

SECTION V: Work Associated With Sewer Construction



A. GENERAL

1. PROJECT COORDINATION

The District provides wastewater collection, interception, and treatment services under a Charter and/or Agreements with its Member Municipalities. In general, the District will accept additional sewerage infrastructure when designed in accordance to State/Local Code, general engineering practice, and published District Standards and Details. This specification includes limited District standards intended to convey the general nature and quality of acceptable infrastructure.

All project submittals shall include a detailed design documenting the basis for the selection, sizing, and general design of the infrastructure. This shall include, at a minimum, the number of units and expected flows, factors and assumptions used in sizing sewers, force mains, pump stations, and other infrastructure.

All project submittals shall include a detailed project schedule that clearly identifies the dates or timeframes associated with Planning Committee Submittals and Approvals, construct start dates, testing and start-up of infrastructure, acceptance by the District, and expected commissioning of systems.

The District reserves the right to recover costs associated with the review of any submittals, analysis of capacity to serve, inspection, and field-testing and start-up. Any fees will be in accordance with the fee schedule published in Part II – Work Associated with Water Line Construction A. 1.

The District will not accept or operate any infrastructure until the project has been completed and tested in accordance with any submittals and District Standards and Details. As-built drawings must be provided before any infrastructure will be accepted or operated by the District.

2. INSPECTION

An inspector from the District, a consultant working for the District, or an inspector retained by the local municipality (with responsibility for the oversight of sewerage infrastructure to be installed) will be assigned to each project to ensure that all work is completed and materials are installed in compliance with all submittals and these specifications. During the course of the work the inspector will report to the Engineering Supervisor on the progress of the work. The District, or its representative, before incorporation into the work, must approve any deviation from the approved plans or specifications.

The Contractor shall schedule with the District for inspection services a minimum of 3 working days prior to construction. The District cannot guarantee an inspector for the project without this notice. Start-up and acceptance testing of systems will require a 14 working day notice.

B. DESIGN CRITERIA

In general, the District will accept additional sewerage infrastructure when designed in accordance to State/Local Code, general engineering practice, and published District Standards and Details. This specification includes limited District standards intended to convey the general nature and quality of acceptable infrastructure.

C. STANDARD SPECIFICATIONS AND DETAILS

1. SEWERS AND DRAINS

PART 1 GENERAL

1.01 This section shall define the standards associated with the following:

a. Sanitary sewer pipe

- b. Forcemain pipe
 - c. House service pipes
 - d. Storm sewer pipe
- 1.02 RELATED WORK:
- 1.03 SUBMITTALS:
- A. Manufacturer's product data and installation instructions.
 - B. Certified copies of tests on pipe units.
 - C. Construction Records: Record depth and location of the following:
 - 1. House service capped ends, cleanouts, bends in house service, connection points to sewer main.
 - 2. Bends, thrust blocks in force mains.
 - 3. Repairs to existing pipes.

Record neatly in a permanently bound notebook and submit at Substantial Completion. Provide access to records for the District at all times. Submit copies to the District on a weekly basis.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS:

- A. General: Provide fittings of same type and class of materials as pipe. Provide commercially manufactured wyes or tee/wyes for service connections. Fitting must have single piece gasket.
- B. PVC Non-Pressure Pipe and House Services (Sewer): 4" through 12" Diameter: ASTM D3034 or ASTM D3033, strength requirement SDR 35; push-on joints, ASTM D3212; gaskets, ASTM F477.
- C. PVC Pressure Pipe (Forcemain):
 - 1. Less than 3" Diameter: Must be approved by PWD prior to approval
 - 2. Less than 4" Diameter: ASTM D2441, strength requirement SDR 21; push-on joints, ASTM D3139; gaskets, ASTM F477.
 - 3. 4" Diameter and Larger: ASTM D2241, Class 150, strength requirement DR 18, with cast iron pipe outside diameters; push-on joints, ASTM D3132; gaskets, ASTM F477. All fittings to be ductile iron mechanical joint, AWWA C110 with 250 psi minimum pressure rating.
- D. Storm Sewer Pipe: Polyethylene drainage pipe with corrugated exterior and smooth wall interior, highway grade, AASHTO M252, ASTM F405, by American Drainage Systems, or approved equal.
- E. Reinforced Concrete Pipe: ASTM C76; Class IV, O-ring gasket joints with rubber gaskets, meeting MDOT specifications.

- F. Ductile Iron Pipe: AWWA C151; thickness Class 52 AWWA C150; double cement lined, AWWA C104; push-on joints or mechanical joints with rubber gaskets, AWWA C111; fittings, AWWA C110.
- G. Underdrain: Perforated, corrugated polyethylene pipe with smooth wall interior, AASHTO M252, ASTM F405, by American Drainage Systems, or approved equal.

2.02 MISCELLANEOUS:

- A. Flexible Couplings: Use and location shall be approved by the District.
 - 1. Type A: Dresser Style 53 as manufactured by Dresser, or approved equal.
 - 2. Type B: Neoprene sleeve with stainless steel bands by Fernco, or approved equal.
- B. Pipe Supports: Saddle type, steel, painted, adjustable, by ITT Grinnell, or approved equal.
- C. Geotextile Fabric: Propex 4508 by Amoco Fabrics Co., or approved equal.
- D. Forcemain Marking Tape: Lineguard III by Tri-Sales, Inc., 2" wide, green; detectable with magnetic locators, or approved equal.
- E. Rigid Insulation: Extruded closed-cell rigid foamed polystyrene, 2 inch thickness, width of trench, Styrofoam HI-60, by Dow Chemical, or approved equal.
- F. Air and Vacuum Valves:
 - 1. Construction: Cast iron body and cover, ASTM A126; Stainless steel concave float, ASTM A240 T304; Stainless steel float stem, ASTM A581 T303; Buna-N needle and seat; Brass plug, ASTM B124. Operating pressure from 0 to 150 psi.
 - 2. Outlet: 1-inch diameter. Provide a short nipple and a return elbow with piping as shown on the Drawings.
 - 3. Inlet: 2-inch diameter. Provide taps, piping and valves as shown on the Drawing.
 - 4. Coating: Red oxide phenolic primer paint.
 - 5. Model: ACO 443 Sewage Combination Air Valve as manufactured by Valve and Primer Corporation, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF GRAVITY PIPE AND FITTINGS:

- A. Methods: Install in accordance with manufacturer's recommendations. Use a laser beam for line and grade unless otherwise permitted by the District. Secure each length of pipe with bedding before placing next length. Plug open ends

when work is suspended. Bed pipe as shown on Drawings. A 30-inch minimum cover over the top of PVC pipe and DIP pipe should be provided before the trench is wheel-loaded.

