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**Part 1            General**

**1.1                DESCRIPTION OF WORK**

- .1            The work described herein shall consist of the construction of a sewage pumping station as shown on the Plans and specified in Section 01001, Special Provisions, including the supply and installation of a precast reinforced concrete manhole; the supply and installation of piping, valves, fittings and related appurtenances; the supply and installation of miscellaneous metal; the supply and installation of pumping equipment; the supply and installation of electrical equipment; the connection of the electrical equipment to the source of power; the sanding, priming and painting of all uncoated non-galvanized iron and steel products; the connection of the lift station to the influent sewer main, and to the discharge force main; and testing the completed lift station (including pumps, piping etc.).

**1.2                STANDARDS**

The following organizations publish Standards which have been referred to in this Section:

- .1            CSA International  
                 178 Rexdale Boulevard  
                 Toronto, ON M9W 1R3
- .2            ASTM – American Society for Testing and Material  
                 100 Barr Harbor Drive  
                 West Conshohocken, PA 19428-2959 USA
- .3            AWWA – American Water Works Association  
                 666W. Quincy Avenue  
                 Denver, Colorado 8235 U.S.A.

The Standards referred to shall be the most recent edition.

**1.3                QUALITY ASSURANCE**

- .1            CONCRETE - The Engineer shall carry out such tests on the concrete as he considers necessary in accordance with CSA Standard A23.2, Methods of Test for Concrete. Such tests shall be at the expense of the Owner, except that the Contractor shall furnish any and all test samples free of charge.



- .2 LEAKAGE – The Contractor shall undertake infiltration and ex-filtration testing of the completed sewage pumping station to ensure the manhole is watertight.
- .3 OPERATION - The Contractor and the suppliers of major pumping and control components shall test the operation of the sewage pumping station under the direct supervision of the Engineer.
- .4 WELDED JOINTS - The Engineer shall test welded joints by x-raying or other means. Such tests shall be at the expense of the Owner, except that the Contractor shall supply any and all test samples free of charge. Welders shall hold a valid "Welder's Licence" as issued in the Province of Manitoba and shall be certified by Manitoba Labour and Immigration.

#### **1.4 STORAGE AND HANDLING**

- .1 Pumps, pipe, fittings, precast concrete manhole sections and other materials associated with the construction of the sewage pumping station shall be stored and handled in accordance with the recommendations of the Manufacturer and in a manner approved by the Engineer.

#### **1.5 INSPECTION**

- .1 Inspection of the work described in this Section shall be performed by the Engineer.

### **Part 2 Products**

#### **2.1 APPROVED MATERIALS**

- .1 Materials and products shall be supplied in accordance with the Listing of Approved Products in the attached appendix, Section 150500, Basic Materials and Methods, as shown on the Plans and as specified in Section 01001, Special Provisions.

#### **2.2 PRECAST CONCRETE MANHOLE**

- .1 Unless otherwise specified in Section 01001, Special Provisions, the lift station structure shall be a precast reinforced concrete manhole conforming to ASTM C478 Standard for Reinforced Concrete Manhole Section, complete with precast reinforced base, working floor slab, or (fibreglass mesh working floor) and top slab, each designed for 700 kg live load, with cast-in-place galvanized steel or light aluminium access hatch frame and covers; tongue-in-groove manhole section joints with deformable bituminous gaskets ("Ram-nek" or approved equal); cast-



in-place openings as required; and cast-in-place galvanized or aluminium manhole rungs.

## 2.3 CONCRETE

- .1 Concrete grout shall be non shrink type in accordance with Clause 2.7.6 of Section 033000, cast in place concrete or as specified in Section 01001, Special Provisions.

