

**DECATUR COUNTY
CONSTRUCTION & DEVELOPMENT
STANDARDS MANUAL**

**SECTION 02750
LIFT STATION**

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LIST OF DRAWINGS

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Lift Station	LS-1
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1.00 General

1.01 Description

A. Furnish all labor, equipment and material to construct one duplex submersible pumping station consisting of pumps, motors, wet and dry basin, valves, piping, air pump and piping, hatches, guide rails, pump removal components, control center, mercury float switches, interconnecting electrical wiring, incoming power supply and all other features regularly and normally required as a part of a complete and functional facility. All work to be in accordance with site requirement details in the plans, these specifications and the manufacturer's recommendations.

1.02 Related Item Described Elsewhere

- A. Cast-In-place-Concrete Section 03300
- B. Force Main Section 02750

2.00 Materials

2.01 General

A. All of the mechanical and electrical equipment shall be an integral package supplied by the pump manufacturer with local representation as to provide undivided responsibility. The package shall be or equal in construction and performance to Hydromatic Pump equipment and specific requirements set forth herein and in the plans.

B. The contractor is to submit to the Project Engineer for review and approval five (5) sets of shop drawings, detailed specifications, pump warranty and performance characteristics for all of the equipment and fixtures to be furnished and installed. The receiving wastewater utility will review the submittal and render a decision in writing as to the acceptability of the equipment. Without prior approval, the item of work may not be accepted.

C. Exceptions to this specification or associated plans must be submitted in writing and clearly stated. The exceptions would then be considered and must be approved by the receiving wastewater utility prior to proceeding with work.

2.02. Pumps

A. The pumps shall be a centrifugal, non-clog, solids handling, submersible, wastewater type designed for Class 1 Group C and D, Division 1 Hazardous Locations. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a 4" standard ASA 125 lb. flange, faced and drilled. All external mating parts shall be machined and Buna N Rubber O-ring sealed on a beveled edge. All mating surfaces shall be flame proof joints with special labyrinth joint to prevent a flame or spark to travel to the media being pumped. Gaskets shall not be acceptable. All

fasteners exposed to the pumped liquids shall be 300 series stainless steel.

2.03 Operating Conditions

A. Each pump shall be sized by a Professional Engineer registered in the State of Indiana. Design calculations shall be submitted to Decatur County Area Plan and receiving wastewater utility for review and approval.

2.4 Electric Power Cord

A. Electrical power cord shall be STW-A, water resistant 600V, 60°C., UL and CSA approved and applies dependent on amp draw for size.

B. The pump shall be triple protected with a compression fitting and two epoxy potted areas at the power cord entry to the pump. A separation between the junction box area of the pump and the motor by a stator lead sealing gland or terminal board shall not be acceptable.

C. The power cable entry into the cord cap assembly shall first be made with a compression fitting. Each individual lead shall be stripped down to bare wire at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary attraction.

D. The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with a screwed wire to wire connection, rather than a terminal board that allows for possible leaks.

E. The connection box wiring shall be separated from the motor housing wiring by stripping each lead down to bare wire, at staggered intervals, and separating each strand. This area shall be filled with an epoxy compound potting. Fiberglass terminal boards which are subject to heat fatigue and cracking, and which may lead to possible leaks shall not be acceptable.

F. The cord cap assembly where bolted to the connection box assembly and the connection box assembly where bolted to the motor housing shall each be sealed with a Buna N Rubber O-ring on a beveled edge to assure proper sealing.

2.05 Motor

A. The motor shall be a submersible, explosion-proof wastewater motor and designed for a Class 1, Group C and D, Division 1 Hazardous location.

B. The stator, rotor and bearings shall be mounted in as sealed submersible type housing. The stator windings shall have Class F insulation, (155°C of 311°C), and a dielectric oil filled motor, NEMA B design. Further protection shall be provided by on winding thermal sensors. Because air-filled motors do not dissipate heat as efficiently as oil-filled motors, air-filled motors do not dissipate heat as efficiently as oil-filled motors, air-

filled designs shall not be acceptable.

C. The pump and motor shall be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Dependence upon, or use of, water jackets for supplemental cooling shall not be acceptable.

D. Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed in the field without the use of heat or a press. Stators held by a heat shrink fit shall not be acceptable. Stators must be capable of being repaired or rewound by local motor service station. Units, which require service only by the factory, shall not be acceptable. No special tools shall be required for pump and motor disassembly.

E. Pump shall be equipped with heat sensors. The heat sensor shall be a low resistance, bi-metal disc that is temperature sensitive. It shall be mounted directly on the stator windings and sized to open at 120°C and automatically reset at 30-35°C. differential. The sensors shall be connected in series with motor starter coil so that the starter shall be equipped with 3 leg overload heaters so all normal overloads are protected by the starter.