B. Grade and Line:

1. Grade and Line shall be sufficient to provide minimum velocities of 2.0 fps. Lay pipe to line and grade shown on the Drawings as reviewed and approved by the District. If grade is not shown, determine elevations of start and finish points for each run of pipe. Lay pipe to a uniform grade between these points.
2. Line and grade may be adjusted as approved by the District, when required by field conditions.

C. Conditions: Lay pipe in the dry. Do not use installed pipe to remove water from work area.

D. Flush and clean all pipe and remove all debris and materials. Flushing and cleaning methods shall be in accordance to District Standards and approved by the District. Gravity flushing is not acceptable.

E. Connections to Manholes and Catch Basins: Any connections shall be in accordance with District Standards. Connections to existing wastewater manholes and catch basins shall be performed under PWD Inspection. Connections shall be cored as opposed to being drilled/chiseled. Connections to existing structures must not result in additional infiltration. Any joints shall be located within 3 feet of inside surface of manholes and catch basins.

F. House Service Fittings and Leads:

1. Size of service leads 4" unless otherwise indicated.
2. Depth and location of service to be determined in field, as approved by the District.
3. Provide tee/wye or wye fittings on main line pipe. Extend services to a edge of Right-of-Way as determined by the District.
4. Provide clean outs as required.
5. Plug, or cap, and stake ends of new service. Provide stake that extends from plug or cap to 1 foot above ground surface. Provide the District with measurements of pipe installed and in obtaining swing ties to ends of leads.
6. All service connections must be shown on as-built drawings.
7. No residential service connections shall be allowed to tie into District owned sewer force mains.

3.02 INSTALLATION OF FORCEMAINS AND PRESSURE PIPE:

A. Grade and Line: Lay pipe to line and grade as approved by the District. Do not allow positive-negative grade discontinuities. See Article 3.01 B above.

- B. Methods, Conditions, and Connections to Manholes: See Articles 3.01 above.
 - C. Install warning tape continuously from the pump stations to the end of each force main. At ends of rolls and repairs, splice tape with 3-foot overlap connected with duct tape. Supply the District with one full roll for future repairs. Extend to grade of each manhole and at pump stations.
 - D. Thrust Protection: Provide thrust protection at all bends in forcemains in accordance with Standards and as approved by the District.
 - E. Terminus: Forcemains shall terminate in manholes prior to connecting to District owned sewer mains.
- 3.03 UTILITIES TO BE ABANDONED: Close open ends of abandoned underground utilities that are not indicated to be removed. Provide sufficiently strong closures, such as caps or brick and mortar, acceptable to the District to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed. CONTRACTOR may remove abandoned utilities with written permission of the District or Town.

3.04 INSULATION:

- A. Install as shown on approved Drawings.
- B. Provide 2-inch minimum thickness for sewer, forcemain, and water main, compacted sand layers directly above and below insulation.

3.05 TESTING OF SANITARY SEWERS:

- A. General: Test all sanitary sewer pipes after backfilling. Install all house service leads on main line before testing. Perform tests in presence of the District. A maximum of 1000 feet of pipe may be installed but not tested at any time.
- B. Gravity Sewer Leakage Tests: Use low pressure air test as follows:
 - 1. Plug ends of section to be tested.
 - 2. Supply air slowly to the pipe to be tested until the air pressure inside the pipe is 4.0 psi greater than the average back pressure of any groundwater submerging the pipe.
 - 3. Disconnect air supply and allow a minimum of two minutes for stabilization of pressure.
 - 4. Following stabilization period measure drop in pressure over the test period within the following times:

<u>Nominal Pipe Size (in.)</u>	<u>Test Period (min.)</u>
4	4
6	4
8	6
10	6
12	7
15	8

18	9
21	11
24	13

5. Acceptable drop: No more than 1.0 psi.

C. Forcemain and Pressure Sewer Tests: Use hydrostatic test as follows:

1. Fill section of pipe with water and expel all air.
2. Pressurize to 1.5 times the normal operating pressure but not less than 60 psi.
3. Measure leakage over a 2-hour test period.
4. Acceptable leakage: Less than 10 gallons per day per inch diameter per mile of pipe tested.

D. Deflection Test for PVC Gravity Sewer Pipe: Test 100% of pipe with "GO-NO-GO" gauge allowing maximum deflection per ASTM D3034, Appendix X1, Table X1.1.

E. TV Inspection: All sewers and drains shall be inspected by an approved CONTRACTOR using TV pipe inspection. Defects in materials and/or workmanship found during the inspection shall be corrected by the CONTRACTOR.

F. Repair and/or replace all pipes not passing tests, using materials and methods approved by the District, and retest.

2. MANHOLES/PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 This section defines the standards associated with the following:

1. Precast Manholes
2. Drop Manholes
3. Precast Wet Well and Valve Pit
4. Catch Basins
5. Inverts
6. Risers
7. Frames, Covers, and Grates

1.02 RELATED WORK:

1.03 QUALITY ASSURANCE:

- A. General: Provide complete manhole and precast concrete structures capable of supporting AASHTO H20 loading. All precast concrete shall comply with ASTM C913 "Standard Specification for Precast Concrete Water and Wastewater Structures."

- B. Precast Manhole and Catch Basin Components: Comply with ASTM C478.
- C. Antifloatation Slab Design Certificate: The CONTRACTOR may provide the precast structures requiring antifloatation slabs as one complete unit. If provided as a monolithic unit, submit a certificate of design signed by a Professional Engineer registered in the State of Maine, certifying that the structure including the slab has been designed to withstand all forces including soil, traffic and hydrostatic in accordance with all applicable laws, regulations, rules and codes.

1.04 SUBMITTALS:

- A. Shop Drawings: Submit for precast manholes and all precast concrete items. Show components to be used, elevations of top of precast sections, base and pipe inverts, location of pipe penetrations, steps, for each manhole. Verify finish grade elevation at each proposed manhole location in the field.
- B. Product Data: Submit manufacturers' product data and installation instructions for frames, covers, grates, precast items, manhole sleeves, joint sealants, and frost barrier.

PART 2 - PRODUCTS

2.01 MANHOLES (INCLUDES WET WELL):

- A. Base Sections: Precast monolithic construction with steps (no steps in wet well).
- B. Barrel Sections: Precast with steps (no steps in wet well).
- C. Top Sections: Precast eccentric cone with steps. Use flat cover for wet well, if shown on Drawings or approved by the District.
- D. Steps: Polypropylene reinforced with steel rod. Meet OSHA requirements, minimum width 16". Cast into concrete.
- E. Pipe to Manhole Connections:
 - 1. Pipe diameter 6" or larger: Flexible manhole sleeves shall be CP series manufactured by Interpace Corp., or approved equal. Size to fit diameter and type of pipe without use of gaskets.
 - 2. Pipe diameter less than 6": Thermoplastic pipe sleeve shall be Link-Seal Century Line Model CS100 by Thunderline Corp. with sleeve seal equal to "Link-Seal" by Thunderline Corp., or approved equal.
- F. Joints Between Precast Sections: Watertight, shiplap-type seal with two rings of one-inch diameter butyl rubber sealant.