## 2.4 PIPE, FITTINGS AND JOINTS – INTERIOR OF STATION

- .1 Pipe, tees, elbows, reducers, sleeves and related fittings shall be one of the following:
  - .1 STEEL - shall be black seamless steel, ASTM Type A53 Grade B with either integral flanges or bevelled ends suitable for slip on flanges. Flanges shall be suitable for 1000 kPa service, forged steel, flat-face type, and drilled, conforming to the current AWWA Specification C207, Standard for Steel Pipe Flanges.
  - .2 IRON - shall conform to the following standards:
    - .1 AWWA C101 - Standard for Thickness Design of Cast Iron Pipe
    - .2 AWWA C106 - Standard for Cast Iron Pipe
    - .3 AWWA C110 - Standard for Gray Iron and Ductile Iron Fittings
    - .4 AWWA C115 - Standard for Flanged Iron Pipe
    - .5 AWWA C150 - Standard for Thickness Design of Ductile-Iron Pipe
    - .6 AWWA C151 - Standard for Ductile-Iron Pipe
  - .3 PVC – **shall be allowed in sewage pumping stations of under 10 horsepower each pump only** and shall conform to the following Standards:
    - .1 ASTM D1784 - Standard for Rigid PVC Compounds
    - .2 ASTM D1785 - Standard for (Schedule Type) PVC Plastic Pipe
    - .3 CSA B137.0 - Standard for Thermoplastic Piping
    - .4 CSA B137.3 - Standard for Rigid PVC Pipe for Pressure Applications

PVC compound shall be Type 1, Grade 1, Polyvinyl Chloride 1120. The pipe and fittings shall be Schedule 80 unless otherwise specified on the plans or in Section 01001, Special Provisions. PVC joints shall be solvent welded type or threaded type where shown on the plans.



- .4 Fittings shall be complete with integrally cast flanges for plain end pipe or threaded in accordance with AWWA C115, with threaded flanges installed.
- .5 For steel, PVC and iron pipe and fittings, gaskets shall be full faced and drilled, red rubber or approved equal. Nuts, bolts and washers shall be all stainless steel with hexagonal heads.
- .6 Subject to the approval of the Engineer, the Contractor may use mechanical-joint type adaptor flanges to connect plain end steel or iron or PVC pipe to appurtenances with integral flanges. Adaptor flanges shall be ductile-iron, Grade 65-45-12, conforming to the current ASTM Standard A536, Standard for Ductile-Iron Castings, and drilled in accordance with the current AWWA Standard C110, Standard for Gray Iron and Ductile Iron Fittings. Set screws shall be zinc-plated, heat treated steel with a minimum tensile strength of 28 MPa. The rubber gasket shall conform to the current AWWA Standard C111, Standard for Rubber-Gasket Joints for Cast Iron and Ductile-Iron Pressure Pipe and Fittings. Nuts, bolts and washers shall be all stainless steel with hexagonal heads.

## 2.5

### PUMPS

#### .1 LIQUID END

- .1 Type - fully submersible pump & motor unit
- .2 Service - for intermittent and continuous duty
  - .1 Raw sewage, 0<sup>o</sup> C - 70<sup>o</sup> C
  - .2 Solids up to 65 mm  $\phi$
  - .3 Suitable for running dry for 24 continuous hours
- .3 Openings - minimum 65 mm  $\phi$  suction inlet
  - .1 Minimum 75 mm  $\phi$  flanged (AWWA C110) discharge
- .4 Impeller - non-clog type, cast iron
  - .1 Pressure vanes on back side
- .5 Seal - double mechanical type in oil-filled, pressure equalizer chamber
- .6 Shaft - 416 stainless steel
- .7 Pump/Motor Housing - cast iron
- .8 Hardware - corrosion resistant

#### .2 MOTOR UNIT

- .1 Motor



- .1 Overload protection (in control box for 1  $\phi$ ; in magnetic starter for 3  $\phi$ )
- .2 Motor Speed - maximum 1800 rpm
- .3 Bearings - ball type
- .4 Approval - CSA approved for submersible operation
- .3 SPECIFIC PERFORMANCE CHARACTERISTICS
  - .1 Listed in Section 01001, Special Provisions
- .4 ACCESSORIES
  - .1 Chain - minimum 9 m long, hot dipped galvanized
  - .2 Coupling - slide away discharge type with guide bar accessories
  - .3 (c) Cable - minimum 9 m sow cable
- .5 GENERAL
  - .1 Service – the supplier must have a factory appointed maintenance/repair/service depot for the make of pump being offered.
  - .2 Standard - the supplier shall provide information with respect to previous installations presently in operation in the Province of Manitoba.