2.06 Bearings and Shaft

A. An upper radial bearing and a lower thrust bearing shall be required. These shall be heavy-duty single row ball bearings that are permanently lubricated by the dielectric oil, which fills the motor housing. Double row, sealed grease packed bearings shall not be acceptable. Bearings, which require lubrication according to a prescribed schedule, shall not be acceptable.

B. The shaft shall be machined from a solid 303 stainless steel forging and be a design which is of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life.

2.07 Seals

A. The pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals. John Crane Type 21, BF1C1, seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area. Units, which require the use of tungsten-carbide seals or foreign manufactured seals, shall not be acceptable. Seals shall be locally available.

B. The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.

C. There shall be an electric probe or seal failure sensor installed in the seal chamber between the two tandem mechanical seals. If the lower seal fails, contaminants which enter the seal chamber shall be detected by the sensor and send a signal to operate the specified warning device.

D. Units equipped with opposed mechanical seals shall not be acceptable.

2.08 Impeller

A. Impeller shall be of the two-vane, enclosed non-clogging design and have pump-out vanes on the front and backside of the impeller to prevent grit and other materials from collecting in the seal area. Single vane design impellers which cannot be easily trimmed and which do not maintain balance with wear causing shaft deflections and reducing seal and bearing life are not acceptable. Impeller shall not require coating. Because most impeller coating do not remain beyond the very early life of the impeller, efficiency and other performance data submitted shall be based on performance with an uncoated impeller. Attempts to improve efficiency by coating impeller shall not be acceptable.

B. Impellers shall be dynamically balanced. The tolerance values shall be listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames. The tolerance is to be split equally between the two balance plans, which are the two impeller shrouds.

RPM	Tolerance
3500	.01 in. - oz./lb. of impeller weight
1750	.02 in. - oz./lb. of impeller weight
1150	.026in. - oz./lb. of impeller weight
870	.03in. - oz./lb. of impeller weight

C. The impeller shall be threaded shaft or tapered shaft and key driven. A 300 series stainless steel washer and impeller bolt shall be utilized to secure the impeller to the shaft for both threaded and tapered shafts. Straight end shafts for attachment of the impeller shall not be acceptable.

2.09 Casing

A. The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.

B. A volute case wearing ring shall be provided to minimize impeller wear. The wear ring shall be alloy 230 brass, ASTMB-43 and held by 300 series stainless steel fasteners. The wear ring shall be easily replaceable in the field. Wear rings of any other material shall not

be acceptable.

2.10 Serviceability

A. The complete rotating assembly shall be capable of being removed from the volute without disturbing the suction piping, discharge piping, and volute. The motor housing, seal housing with seal plate and impeller still attached to the shaft shall be capable of being lifted out of the volute case from the top as one assembly.

2.11 Operation of System

A. On sump level rise, the lower mercury switch shall first be energized, then the upper level switch shall next energize and start the lead pump. With the lead pump operating, sump level shall lower to lowest switch and turn off the pump. The alternating relay in the "Control Center" shall index on stopping of the pump so that the lag pump will start on the next operation. If sump level to third float or lag pump switch and the lead pump has failed or is not operating, the override switch shall energize and start the lag pump. Only lag pump shall operate until low level switch turns off pump. In case of pump failure the alarm shall be activated when lag pump comes on. If level continues to rise and both pumps are not operating, alarm level switch shall energize and signal the alarm. If one pump should fail for any reason, the second pump shall operate on the override switch. All level switches shall be adjustable for level setting from the surface.

2.12 Control Center

A. The control center shall be built in a NEMA 4x stainless steel enclosure and shall be suitable for the specified horsepower and voltage for the pumping equipment. The outer door of the panel shall be hinged dead front with provisions for locking with a padlock. Inside shall be a separate hinged panel to protect all electrical components.

B. A circuit breaker and NEMA rated magnetic starter with 3 leg overload protection and manual reset shall be provided for each pump. Starters shall have auxiliary contacts, on three phase applications, to operate both pumps on override conditions. A separate circuit breaker shall be supplied for power to the control circuit. The control center shall include extra circuit breakers of adequate size to provide 115 volt, 1 phase power for equipment in the dry well and one convenience outlet. The control center shall include a control voltage transformer to reduce supply voltage to a suitable control voltage such as 115 volt, 1 phase. An alternating relay shall be provided to alternate pumps on each successive cycle of operation. A green run light and a H-O-A switch shall be provided for each pump. A terminal strip shall be provided to make field connections of pump power leads, float switches, seal sensor leads, heat sensor leads.