2.02 DROP AND VALVE MANHOLES:

- A. General: Conform to requirements for manholes. Provide pipe and accessories as shown on Drawings.
- B. Riser Support Bracket: 10 gauge, Type 304, No. 3 finish stainless steel.

2.03 CATCH BASINS:

- A. Base Sections: Precast monolithic construction.
- B. Barrel Sections: Precast monolithic construction.
- C. Top Sections: Precast eccentric cone. Use flat cover for wet well, if shown on Drawings or approved by the District.
- D. Joints Between Precast Sections: Watertight, shiplap-type seal with two rings of one-inch diameter butyl rubber sealant.

2.04 INVERTS:

- A. 180 Degree Straight Through Manholes: One piece molded fiberglass invert with integral pipe connections that are factory precast integral with the manhole base, "Fiberliner 2000 Invert System" as manufactured by Fiberliner 2000 New England, Inc, Tel. (508) 349-7401; or approved equal.
- B. Non Straight Through Manholes: One-piece plastic composite invert, "Reliner" as manufactured by Reliner – Duran, Inc. Tel. (860) 434-0277; or approved equal. Provide concrete backfill with brick table.
 - 1. Concrete: 3000 psi..
 - 2. Sewer Brick: ASTM C32, Grade SS, hard brick.
 - 3. Mortar: Type M, ASTM C270. Use Type II portland cement, Type S lime. Proportions for Mortar: 1 part portland cement, 1/4 part hydrated lime, 3 to 3 3/4 parts sand.

2.05 RISERS:

- A. General: Rubber riser rings are preferred.
 - 1. Rubber adjustment riser rings manufactured from a rubber fibrepolyurethane prepolymer composite, "Infra-Riser" as manufactured by GNR Technologies Inc., Tel. (514) 366-6116; or approved equal.
 - 2. No more than 3 courses of brick may be used. Any work must be acceptable to the District.

2.06 FRAMES, COVERS, AND GRATES:

- A. Material: Cast iron, ASTM A48 Class 30.
- B. Manhole Frames and Covers: For manholes 6' or more in vertical height, use minimum 24" diameter opening. For manholes 6' or less in vertical height, use a min. 28" diameter opening. Weight of 350 pounds, labeled with "SEWER" in 3" high raised letters on cover for sewer manholes. Standard frames and covers shall be Model M267S by Etheridge Foundry, or approved equal.
- C. Hatches: Hatches shall be equipped with heavy forged brass hinges, stainless steel hinge pins, spring operators, automatic hold open arm with release handle,

1/4" diamond plate cover and locking mechanism. Single leaf with grab bar Bilco Type J and double leaf with grab bar Bilco Type JD, or approved equal. Sizes as indicated on Drawings as approved by the District.

- 2.07 FLOOR BOXES: Floor boxes to be cast-in-place. Floor boxes to be constructed of cast iron with bronze bushings to preserve stem alignment, Clow Model F-5695, or approved equal.
- 2.08 MISCELLANEOUS:
- A. Manhole Cover Lifting Tools: Provide two (2) cover lift lifting tools by Etheridge Foundry, or approved equal, compatible with manhole covers provided.
 - B. Frost Barrier: U.V. resistant, high grade polyethylene, minimum thickness six (6) mils.
 - C. Joint Sealants:
 - 1. Butyl Rubber Sealant: One (1) inch diameter strips manufactured by Kent Seal, or approved equal.
 - 2. Butyl Rubber Caulking: Conform to AASHTO M-198, Type B.
 - D. Sewer Manhole Inverts: Provide inverts as specified or as shown. Configuration to be as required by connecting pipes and as shown on Drawings.

PART 3 - EXECUTION:

- 3.01 INSTALLATION OF MANHOLES/PRECAST STRUCTURES:
- A. Placement: Place precast bases and structures on compacted bedding material so bottom of structure is plumb and pipe inverts are at proper elevations. Place manhole barrel and top sections in the appropriate height combinations. Plug all lifting holes inside and out with non-shrink grout. Construct manhole inverts in accordance with specifications.
 - B. Joints: Follow manufacturers instructions for sealing joints between precast sections. Provide two rings of 1 inch diameter butyl rubber sealant. Point joints inside and out with butyl caulk.
 - C. Frame and Covers:
 - 1. Set to final grade as shown on the Drawings and as specified. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
 - 2. Use two rings of 1 inch diameter butyl rubber sealant between frame and rubber riser. Provide downward force to frame so as to compress the joint, provide a watertight seal, and prevent future settlement. Point compressed joint with butyl rubber caulk sealant.
 - 3. Set manhole frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.

- D. Inverts: As specified.
- E. Steps: Replace any steps that are out of plumb and proper horizontal placement.
- F. Frost Barriers: Wrap each manhole to the maximum excavation depth or not less than 6 feet below grade, with a minimum of four layers of 6 mils each of the polyethylene.
 - 1. Clean manhole exterior of all dirt and remove any protrusions.
 - 2. Apply a 6-inch wide vertical strip of bituminous waterproofing adhesive from the top of manhole to the greatest excavation depth, but not in excess of 6 feet.
 - 3. Start poly wrap at adhesive strip and proceed around manhole continuously, overlapping adhesive strip a minimum of 24 inches on the final layer.
 - 4. Tuck and pleat poly at top in a continuous manner, minimizing size of folds. Extend poly past top of manhole frame and temporarily tuck remainder inside frame, until final backfill and paving.
 - 5. Paved areas: Cut poly flush with manhole rim after pavement is in place.
 - 6. Unpaved areas: Pull loose ends of poly together, remove excess air and tie off end with galvanized wire. Bury with manhole below grade.

3.02 LEAKAGE TESTING - MANHOLES:

- A. General: Tests must be observed by the District. Manholes must be complete, including backfill, for final test acceptance except for shelf and invert. Plug all pipes and other openings in the manhole walls prior to test.
- B. Exfiltration Test:
 - 1. Plug pipes into and out of MH and secure plugs.
 - 2. Lower groundwater table (GWT) to below MH. Maintain GWT at this level throughout test. Provide means of determining GWT level at any time throughout test.
 - 3. Fill MH with water to top of cone.
 - 4. Allow a period of time for absorption (determined by CONTRACTOR).
 - 5. Refill to top of cone.
 - 6. Determine volume of leakage in an 8 hour (min) test period and calculate rate.

7. Acceptable leakage rate: Not more than 1 gallon per vertical foot per 24 hours.
8. The District reserves the right to require an infiltration test if the District is not satisfied with the exfiltration test.