## **2.6 GATE VALVES – INTERIOR OF STATION**

- .1 Gate valves shall be bonnetless, wafer-style knife gate valves suitable for 1,000 kPa cold water service, with solid one piece all stainless steel, Type 316 body, type 18-8 stainless steel gate and stem, mild steel stuffing box and yoke, neoprene packing, stainless steel stem nut, ductile-iron operating wheel, and stainless steel nuts, bolts and washers. The valve shall be counter clockwise opening, with body drilled for flange connections.

## **2.7 CHECK VALVES**

- .1 Check valves shall be flanged swing check or wafer style, iron body, Type 316 stainless steel disc, seat, hinge, and related fittings. Buna N rubber "O" ring, stainless steel or bronze spacer, cadmium plated steel external manual operating lever and related fittings or the check valves shall be ball-type with threaded (50 mm and smaller) or flanged (50 mm and larger) joints.

## **2.8 MISCELLANEOUS**

- .1 PIPE SUPPORT STRAPS – Shall be all stainless steel with all stainless steel nuts, bolts, and washers.



- .2 VENTILATION PIPING – shall be seamless black steel thin wall pipe with light gauge welded fittings.
- .3 GUIDE RAILS, BASKET SUPPORT ASSEMBLY AND FITTINGS - shall be galvanized wrought iron or stainless steel.
- .4 TRASH BASKET - shall be fabricated of aluminium.
- .5 ACCESS HATCH - shall be a gasketed galvanized or aluminium hinged frame and cover unit as shown on the Plans and shall be lockable. The access hatch frame shall be cast into the precast or cast-in-place top slab.
- .6 WORKING FLOOR (other than concrete) – shall be a Vinyl Ester based fibreglass non skid mesh system with a Class 1 ASTM E-84 flame spread rating of 25 or less. The system shall be designed to limit deflection to L/240. Mesh spacing shall be 38 x 38 mm x 38 mm thick. The system shall be complete with all stainless steel clips, wide flange I beam (150 mm flange, 9 mm thick web) supports and stainless steel fasteners to construct a complete working floor as shown on the plans and specified in Section 01001, Special Provisions.

## **2.9 ELECTRICAL**

- .1 Electrical products shall conform to Section 260100, Electrical Work, Part 2 and shall be supplied in accordance with Section 01001, Special Provisions and as detailed on the plans.

## **2.10 LIQUID LEVEL CONTROL**

- .1 FLOAT SWITCHES - Unless otherwise specified in Section 01001 Special Provisions, the operation of the lift station pumping equipment shall be regulated by means of four "tear-drop" shaped submersible, weighted mercury float switches encapsulated in an enclosure suitable for immersion in domestic sewage. Each float switch shall be individually suspended by means of a submersible cable affixed to a level regulator hanger to be mounted on the wall, or the bottom of the working floor level of the lift station. The cable attachment to the hanger shall be such that field adjustments can be made readily to vary the operating level of each switch. The submersible cables supplied with the float switches shall be of adequate length (15 m) to allow them to extend directly into the electrical panel located above the lift station. The float switches shall be suitable for 120 volt, 1 phase, 60 Hz pilot duty. The contacts shall be normally open.



- .2 **ULTRASONIC LEVEL CONTROLLER** - As an alternative to mercury float switches, the Contractor may utilize ultrasonic level controllers. Unless otherwise specified in Section 01001, Special Provisions Ultrasonic Level Controllers shall be as follows:
- .1 Unit to continuously display liquid levels.
  - .2 Unit to be calibrated to provide volume pumped data c/w permanently affixed instructions for programming and accessing data.
  - .3 Unit to allow a separate float switch to be connected to provided low level protection.
  - .4 Unit to be have sufficient false target buffering and be rated by Manufacturer for use in a limited space with false targets as shown on the plans. Transducer to have built in temperature compensation. Provide certification from Manufacturer that transducer will operate satisfactory for this application prior to ordering.
  - .5 Provide sufficient circuits set to operate as per the depths shown on the plans. Provide the following Action:
    - .1 High water level – red light in panel, operate dialer and siren
    - .2 Start Lag Pump
    - .3 Start Lead Pump
    - .4 Stop pumps
    - .5 Emergency stop pumps due to low level float
  - .6 Provide a plaque that identifies the use of the relays i.e.: R1- high water level.
  - .7 Provide loss of echo detection which activates the telephone dialer, an alarm light and siren.
  - .8 Use Milltronics Hydroranger plus c/w XPS-10 transducer or approved equal.