C. The control center shall incorporate connections for heat sensors, which are installed in the pumps. The connection shall disconnect the starter upon high temperature signal and will automatically reconnect when condition has corrected.

D. The control center shall include an hour meter for each pump to register the elapsed operating time of each pump.

E. The control center shall have a high water alarm built-in the main enclosure. The high water alarm shall consist of a flashing alarm light with red Lexan plastic cover mounted on top of the enclosure such that it is visible from all directions. An alarm horn shall be mounted on the side of the enclosure. A push to test horn and light button shall be mounted on the inside of the panel. The alarm shall be supplied with a self continued power system for continuous service during power outages.

F. Two schedule 40 metal conduits shall be provided from the wet well basin to the control center which will allow the cables to be pulled through without difficulty and allows the use of one piece cables from the pumps and float switches to the control center. The conduit shall be sealed at the control center to avoid entrance of sewer gases into the control panel.

G. All components of the control center shall be American made and available from local sources. In particular, items such as circuit breakers, overload protection, relays, etc. shall be available and in stock by local sources.

H. In order to maintain unit responsibility and warranty on the pumping equipment and control center, the control center must be accepted in writing by the pump manufacturer as suitable for operation with the pumping equipment.

2.13 Valves and Piping

A. A swing check valve with external swing arm and an eccentric plug valve shall be installed in each discharge line.

2.14 Access Hatch

A. Aluminum door access hatches frames and door assembly shall be provided and installed on the concrete basin top. The doors shall be provided with lifting handle, safety latch to hold in the open position and hasp suitable for padlock. The door shall have a non-skid finish. The openings shall be as shown on the detailed drawing.

2.15 Support

A. Though the pump may not require feet to support the unit while installed, the pump volute must have feet to support the unit when removed for service. Units, which do not have feet upon which the unit can be supported when removed for service, shall not be acceptable.

2.16 Auto Coupling Slide Rail System

A. A rail system shall be provided for easy removal of the pump and motor assembly for inspection and service. The system shall not require a man to enter the wet well to remove the pump and motor assembly. Two rails of 2 inch stainless steel pipe shall be provided for each pump. The guide rails shall be positioned and supported at the bottom by the pump mounting base. The guide rails shall be aligned vertically and supported at the top by attachment to the access hatch frame. One intermediate guide rail support is required for each 15' guide rail length.

2.17 Painting

A. The pump shall be painted after assembly, but before testing with lead free, air-dried enamel. The paint shall be applied in one coat with a minimum thickness of 3 to 4 mils.

2.18 Testing

- A. Commercial testing shall be required and include the following:
1. The pump shall be visually inspected to confirm that it is built in accordance with the specification as to horsepower, voltage, phase and hertz.
 2. The motor seal and housing chambers shall be meggered for infinity to test for moisture content or insulation defects.
 3. Pump shall be allowed to run dry to check for proper rotation.
 4. Discharge piping shall be attached, the pump submerged in water and amp readings shall be taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalance resistance exists. If so, the stator shall be replaced.

2.19 Warranty

A. The pump unit or any part thereof shall be warranted against defects in material or workmanship within one year from date of final acceptance and shall be replaced at not charge with a new manufactured part, F.O.B. factory or authorized warranty service station. The warranty shall not assume responsibility for removal, reinstallation or freight, nor shall it assume responsibility of incidental damages resulting from the failure of the pump to perform. The warranty shall not apply to damage resulting from accident, alteration, design, misuse or abuse.