C. Vacuum Test:

1. Manholes may be vacuum tested in lieu of the exfiltration test. The vacuum tests must be performed prior to backfilling the manhole, filling joints, and constructing the manhole inverts and benches. All pipe connections shall be made prior to the test.
2. Plug pipe openings and securely brace the plugs and pipe.
3. Set the tester onto the top section of the manhole and inflate the compression band to effect a seal between the structure and the vacuum base.
4. Connect the vacuum pump to the outlet port, open the valve, start the motor and draw a vacuum of 10" mercury.
5. Close the valve and monitor the vacuum gauge.
6. The test shall pass if the vacuum holds at 10" mercury or drops no lower than 9" within the following times:

<u>Depth of Manhole (feet)</u>	<u>Time (min.)</u>
0 - 10	3.0
10 - 15	3.5
15 - 20	4.0
20 - 25	4.5
>25	5.0

7. If the vacuum drops in excess of the prescribed rate, the CONTRACTOR shall locate the leak, make proper repairs, and retest the manhole.
8. If the unit fails the test after repair, the unit shall be water exfiltration tested.

3.03 REPAIRS:

- A. Determine causes of all leaks and repair them. Perform earthwork required if manhole has been backfilled.
- B. Perform repairs using methods and materials approved by the District. Remove and replace or reconstruct manhole if necessary. Remove and replace defective sections if required by the District.

3. SUBMERSIBLE PUMP STATION

This specification is to be used by Consulting Engineers who are specifying submersible pump stations to be owned and/or operated by the Portland Water District (PWD). Certain items herein need to be specified by the Consulting Engineer. Special circumstance may require deviations from this specification; these should be discussed with the PWD Engineering Department (207-774-5961).

PART 1 – GENERAL

1.01 PUMP STATION DESIGN REFERENCES:

- A. Submersible Pump Station Description (This Document)
- B. Generic Wastewater Pump Station Control Panel Drawing
- C. Pump Station Electric Layout Drawings (3 drawings)
- D. Telemetry Panel Bill of Materials (To be supplied upon request)
- E. General Electrical Specifications

1.02 DESCRIPTION OF WORK: Furnish, install and test submersible wastewater pump station(s) as specified herein and shown on the Drawings, including:

- A. Pre-cast concrete wet well
- B. Pre-cast concrete valve manhole
- C. Pumps and motors
- D. Slide-away coupling, base and rail system
- E. Piping and valves
- F. Electrical, controls, and alarms
- G. Miscellaneous components

1.03 SUBMITTALS:

- A. Submit five (5) copies of all submittals. The Consulting Engineer shall also review all submittals for compliance with this specification and be responsible for final approval of the submittals. Submittals shall include the following:
 - 1. Complete layout drawings illustrating all construction details, dimensions and elevations, plus any manufacturer instructions on installation and/or handling.
 - 2. List of materials, shop drawings, manufactures literature, operating instructions and maintenance data necessary to determine the structures, materials and equipment to be supplied by the CONTRACTOR meet the requirements of this specification.
 - 3. Pump manufacturer's performance curves showing total head, power and efficiency over the specified capacity range of each pump.
 - 4. Submit calculations demonstrating that the pump station and valve pit have a factor of safety of at least 1.15 against flotation assuming the groundwater level is at finish grade and the structures are empty.

5. Complete layout and schematic drawings of the electrical and instrumentation system. Drawings shall show all devices, wiring, terminal blocks, wire numbers, terminal block numbers, etc. Drawings shall clearly show all connections to existing wiring and instrumentation that shall remain as part of the final product.
6. The pump station manufacturer shall combine all the above information into a common submittal package.

1.04 QUALITY ASSURANCE:

- A. Qualification of the manufacturer: Minimum of 5 years experience in the design and manufacturer of submersible pump stations for wastewater. One manufacturer shall provide all structures, equipment and appurtenances, regardless of their original manufacturer. The CONTRACTOR shall be responsible for the satisfactory operation of the entire system.

1.05 GUARANTEE:

- A. The CONTRACTOR shall guarantee for one year from substantial completion that the pump station, including the structure and all its equipment will be free from defects in materials and workmanship.
- B. The CONTRACTOR shall obtain a 5 year warranty from the access hatch manufacturer, in the name of the Portland Water District, against defects in materials and workmanship, covering parts and labor.

1.06 TOOLS AND ACCESSORIES:

- A. The CONTRACTOR shall furnish any specialty tools required to adjust, operate, maintain and repair the equipment. Any such tool shall be delivered prior to the acceptance of the pump station.

1.07 SUBSTITUTIONS:

- A. All materials shall be supplied by the manufacturer(s) listed unless the statement "or equal" is specifically used for that item. All substitutions shall be clearly identified in the CONTRACTOR's submittals. The OWNER shall reserves the right to reject any substitution it considers not to be equal to that specified herein.

PART 2 – PRODUCTS

2.01 PRECAST CONCRETE ENCLOSURES:

- A. The wet well and valve pit shall be designed and fabricated:
 1. To the dimensions shown on the contract drawings or as modified and approved by the Owner during the submittal process.
 2. To withstand all dead and live loads, and to the requirements of ASTM C478.
 3. For HS-20 wheel loading.
 4. To resist buoyant forces.
- B. Concrete Requirements
 1. Cement shall be Portland Cement conforming to ASTM C-150.

2. Min. 28 day compressive strength of concrete 4000 psi.
 3. Reinforcing steel min. yield stress 40,000 psi.
 4. Min. concrete cover 1".
 5. Min. cement content 564 lbs. per cubic yard.
 6. Entrained air 4.5% +/- 1%.
- C. Concrete Testing: The pump station manufacturer shall collect test cylinders from the same concrete batch used to manufacture the components supplied for this project. Test cylinders shall be cured in the same manner as the actual components. Test cylinders shall be tested at 7 days and 28 days. The test results shall be sent to the OWNER.
- D. Horizontal Joints: Shiplay type, sealed with two 1" butyl rubber sealant strips.
- E. Exterior Waterproofing: Waterproof all exterior below grade surfaces with HLM 1300S by Sonneborn or equal; 55 mils thick. Waterproofing is to be field applied to a dry surface under manufacturer's recommended ambient conditions.
- F. Interior Coating: Coat interior of pump station wet well and standby tank with coal tar epoxy; 3 coats with total dry film thickness not less than 15 mils.)