## **2.11 ELECTRICAL PANEL**

- .1 The operation of the sewage pumps shall be controlled by a weatherproof, enclosed electrical panel, conforming to CSA Enclosure 3 Standards. The panel shall be supplied with a main service entrance breaker in a separate enclosure within the panel. A lightning arrestor and thermostatically controlled heater shall also be provided. The panel shall include an inside cover for switches, indicator lights, reset controls and hour meters. This cover shall be attached to the panel with metal hinges. Branch disconnect breakers for each pump and circuit breakers shall be provided for all system components. The panel shall include compatible pump motor starters with ambient temperature compensated quick trip relay



heaters on each motor lead and hand-off-automatic controls with all the necessary relays to operate in conjunction with level regulators. A manual alternator switch shall be provided to reverse the order of the lead and secondary sewage pumps. Hour meters shall be provided to record the operation time of each pump. A red high level warning light and a siren alarm shall be mounted on top of the panel protected by a wire mesh guard. These are to be activated automatically by a high level float switch in the lift station. The alarm shall have a silencing switch with a silencing indicator light and automatic reset on return to service. All switches and indicator lights shall be clearly identified with lamacoid name plates. The panel shall make provision for a 120 volt, 60 Hz single phase duplex power outlet which shall be recessed within the panel. The power outlet shall be capable of providing 20 amps of electrical current capacity.

- .2 The electrical panel design shall provide for the incorporation of an auto-dialer option and for automatic pump alternator control.

## 2.12 CONNECTION TO LINES

- .1 **INFLUENT SEWER PIPE** – The Contractor shall install a gate valve on the sewer or forcemain from the last manhole extending into the lift station and shall install the valve approximately 1 metre upstream of the lift station. The gate valve shall conform to the current AWWA Standard C509 Standard for Resilient Seated Gate Valves, 1,000 kPa service. The valve shall have an epoxy coated cast iron body with bronze or Buna-N rubber disc trim. The valve shall be complete with a counter-clockwise opening non-rising spindle. The joints shall be of the same type as the pipe to which the valve is joined. Each gate valve shall be complete with a valve box, including an extension spindle with a 50 mm square operating nut, stone disc, and metal valve box cover. The box and extension spindle shall be adjustable to suit the depth of bury specified for the pipe, plus or minus 0.3 metres.

Influent sewer pipe shall be in accordance with the appropriate specification for the following types of pipe:

- .1 **PVC PIPE** - The pipe shall be manufactured of Type 1 Grade 1 polyvinyl chloride 1120 in accordance with either of the two following alternatives:
  - .1 The pipe shall conform to the current ASTM Standard D1784, Standard for Rigid Polyvinyl Chloride Compound and D2241, Standard for Polyvinyl Chloride Plastic Pipe, and to the current CSA Standard B.137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications, and shall be Series 125 (SDR32.5) or Series 160 (SDR 26).





- .2 The pipe shall conform to the current AWWA Standard C900, Standard for Polyvinyl Chloride Pressure Pipe, and shall be Class 100 or Class 150.

Each length of pipe shall have an integral bell end with a rubber gasket as supplied by the pipe manufacturer. Pipe lengths shall not exceed 6 m.

