transmission of piping weight or reactions to the equipment at pipe connections.

.3 Grout pump steel support base using non-shrink grout Sika 212SR or equivalent.

.4 Provide the services of the manufacturer's representative to inspect and make final adjustments to the equipment.

.5 Provide all pumping units properly mounted, aligned and balanced so that vibrations do not exceed the limits recommended by the Hydraulic Institute Standards for Centrifugal Pumps.

.6 Acceptance of equipment shall be subject to the final inspection of the Departmental Representative based on running tests after installation.

.7 Check for correct direction of rotation.

3.3 Lubrication

.1 The Contractor shall ensure that the pump and drive are correctly lubricated in accordance with the manufacturer's instructions.

3.4 Field Testing

.1 Force Main: Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 1035 kPa (150 psig).

.2 Field test all pumps in the presence of the Departmental Representative to demonstrate the installation is correctly completed and all pumps are

operating satisfactorily over the entire speed range specified without vibration or cavitation.

.3 If vibration or cavitation should occur during the test procedure, correct any deficiencies as required and retest the pump until all vibration or cavitation is removed.

.4 During the initial test of a pump unit, Contractor is to arrange to have the Departmental Representative, the manufacturer's representative and a representative of the Departmental Representative on site.

.5 All costs for the presence of the pump manufacturer's representative for inspections, adjustments and performance tests shall be borne by the Contractor.

.6 After construction debris and foreign material has been removed from the wet well, Contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment; test manual control devices and automatic control systems. Be alert to undue noise, vibration, or other operational problems.

.7 Prior to acceptance by Owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to specified operating characteristics.

3.5 Painting

.71 Thoroughly clean and touch up paint in the field.

3.6 Manufacturer’s Start-up Services

.1 Provide 8 man-hours of on-site service by manufacturer’s technical service representative. The representative or factory service technician shall inspect the completed installation. He shall calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section addresses the procedures to be employed for replacing existing water and sanitary force mains crossing Cameron Creek by pipe bursting as identified on the drawings, and replacing with new high density polyethylene pipe (HDPE) pipe.

1.2 RELATED SECTIONS

.1 Section 331116 – Site Water Utility Distribution Piping

.2 Section 333113 – Public Sanitary Utility Sewage Piping

1.3 REFERENCES

.1 International Pipe Bursting Association – Guideline Specification for the replacement of Mainline Sewer Pipes by Pipe Bursting

.2 International Pipe Bursting Association – Guideline for Pipe Bursting

.3 USPEA - State of Technology for Rehabilitation of Water Distribution Systems

.4 USEPA – Quality Assurance and Quality Control Practices for Rehabilitation of Sewer and Water Mains

1.4 QUALIFICATIONS

.1 The contractor shall be trained to operate pipe bursting equipment and systems. The contractor shall provide proof of training and proficiency in the use of the equipment. Only the contractor's trained employees shall operate the equipment.

.2 The contractor shall be trained by the respective manufacturer of the pipe bursting equipment in the use of that machinery. The contractor shall provide certification from the manufacturer that the contractor has been trained and is proficient in the use of the equipment. Only the contractor's employees trained and certified by the manufacturer shall be allowed to operate the equipment during the project.

.3 The contractor must have successfully completed 3,000 feet of pipe bursting which includes one successful static pipe bursting project. Contractor shall submit a list of these projects including the owner, engineer, addresses, phone numbers and dates that said projects were completed with their proposal. Or, the contractor shall submit with bid documents proof that they will use manufactures equipment and technical support for project start up.

1.5 EQUIPMENT

.1 Pipe bursting tool shall be static and hydraulically operated. The bursting action of the tool shall increase the external dimensions sufficiently, causing pitting and breakage of the pipe at the same time expanding the surrounding ground. This action shall not only break the pipe, but also create the temporary void into which the burster can be statically pulled which enables forward progress to be made. Simultaneously, the new polyethylene pipe, directly attached to the expander, shall also move forward.