2.02 SEWAGE PUMPS:

- A. Pumps: For each pump station provide two submersible, non-clog, horizontal discharge, wastewater pumps as specified herein and capable of handling a 3" solid. Pumps shall be designed to pump raw, unscreened wastewater. The pumps shall be designed to operate in a lead-lag sequence.
- B. Size: Each pump shall meet the design flow conditions.
- C. Materials: the volute, seal plates, impeller and motor housing shall be constructed from ASTM A-48 class 30 cast iron. Pumps shall be painted with water based air dry enamel of 2.0 mil minimum thickness. All exposed hardware shall be 300 series stainless steel. All gaskets shall be compression square ring type.
- D. Impeller: The impellers shall be of the non-clog design with pump out vanes on the backside. The impeller shall be dynamically balanced to ISO G6.3 specifications. The impeller shall be trimmed to meet specific performance characteristics prior to balancing.
- E. Seal: Pump shall have a double mechanical seal of the single spring design operating in an oil-filled seal cavity. A moisture sensor detection system shall be integrated as standard within the oil-filled cavity, with appropriate alarming provided. Seal faces shall be carbon for the rotating face and ceramic for the stationary face.
- F. Slide-away coupling, base and rail system: Discharge base shall be supplied by the pump manufacturer and designed to support the total weight of the pump. Slide away coupling shall be an integral part of the mechanism and shall be so constructed that, when lowered onto the discharge base, the knife action of the vertical metal to metal seal provides a self-sealing, non-clogging unit. It shall have guides for ease of raising and lowering on stainless steel rails. The base shall be bolted directly to the floor. The vertical flanged elbow shall be 125 lb. ANSI standard.
- G. Motors: The motor's rotor and stator assembly shall be of the standard frame design and secured to the pump seal plate by threaded fasteners allowing for

easy serviceability. The motor shall be constructed with the windings operating in a sealed housing that contains clean dielectric oil for heat dissipation making it capable of operating in a totally, partially or non-submerged condition for extended periods of time without damage due to the heat generated. Protection against excessive temperature shall be provided by a heat sensor thermostat attached to the starter windings and connected in series with the automatic starting circuit in the control panel.

- H. Shaft: The pump/motor shaft shall be of 416 stainless steel.
- I. Tests: Each unit shall be given a factory certified test. A copy of the test results shall be supplied to the Portland Water District prior to equipment start-up.

2.03 PIPING AND VALVES

- A. Ductile Iron Pipe:
 - 1. Pipe: AWWA C151, class 53, size as shown on the Drawings.
 - 2. Flanged fittings, gaskets, bolts & nuts: AWWA C110, fittings shall be cast iron, 175 psi pressure rating; gaskets shall be full faced.
 - 3. Mechanical joint fittings: AWWA C110, AWWA C11, cast iron, 250 psi pressure rating.
- B. Check Valves: Equal to Clow sized as shown on Drawings. Iron body, bronze mounted, outside lever and weight, ANSI #125 flanges.
- C. Gate Valves shall be resilient seated gate valves meeting the latest AWWA C-509 standard.
 - 1. Valve shall have a smooth unobstructed water way, be rated for zero leak rate at 200 psi differential working pressure and have a 400 psi hydrostatic test for structural integrity.
 - 2. Valve disc or wedge shall be constructed of ductile iron (less guiding mechanism) and be fully encapsulated and permanently bonded with a resilient elastomer.
 - 3. The internal and external valve body, including the stuffing box, bonnet and interior of the wedge shall be epoxy coated with 8 mils D.F.T. Interior shall meet latest version of AWWA C-550.
 - 4. Valve shall open left.
 - 5. Valve shall be one of the following: U.S.P. Metroseal, Waterous Series 500 (AFC), Muller A-2360 or Clow F6100 Series.
- D. Bolts & Nuts: Hex head, UNC, Type 304 stainless steel.
- E. Hangers and Supports:
 - 1. For ductile iron pipe: Supports: 4" adjustable, cast iron saddle, lock nut nipple and reducer, assembled; equal to ITT Grinnel Fig. 264. Hangers: ½" galvanized hanger rods, threaded both ends; welded steel wall bracket equal to ITT Grinnel Fig. 195; adjustable clevis equal to ITT Grinnel Fig. 260.
- F. Miscellaneous
 - 1. Pipe Sleeves: Hot dipped galvanized steel pipe sleeves with waterstop collars as manufactured by Thunderline Corp.; "Link-Seal" compatible.

2. Link Seal: Mechanical type rubber seal with stainless steel bolts and units as manufactured by Thunderline Corp.
3. Manhole Boot: Flexible manhole sleeve equal to CP series manufactured by Interpace Corp. sized to fit diameter and type of pipe without the use of gaskets.

2.04 MISCELLANEOUS COMPONENTS

- A. Valve Manhole and Pump Station Access Hatches: Double door access cover by Bilco, or equal. Door leaf shall be ¼" aluminum diamond pattern plate to withstand 150 pounds per square foot. Doors shall be equipped with heavy forged brass hinges, stainless steel hinge pins, automatic hold open arm with release handle and have a recessed hasp covered by a hinged lid flush with the hatch surface designed to allow the door to be secured by a padlock. Sizes as shown on drawings. Warranty period shall be no less than five years.
- B. Stainless Steel Chains: For removing pumps from wet well; size 3/8 inch minimum.
- C. Davit Arm Base Plate: Provide and install davit arm base plate(s) as shown on the drawings. The base plate shall be by DB Industries and designed to be compatible with a model L1830, DB Industries davit arm and meet the following requirements:
 1. Rated working load: 350 pounds
 2. Base height: 15.75 inches; base width: 12 inches by 12 inches
 3. Zinc plated steel construction

2.05 FINISHES

- A. General: Prepare surfaces and apply finishes as recommended by finish manufacturer. Paint shall be as manufactured by Tnemec Company or equal. All surfaces shall be coated with the type of paint indicated below and applied at the dry film thickness (DFT) in mils per coat as noted:
 1. Metal (excluding galvanized and stainless steel):
 - a. Prime – Polyamide epoxy primer, No. 66-1211 hi-build epoxoline by Tnemec or equal (3 mils DFT).
 - b. First coat – Polyamide epoxy, No. 66 series hi-build epoxoline by Tnemec or equal (5 mils DFT).
 - c. Second coat – Polyamide epoxy, No. 66 series hi-build epoxoline by Tnemec or equal (5 mils DFT).

2.06 ELECTRICAL POWER AND CONTROL SYSTEM:

- A. General:
 1. Provide complete electrical power and control system to the weather head on utility pole. Electrical power shall be a minimum of 110 volt, single phase, 60 Hertz, **the power requirements shall be determined by the ENGINEER**. The electrical system shall include supplying, installing and testing the utility pole (if required by CMP), wiring, electrical meter, disconnects, control devices, conduit and appurtenances to make a fully functional system. Additional details are provided herein and on the Drawings.
 2. Supply all materials, devices and equipment in conformance with:

- a. Underwriter's Laboratory, Inc.
 - b. National Electric Manufacturers Association
 - c. American National Standards Institute
 - d. National Electric Code
 - e. Local Power Company
3. Supply and install conduit, wiring and weather head on the utility pole. Supply and install an electrical meter per Central Maine Power's (CMP) requirements. The CONTRACTOR is responsible for coordinating its activities with CMP.
 4. The Power panel shall be contained in an exterior enclosure with a solid door(s). Fasten all electrical components to removable sub-plates with screws and lock washers. Tap sub-plates to accept screws. Do not use self-tapping screws. The main control panel shall be provided with a 100 watt, incandescent light, light switch and a utility receptacle that shall remain accessible and functional whether or not the inner door is open.
 5. The Control panel shall be constructed following the Generic Wastewater Control Panel drawings and the Instrumentation Specifications.
 6. General Control Description: The control system shall allow the pumps to be operated in either manual or automatic modes. The control loop for each pump shall incorporate a hand-off-auto switch, on-off and lead-lag control using an ultrasonic level indicator and a Programmable Logic Controller (PLC), time delay relay and motor overload relay. Alarms and pump status shall be displayed on the interior door of the control panel and transmitted via telemetry to the Portland Water District's Douglass Street facility as described below. The following items shall be mounted on the inner door of the main control panel (please refer to the Generic Wastewater Control Panel drawings for the complete details):

Pump 1 H-O-A switch	Pump 2 H-O-A switch
Pump 1 over-load reset button	Pump 2 over-load reset button
Pump 1 Run Light (green)	Pump 2 Run Light (green)
Pump 1 Seal Alarm (red)	Pump 2 Seal Alarm (red)
Pump 1 Overload (red)	Pump 2 Overload (red)
Pump 1 Temp Alarm (red)	Pump 2 Temp Alarm (red)
High-high wet well light (red)	110 volt GFI receptacle
Hydro-Ranger programmer	
 7. Pump run status, motor overload, high motor temperature and pump seal leak alarm lights shall be displayed on the Control Panel swing-out panel, and grouped by the pump. Each of these alarms will be sent individually to the telemetry panel.
- B. Components in wet well: Comply with National Electric Code requirements for Class I, Group D, Division 1 locations.
 - C. Enclosures:
 1. At minimum, the control panel, telemetry panel and miscellaneous electrical devices shall be mounted on a sheet of marine plywood

- attached to pressure treated 6" x 6" wooden posts. The plywood sheet shall be braced with pressure treated 2" x 4"s or unistrut suitable for exterior use. Additional details are provided on the drawings. For residential areas, it is strongly recommended to enclose the above equipment in a 10'x12' building set on a concrete pad.
2. The telemetry panel enclosure shall be 16"x30"x36" for all applications, and it will be constructed of factory painted metal with a NEMA 4 rating (ref: Telemetry Panel Bill of Materials for details).
 3. The Control Panel enclosures, within 1000 feet of salt water (mean high tide line), shall be:
 - a. Exterior Enclosures: NEMA Type 3R, 4 or 4X, materials of construction shall be stainless steel with stainless steel hardware. Enclosures shall be lockable with a padlock. The telemetry panel will have a door stop kit that will have an easy disengagement to allow full swing of the door. Enclosures shall have a built in pocket for storing the panel's as-built wiring diagram.
 - b. Interior Enclosure: NEMA Type 4X or 12, materials of construction shall be stainless steel or fiberglass with stainless steel hardware. Enclosures shall have a built in pocket for storing the panel's as-built wiring diagram.
 4. The Power Panel at all other locations:
 - a. Exterior Enclosures: NEMA Type 3R, 4 or 4X, materials of construction shall be steel with stainless steel hardware. Enclosures shall be factory painted to ensure rust resistance. The telemetry panel will have a door stop kit that will have an easy disengagement to allow full swing of the door. Enclosures shall be lockable with a padlock. Enclosures shall have a built in pocket for storing the panel's as-built wiring diagram.
 - b. Interior Enclosures: NEMA Type 4, 4X or 12, materials of construction shall be steel or non-metallic with stainless steel hardware. Enclosures shall be factory painted to ensure rust resistance. Enclosures shall have a built in pocket for storing the panel's as-built wiring diagram.
 5. No electrical devices or terminal blocks within the enclosures shall be located within 18" of the ground or concrete pad.
- D. Main Disconnect Switch: Disconnect switches shall be heavy duty and be designed to accept a padalock as manufactured by Square D, or equal. Main disconnect switch may be incorporated as part of the main circuit breaker
- E. Main Circuit Breakers: Normal duty molded case, bolt in type, interrupting capacity 10,000 amperes RMS symmetrical at 120/240 volts, manufactured by General Electric, Westinghouse or Square-D. Minimum size: 100 Amps.
- F. Surge Suppressor: Provide protection from lightning and electrical surges. Surge suppressor shall have a peak surge current rating of be 80,000 amps per phase and include auxiliary dry contacts. The surge suppressor shall be The Protector, P-Plus model as manufactured by Innovative Technology, Inc of Brooksville, Florida or approved equal.
1. Single Phase: Model P1S120/240+C.
 2. Three Phase: Model P3Y120/208+C.

- G. Emergency Power Outlet: 600 volt, 100 amp, manufactured by Killarc, model number WRWJS-1004, no substitutes.
- H. Manual Transfer Switch: Industrial duty as manufactured by Square-D or approved equal.
- I. Control Power:
 - 1. Control Power Transformer: Industrial duty as manufactured by Cutler-Hammer or approved equal.
 - 2. Distribution Panel: Provide separate 100 amp circuit breaker if main circuit breaker is larger than 100 amps.
 - 3. Circuit breakers: Shall be as manufactured by General Electric or equal, normal duty molded case, bolt in type, interrupting capacity of 10,000 amperes RMS symmetrical at 120/240 volts.
- J. Motor Branch Components & Motor Control Circuit:
 - 1. General: Provide highest quality industrial components. Provide separate circuit protection, motor starter, and overload relay for each pump. Motor starter overload relay shall have auxiliary N.O. contact (closed on tripping) to activate "Motor Overload" alarm. Provide a motor winding over temperature thermostat in the motor which shall activate a "High Temperature" alarm. The pump seal leak detector shall activate a "Seal Leak" alarm.
 - 2. Circuit Protection: Heavy duty circuit breaker, interrupting capacity 10,000 amperes at 240 volts, sealed by manufacturer after calibration. Provide padlocking operating mechanism for each breaker. Label circuit breakers to indicate circuit protected.
 - 3. Motor Starters: NEMA rated, size 1 or above magnetic, open frame, contacts shall be replaceable without removing starter from mounted position, provide under-voltage release and overload protection on all three phases; provide capacity for addition at least 2 auxiliary contacts. Overload relays shall have visual trip indication and manual reset. All starters shall be Square D, Allen Bradley, Westinghouse, or approved equal.
 - 4. Overload Thermal Units: Shall be supplied by the motor starter manufacturer and sized for the pumps specified herein.
 - 5. Overload reset buttons shall be mounted on the face of the interior control panel to allow operators to reset the overloads without opening the panel door.
 - 6. Circuit Breakers for Controls and Miscellaneous 120 volt Items: Shall be as manufactured by General Electric or equal, normal duty molded case, bolt in type, interrupting capacity of 10,000 amperes RMS symmetrical at 120 volts.
 - 7. Ground Fault Interrupt Circuit Breakers shall be UL listed Class A.
 - 8. All circuit breakers shall be labeled to indicate circuit protected.
 - 9. Hand-Off-Auto Selector Switches: 3-way selector switches, industrial grade, oil tight construction, equal to Allen-Bradley, or approved equal, 300 volt rated. When a selector switch is in the hand mode the pump shall be energized regardless of wet well level, when in the auto mode the pumps on and off depending on wet well level, based upon the control system.