- .2 POLYETHYLENE PIPE - the pipe shall conform to PE3608 or PE4710 resin of ASTM 714 Polyethylene Pipe based on Outside Diameter. Pipeline flange connection materials shall consist of a polyethylene stub end, epoxy coated ductile iron back-up ring drilled in accordance with the current AWWA Standard C110, Standard for Gray-Iron and Ductile-Iron Fittings, a reinforced rubber gasket and all stainless steel nuts, bolts and washers. Pipe lengths shall not exceed 12 m. Pipes shall be no less than DR26.
- .2 DISCHARGE FORCEMAIN - The discharge pipe extending beyond the lift station wall shall be connected to the forcemain by means of suitable couplers approved by the Engineer. If the forcemain is polyethylene, the connection shall be made by means of a polyethylene flange assembly (polyethylene stub end of the same size and series as the forcemain, with drilled epoxy coated ductile iron back-up ring, full faced red rubber gasket, and all stainless steel nuts, bolts and washers). If the forcemain is PVC, the connection shall be made by means of a socket welded "Vanstone" flange assembly, full faced red rubber gasket, and all stainless steel nuts, bolts and washers.

## **2.13 LIFTING DAVIT**

- .1 The Contractor shall install a base and a portable lifting davit complete with chain hoist at the location shown on the Plans. The lifting davit will be used by maintenance personnel to remove the pumps.

## **2.14 PRESSURE GAUGE**

- .1 Pressure gauges shall be a liquid filled round face, 75 mm diameter with unbreakable crystal and steel case, brass or bronze internal parts, threaded connection with brass snubber (pulsation damper) and shut off cock.

## **2.15 INSULATION**

- .1 Insulation in the lift station shall be 50 mm thick rigid polystyrene in accordance with the current CGSB-51-GP-20 or CAN/ULC S701 type 4 or approved equal.



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## **2.16 PRIMER AND PAINT**

- .1 Primer and paint shall be chemical-resistant grade enamel as shown on the Plans and specified in Section 01001, Special Provisions. Paint shall be medium blue enamel or as otherwise specified.

## **Part 3 Execution**

### **3.1 EXCAVATION BACKFILL AND COMPACTION**

- .1 This portion of the work shall be undertaken in accordance, with Section 022190, Structural Excavation, Backfill and Compaction and Section 022180, pipe Excavation Bedding and Backfill.

### **3.2 ALIGNMENT AND GRADE**

- .1 The lift station shall be constructed to the alignment and grade shown on the plans or as staked on the ground by the Engineer.

### **3.3 LIFTING EQUIPMENT**

- .1 Lifting equipment of adequate capacity shall be used to place the precast lift station slabs and sections.

### **3.4 JOINING**

- .1 All precast concrete slabs and sections shall be joined with a deformable bituminous gasket, ("Ram-nek" or approved equal). The section and slabs shall be joined such that the ladder rungs line up vertically and align properly with the access hatch frame and cover units and working floor to facilitate retrieval of the sewage pumps from the wet well. All joints shall be grouted in the interior and on the exterior of the lift station.
- .2 Fiberglass mesh working floor systems shall be installed in accordance with the manufacturer's recommendations and as shown on the Plans and Specified in Section 01001, Special Provisions.

### **3.5 GROUTING AND BENCHING**

- .1 All holes, joints, pipe and conduits passing through the lift station walls and slabs shall be grouted on both the interior and exterior with approved non shrink grout. The floor of the lift station base shall be benched at a minimum slope of 10 to 1 to the pump intake.



### **3.6 CUTTING PIPE**

- .1 Pipe shall be saw-cut to the appropriate lengths. The ends of steel pipe shall be bevelled to be compatible for welding on slip-on flanges. The ends of iron pipe shall be bevelled and threaded for the installation of threaded flanges.

### **3.7 WELDING**

- .1 Welding of pipe and fittings shall conform to the current AWWA C206, Standard for Field Welding of Steel Water Pipe.

### **3.8 JOINING PIPE AND FITTINGS**

- .1 All flanged pipe, valves and fittings shall be bolted together with a gasket between the flange faces.
- .2 For plain end pipe being jointed to appurtenances with integral flanges or by means of adaptor flanges, the end of the pipe shall be cleaned. The appropriate lubricant shall be applied to the end of the pipe and to the gasket. The adaptor flange and the gasket shall be slipped over the end of the pipe and the adaptor flange shall be bolted to the flange of the appurtenance. The bolts shall be tightened evenly to the manufacturer's recommended torque, but in no case less than 95 Nm. Nuts, bolts and washers joining pipe shall be all stainless steel.