.2 The static pulling frame shall be telescopic in design to allow the cutting head to release at the termination of the pull. This also provides minimal trench length by telescopic adjustment.

.3 Quick lock bursting rods are required to guarantee snap lock connections. Quick Lock rods also stabilize cutting wheels at a 90^{o} plane to invert pipe. Threaded bursting rods are not allowed. This insures the same cutting location eliminating threaded rod failures and turning of rods which effect cutting ability of blades.

.4 The unit must maintain automatic thrust and pull back.

.5 The static unit is capable of pipe bursting in two directions from the same excavation.

1.6 SUBMITTALS

.1 Submit manufacturer's specific technical data with complete information on physical properties of pipe and pipe dimensions pertinent to this job. A certificate of "Compliance with Specification" or suitable alternative shall be furnished for all materials to be supplied.

.2 Complete calculations including lists of parameters, all formulas and all other data showing the design of the new pipe.

.3 Detail drawings and written descriptions of the entire construction procedure to install pipe, bypass sewage flow, pit sizes, pit construction and shoring, dewatering and sewer service reconnections.

Part 2 Products

2.1 Products Specifications

.1 High Density Polyethylene Pipe shall be AWWA C906 (HDPE).

.2 Pipe must conform to ASTM F714 and NSF 61.

.3 HDPE resin shall be PE3408 characterized by ASTM D3350.

.4 All pipes shall be made of virgin material, not reworked except that obtained from manufacturer’s own production.

.5 Dimension Ratios: The minimum wall thickness of the polyethylene pipe (PE) shall meet Minimum 11 SDR of Pipe.

.6 Cuts or gouges, per ASTM F585 are acceptable up to 10% of wall thickness. Beyond 10% of wall, damage must be removed by cutting the damaged section from the pipe string and butt fusing the ends.

.7 Stripe along the length of the pipe shall be blue in color to identify the pipe as potable water.

.8 Pipe connection fittings shall meet AWWA C906 and meet or exceed the pressure requirements of the HDPE pipe.

2.2 Product Handling

.1 Pipe transport and handling shall be per manufacturer’s recommendation.

.2 Product other than pipe must be stored and handled per manufacturer’s recommendations.

2.3 Documentation and Planning

.1 Contractor shall submit a plan to the city or town on a marked-up copy of the project drawings showing the contractor’s construction phasing and plans at the pre-construction meeting. Plan details should include:

a. Pit locations for pipe insertion and burst machine location;

b. Pit locations for service reconnects;

c. Schedule of when various sections are to be rehabilitated;

d. Distances of each pull;

e. Isolating points used to seal the system during the pipe burst;

Part 3 Execution

3.1 SAFETY

.1 Submit manufacturer's specific technical data with complete information on physical properties of pipe and pipe dimensions pertinent to this job. A certificate of "Compliance with Specification" or suitable alternative shall be furnished for all materials to be supplied.

.2 The contractor shall carry out operations in strict accordance with all applicable OSHA Standards. Particular attention is drawn to those safety requirements involving work entry into confined spaces. It shall be the contractor's responsibility to familiarize and its employees with OSHA Standards and regulations pertaining to all aspects of the work.

3.2 INSERTION AND RECEIVING EXCAVATIONS

.1 The location and number of insertion and receiving excavations shall be planned by the contractor and submitted in writing for approval by the Departmental Representative 10 days (or as determined by the Engineer) prior to excavation.

.2 Burst pit and insertion pit locations shall be placed such that excavations are minimized. This may be accomplished by placing either or both of these pits at the point of a service connection.

.3 Before excavation is begun, it will be the responsibility of the contractor to check with the various utility companies and determine the location of existing utilities in the vicinity of the work area. The contractor at no cost to the City, if required, will arrange temporary construction easement and/or right-of-way areas.

.4 Damage to utilities and the resulting repair, temporary service cost, etc., shall be borne by the contractor. Access pits shall be backfilled in accordance with the appropriate specifications.