10. Time Delay Relay: Electro Mechanical Design, contacts rated at 10 amperes minimum at 120 volts. Provide a time delay to prevent both pumps from starting simultaneously, Allen Bradley or approved equal.
 11. Push buttons shall be industrial grade, oil tight construction equal to Allen-Bradley or approved equal. Pilot lights shall be 120 volt.
 12. Labels for all devices on the front of the telemetry and control panels shall be provided. Labels shall be aluminum or heavy duty plastic legend plates. Legend plates shall be attached to the panel by screws, rivets or be an integral part of the device. Stick on labels are not acceptable. Individual letters shall be at least 0.14" high.
 13. Elapsed Time Meter: Provide an industrial grade elapsed time meter (ETM) for each pump. The ETMs shall be flush mounted, 120 volt, water resistant construction, contain at least seven digits capable of recording up to 99,999.99 hours and recording in increments of 0.01 hours. Digits shall be at least 0.14 inches high.
 14. Relays shall be industrial grade cube relays as manufactured by Idec, Allen Bradley or equal.
- K. Level Control System
1. An ultrasonic level measuring devise shall provide level control, level indication and specified auxiliary alarms. The devise shall be a HydroRanger as manufactured by Milltronics (no substitutes allowed) with an XPS-15 transducer. Please refer to the Generic Wastewater Pump Station Control Panel drawings for the complete wiring details.
 2. Provide a single low voltage non-mercury float switch for the high-high wet well level alarm. The float switches shall be housed in an unbreakable steel shell encased in polyurethane. Cable conductors shall be a minimum of #16 AWG. The float switch shall be wired to an intrinsically safe relay. Please refer to the Generic Wastewater Pump Station Control Panel drawings for the complete wiring details.
- L. Provide thermostatically controlled heater in the control panel to minimize condensation and insure operation of the electronic/electrical equipment during cold weather. Calculate based on - 30° F ambient. Heater is to be controlled by thermostat built into control panel. Heater shall be designed so as not to damage enclosure or components.
- M. Wire & Wiring: Run all wiring outside of the electrical panels in conduits. Run signal and instrument wiring in separate conduits from line voltage wiring.
1. Type: THWN or THHW, 600 volts. Color Codes and Identification:
Control Panel:
 - a. Line and load circuits, AC or DC power - Black
 - b. AC control circuit at less than line voltage - Red
 - c. Equipment grounding conductor - Green
 - d. Current carrying common - White
 - e. Hot with circuit breaker open - OrangeTelemetry Panel: (To be supplied upon request)
 2. Sizing:

- a. Electrical control circuit within panels minimum 14 AWG.
 - b. 4-20 mA signal wiring and telemetry panel wiring shall be no smaller than 18 AWG.
 - c. Wiring in conduit minimum 14 AWG; size per voltage drop limitations on control circuit.
 - d. Motor branch wiring minimum 10 AWG; size per NEC.
3. Provide shielded instrument cable where recommended by manufacturer of signal or instrumentation systems or subsystems.
 4. WAGO Brand Terminal blocks for the telemetry panel shall be:

Terminal Strip Specifications

Spec #	Application	WAGO terminal	WAGO end/sep (orange)	WAGO stops	Color
1	Analog Input	280-874	280-373	249-116	grey
2	Analog Outputs	280-874	280-373	249-116	grey
3	Discrete Inputs	281-619	281-341	249-116	grey
4	Discrete Outputs	281-619	281-341	249-116	grey
5	Line AC Power	281-629	281-341	249-116	blue
6	24 VDC Power	281-663	281-335	249-116	red
7	DC Ground	281-664	281-335	249-116	black
8	System Ground	281-657	281-335	249-116	yellow-green
9	Intrinsic Safe Analogs	281-695	209-191	249-116	light grey
10	Intrinsic Safe Discreters	281-695	209-191	249-116	light grey
11	Intrinsic Safe System Ground	281-657	281-335	249-116	yellow-green

5. All of the telemetry wire ends shall be covered with the appropriate WAGO brand wire ferrules. They shall be as follows:

Wire Ferrule Specifications

Spec #	Application	WAGO #	Color
1	12 AWG	216-207	grey
2	14 AWG	216-205	yellow
3	16 AWG	216-204	black
4	18 AWG	216-203	red
5	20 AWG	216-202	grey
6	22 AWG	216-201	white
7	Crimping Tool	206-204	

6. All field and cabinet wires will be labeled clearly with either the tagname of the applicable signal, or with an appropriate identifier, using a plastic heat shrink label.
7. Use slotted plastic wire ways within the control panel for routing wires.

8. Bundle all wires not within slotted plastic wire ways. Do not bundle in slotted plastic wire ways.
 9. Control wires entering or leaving the control panel shall be attached to a terminal strip. The individual connections on the terminal strip shall be numbered.
 10. Identification of conductors: Provide permanently attached wire number 1" from each end of each wire at every termination point. For fully visible wires not more than 4" long, provide one number at midpoint. Provide wire numbers matching terminal strip numbers. Number progressively from left to right or top to bottom. Do not use alphabetical identification.
- N. Conduit and Fittings:
1. Rigid conduit: Galvanized steel, provide for general use.
 2. Liquid tight flexible metal conduit: Smooth, flexible galvanized steel core with abrasion resistant, liquid tight PVC cover; provide for all connections to motors.
- O. Utility receptacles shall be a 110 volt, 20 amp, duplex, GFI receptacles. Receptacles shall be Arrowhart 5735-S.
- P. Wet well Junction Box: Provide at least two Class 1, Division 1, Group D rated junction box for installation outside of wet well. Units shall be complete with corrosion resistant terminal strips for making up all connections. During installation and hookup, coat all wire connections with NO-OX to prevent corrosion of contacts by moisture. Label all wires to identify their destination and use.
- Q. Standby Generators / Emergency Power: All submersible pump stations that are to be owned and operated by the Portland Water District shall require emergency standby generators with automatic transfer switches. Standard specifications are currently under design. Applicant shall consult with the Portland Water District for design criteria and approval.