### **3.9 PAINTING**

- .1 All uncoated non-galvanized iron and steel products installed in the lift station shall be sanded clean such that all rust is removed, primed with a single coat of chemical-resistant primer and painted with two coats of dark grey (or as otherwise specified) chemical-resistant enamel. Stainless steel products do not require priming or painting.

### **3.10 EMERGENCY DISCHARGE CONNECTION**

- .1 The Contractor shall install an emergency discharge connection complete with gate valve as detailed on the Plans. The connection shall connect to the discharge forcemain using an inline tee and a knife gate valve complete with extension stem to a handwheel for operation at the ground level station floor elevation. A removable cap shall be installed at the discharge so that an external sewage pump (i.e. trash pump) can pump sewage from the wetwell into the emergency discharge connection.



### **3.11 ELECTRICAL**

- .1 Installation of electrical products shall conform to the requirements of Section 260100, Electrical Work, Part 3 and as shown on the Plans or Specified in Section 01001, Special Provisions.
- .2 Conduit pipes extending from below the access level of the precast concrete top slab shall be caulked or sealed so that moisture or sewer gas does not travel through the conduit and into the electrical panel.

### **3.12 LIQUID LEVEL CONTROL**

- .1 Float Switches – shall be mounted and connected to the control panel in accordance with the manufacturer’s recommendations and as shown on the Plans.
- .2 Ultrasonic Transducer
  - .1 Locate transducer to allow the ultrasonic signal to be unaffected by surrounding appurtenances. Ensure that 300 mm “deadband” distance is considered in vertical mounting position.
  - .2 Mount transducer to have minimum 150 mm clearance from all obstructions (i.e. Mount unit in a 150 mm one length vertical pipe from top of lift station floor to lift station bottom).
  - .3 Program unit to display liquid level and totalized volume in cu. m.
  - .4 Provide written copy of program parameters entered after unit is commissioned. Include such programming as part to the electrical “record drawings”.
  - .5 Provide a lamicoid label below the unit that provides basic programming instructions.

### **3.13 INSULATION**

- .1 Insulation shall be fastened in accordance with the manufacturer’s recommendations or as shown on the Plans and described in Section 01001, Special Provisions.

### **3.14 TESTING**

- .1 The complete lift station shall be tested. The lift station shall be filled with water until the lower of the two "start" liquid level controls is activated. The procedure shall be repeated for the second pump. Both pump control switches shall then be turned to the "OFF" position and the lift station filled to one half metre below the working floor slab.



- .2 Both pump control switches shall then be turned to the "automatic" position and both pumps shall operate simultaneously until the water level drops to shut off the pumps. Both the liquid level controls, panel, and pumps shall be monitored for proper operation by the Engineer. The water level in the lift station shall be maintained for 48 hours to permit absorption by the concrete. Thereafter the Engineer shall record the water level, and record it again after a 24 hour period. Any leakage shall be noted and remedial action shall be taken. The internal piping of the lift station shall be tested at a pressure of 1,000 kPa for a period of two hours. Any leakage or loss of pressure shall be repeated until all defects are eliminated to the satisfaction of the Engineer. Any defects shall be corrected by the Contractor at his own expense.
- .3 The Contractor shall supply all water for testing of the lift station as well as the water required for the Engineer to perform the necessary testing of the sewage pumps. Water for testing shall be supplied by the Contractor and shall be incidental to the lift station installation and testing.

### **3.15 SEWAGE HANDLING**

- .1 When construction operations require the handling of raw sewage, the Contractor shall maintain sewage pumping service to the treatment facility for the duration of the construction period. The Contractor shall provide all necessary equipment to handle raw sewage in the proper manner to ensure continuous sewage flow to the proper destination. Temporary portable pumping equipment shall be utilized by the Contractor whenever required. The Contractor shall provide such equipment of the required size and pumping rate to ensure the continuous operation of the sewage system.
- .2 Under no circumstances shall raw sewage be discharged into ditches, land, streams, lakes or watercourses by the Contractor during the performance and execution of the work. The Contractor's operations shall be subject to all relevant Health and Environmental Regulations.