.5 All excavations shall be properly sheeted/shored in accordance with relevant specifications for trench safety systems. Any damage resulting from improperly shored excavations shall be corrected to the satisfaction of the Departmental Representative with no compensation due to the contractor.

.6 All open excavations shall be kept secure at all times by the use of barricades with appropriate lights and signs, construction tape, covering with steel plates, etc., or as directed by the Departmental Representative.

.7 One or more receiving pits shall be excavated at the end(s) of the sewer pipe to be replaced or at appropriate points within the length of the existing pipe. Pit shall be centered over the existing pipe.

.8 The number of pits for machine and pipe insertion shall be the minimum necessary to most efficiently accomplish the work. The contractor shall give consideration to the use of excavation required for other purposes such as for sanitary sewer service reconnections and manhole replacement.

.9 Where manholes are used as machine or new pipe insertion pits, the contractor shall identify such manholes and replace them at no additional cost to the City if damaged. Any manhole modification or replacement required shall be considered incidental to the installation of the new pipe.

.10 The cost of diversion pumping around a manhole or insertion pit, if required, from a manhole upstream to a manhole downstream, shall be incidental to the installation of the new pipe.

3.3 Joining of Pipe

.1 Fusing per butt fusion methods in strict conformance to the pipe and/or fusing equipment manufacturer's recommendations shall be used to join sections of HDPE pipe.

.2 Fusing of 'sticks' of pipe shall be performed in the general vicinity of the pipe insertion pit or laydown yard (staging area).

.3 Pipe supplied by the pipe manufacturer in a coil may be fused remote from the pipe insertion pit.

3.4 Hydrostatic Testing

.1 See Section 331116 – Site Water Utility Distribution Piping.

3.5 Disinfection

.1 See Section 331116 – Site Water Utility Distribution Piping.

END OF SECTION

Part 1 General

1.1 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SMOOTH WALL POLYVINYL CHLORIDE (PVC) PIPE

.1 For pipe sizing 200 to 375 mm diameter, all pipe to be PVC gravity sewer pipe to latest revision ASTM D3034, SDR 35, CSA certified as meeting latest revision CSA B182.2-M, c/w integral locked-in gasket bell and spigot systems.

.2 For pipe sizing 450 to 1050 mm diameter, all pipe to be PVC gravity sewer pipe to latest revision ASTM F679, SDR 35, CSA certified as meeting latest revision CSA B182.2-M, c/w integral locked-in gasket bell and spigot systems .

2.2 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material in accordance with Section 31 05 16 - Aggregate Materials and following requirements.

.1 25 mm minus washed drain rock.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.2 Concrete mixes and materials for bedding, cradles, encasement, supports: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.3 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3 in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

3.2 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Protect trench from contents of sewer.

.3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.1 Do not use blocks when bedding pipes.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% corrected maximum dry density.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted common backfill.

3.4 INSTALLATION

.1 Lay and join pipes to: ASTM C 12.

.2 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.

.3 Handle pipe using methods approved by Departmental Representative.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.4 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.6 Joint deflection not to exceed limits recommended by pipe manufacturer.

.7 Water not to flow through pipes during construction unless permitted by Departmental Representative.

.8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Install plastic pipe and fittings in accordance with CAN/CSA-B1800.

.10 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.

.11 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.12 Make watertight connections to manholes and catch basins.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.13 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.

.1 Joint to be structurally sound and watertight.

.14 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.1 Do not dump material within 10 m of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % corrected maximum dry density.

.7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95 % corrected maximum dry density. In other areas, compact backfill to at least 90 % corrected maximum dry density.

3.7 FIELD TESTS AND INSPECTIONS

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 Remove foreign material from sewers and related appurtenances by flushing with water.

.3 Television and photographic inspections:

.1 Carry out inspection of installed sewers by television camera, photographic camera or by other related means.

3.8 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.

END OF SECTION