2.07 TELEMETRY SYSTEM: (To be supplied upon request)

- A. General: The CONTRACTOR shall furnish and install a complete telemetry system as herein specified and shown on the Generic Wastewater Pump Station Control Panel drawings. The pump station telemetry system shall utilize a PLC based radio modem to communicate with the Portland Water District's master wastewater station (see the attached bill of materials).
- B. Enclosure: The telemetry shall be housed in the Control Panel enclosure (refer to the Telemetry Panel Bill of Materials for the specific type) to be furnished by the Contractor. Termination of field wiring by the Contractor shall be via the details illustrated in the Generic Wastewater Control Panel drawings.
- C. The Contractor will verify the following field contacts to "I" and "O" registers of the PLC :
 1. High-high wet well level switch discrete input
 2. Power loss relay discrete input
 3. All pump Auto switch indicator discrete inputs
 4. All pump seal failure discrete inputs

5. All pump overload discrete inputs
 6. All pump high temperature switch discrete inputs
 7. All pump run status discrete inputs
 8. Generator fault discrete input (if required)
 9. Transfer switch set to CMP discrete input (if required)
 10. Transfer switch set to generator discrete input (if required)
 11. Loss of echo from the Milltronics HydroRanger discrete input
 12. Remote radio power switch discrete output
 13. Wet well level indication analog input
- D. The Owner will provide the final PLC program and the services required to include the new pump station in the master telemetry system.

2.08 FACTORY TESTING ASSEMBLY:

- A. Test motors, pumps, controls, and electrical panels for proper operation. Make corrections and adjustments prior to shipping pump station.
- B. Factory assemble and "match mark" all pre-cast items for ease of installation.

PART 3 – EXECUTION

3.01 INSTALLATION:

- A. General: Comply with instructions of pump station manufacturer. Provide five (5) Operation and Maintenance Manuals to OWNER prior to installation of pump stations. As-built electrical drawings may be provided after start-up.
- B. Placement: Place pre-cast items as shown on the Drawings so structure is plumb and pipes are at proper elevation. Plug all lifting holes inside and out with non-shrink grout. Pump station manufacturer shall assist CONTRACTOR in assemble of the pump station. CONTRACTOR shall notify OWNER 3 working days in advance of setting the pump station wet well and valve pit.
- C. Power Supply: Coordinate installation with power company. Provide complete system from pump station to point of connection to CMP facilities.

3.02 INITIAL STARTUP:

- A. Provide at least one factory trained manufacturer's representative for field assembly and start-up of the pump station.
- B. The wet well level will be controlled using the HydroRanger auxiliary control contacts and the on-board HydroRanger control logic. When the telemetry system has been started, the PLC control logic will take over the primary level control.

3.03 FIELD TESTING:

- A. Process Equipment Tests: Test pump stations for proper operation for a minimum of 3 consecutive days. Each pump must operate for a minimum of two hours during the test. Provide water for tests if adequate wastewater flow is not available. Test the control system for all functions including the operation of lead and lag pumps and alternating of pumps. At start and end of test period operate each pump at the design head and measure and record pumping capacity, motor

speed, and horsepower. Test all functions of the alarm system. Schedule all tests with the OWNER. The OWNER shall have the option to witness all tests.

- B. Piping: Test pump lines as force mains.
- C. Telemetry System Tests: Coordinate test with the OWNER to verify pump status, alarms and level indication are received at the Control panel.
- D. Defects and Adjustments: Correct defects, replace defective equipment, and make adjustments to provide a properly operating system. Repeat tests if required by OWNER.
- E. Notify OWNER at least 14 working days prior to tests.

3.04 OPERATOR INSTRUCTION:

- A. Provide 2 hours of instruction on the use of the Milltronics HydroRanger and the PanelView display.

3.05 OPERATIONS & MAINTENANCE MANUALS:

- A. Provide five (5) sets of operations & maintenance (O&M) manuals containing the following information for all equipment and systems provided by the CONTRACTOR:
 - 1. Manufacture's specifications and cut sheets.
 - 2. Manufacture's operations and maintenance manuals.
 - 3. **As-built** mechanical/civil drawings based on the pump station manufacturer's submittals.
 - 4. **As-built** electrical schematic diagrams showing control logic. This diagram may be based on the pump station manufacturer's submittals.
 - 5. **As-built** instrumentation drawings showing all components, wiring, wiring numbers, terminal blocks, and tie points to existing equipment or wiring. These shall be based on the Generic Wastewater Pump Station Control Panel drawings.
- B. Laminate in clear plastic one copy of the as-built electrical schematic diagrams and instrumentation drawings and place these in the interior control panel enclosure.
- C. Provide electronic copies (PDF) of all manufactures O&M materials.
- D. As-built electrical schematic diagrams and wiring drawings shall be drawn using a CAD program fully compatible with AutoCAD release 14. Provide an electronic copy of each drawing to the Portland Water District.

4. TELEVISION INSPECTION OF SEWER LINES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

- A. The CONTRACTOR shall furnish all materials, tools, labor and equipment necessary to visually inspect and document the installed or rehabilitated gravity sewer lines by means of a closed-circuit television system.

1.02 SUBMITTALS

- A. The CONTRACTOR shall submit log sheets upon completion of the CCTV inspection that shall include stationing, manhole numbers, findings and other pertinent data. (See documentation below)
- B. The CONTRACTOR shall provide three (3) copies of the video inspection tape. The tape shall be clearly labeled with the date of inspection and the segment of sewer line inspected. The tapes shall include any initial or pre-rehabilitation pipeline inspections and the repaired or post-rehabilitation pipeline inspection results.

1.03 PRODUCTS

A. EQUIPMENT:

- 1. VHS video system shall be used which utilizes 1/2-inch recording tapes and the SLP mode.
- 2. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing a minimum 650 line resolution color video picture. Picture quality and definition shall be to the satisfaction of the DISTRICT and, if unsatisfactory, equipment shall be removed and no payment made for the unsatisfactory inspection. The camera head shall be pan-and-tilt type with the ability to rotate 360° to view the entire internal circumference of the pipe. The equipment must continuously indicate time, date, and station on the tape. The operator shall narrate to describe conditions or other services encountered.

1.04 EXECUTION

A. INSPECTION:

- 1. Manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. The rate of movement through the pipeline shall be no more than 1 ft/sec. If, during the inspection, the television camera shall not pass through the entire manhole section, the CONTRACTOR shall reset up his equipment in a manner so that the inspection can be performed for the opposite manhole. The CONTRACTOR is required to repeat the TV inspection of areas repaired subsequent to the original TV inspection.
- 2. Whenever non-remote powered and controlled winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two winches and the monitor control.

B. DOCUMENTATION:

- 1. Printed location records shall be kept by the CONTRACTOR that shall clearly show the exact location, in relation to adjacent manholes, of each infiltration point discovered by the television camera. In addition, other

points of significance such as locations of laterals, unusual conditions, collapsed sections, and other discernible features shall be recorded and a copy of such records shall be supplied to the DISTRICT.

2. Video tapes of the entire inspection shall be provided to the DISTRICT upon completion of the inspection. The tape playback shall be at the speed that is recorded. The CONTRACTOR shall be required to have all tapes and necessary playback equipment readily accessible for review by the DISTRICT during the project.