2.20 Mercury Float Switches

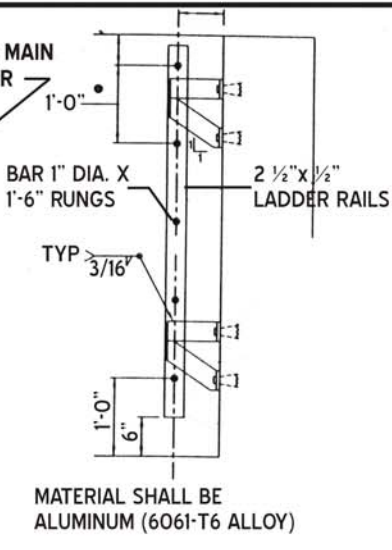
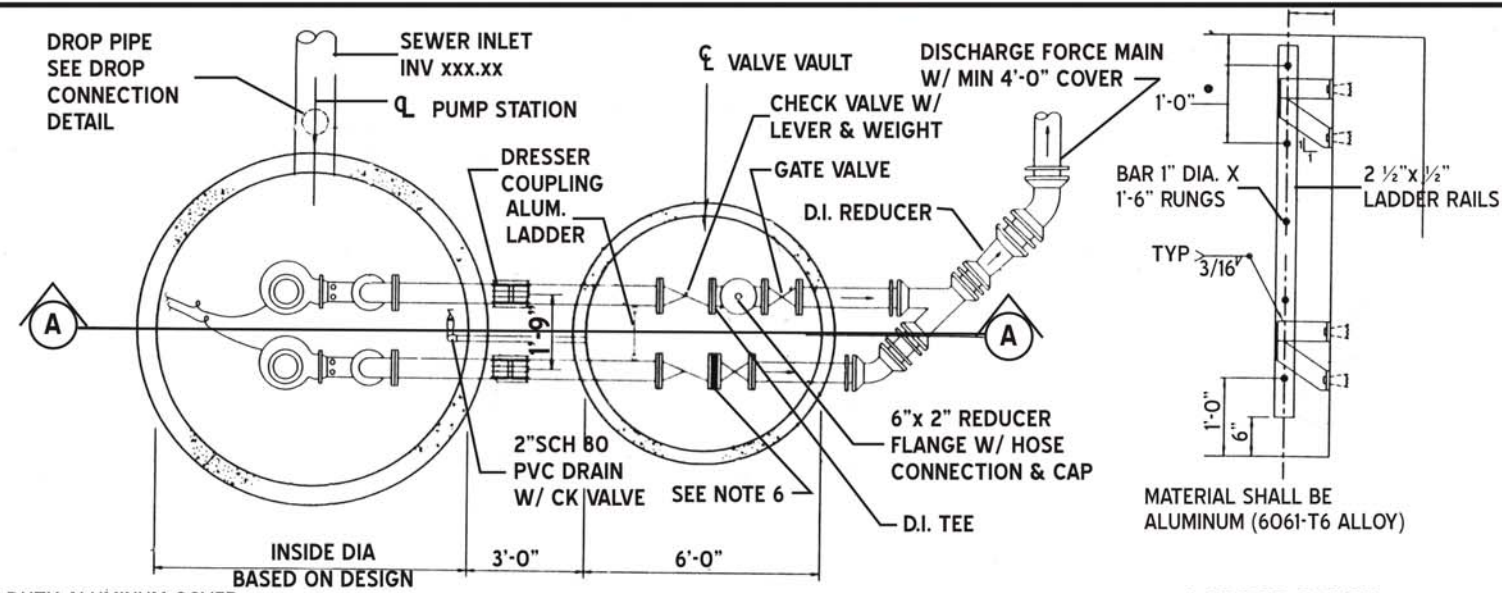
A. Sealed float type mercury switches shall be supplied to control sump level and alarm signal. The mercury tube switches shall be sealed in a solid polyurethane float for corrosion

and shock resistance. The support wire shall have a heavy Neoprene jacket and a weight, which shall be attached to the cord above the float to hold the float in place in the sump. The floats shall also be capable of supporting themselves from a wiring channel support bar.

2.21 Manuals

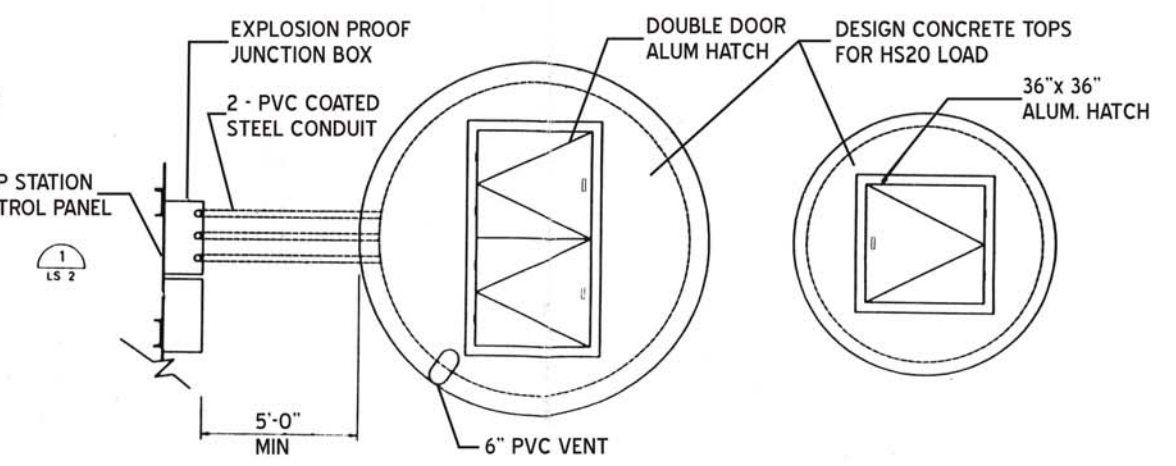
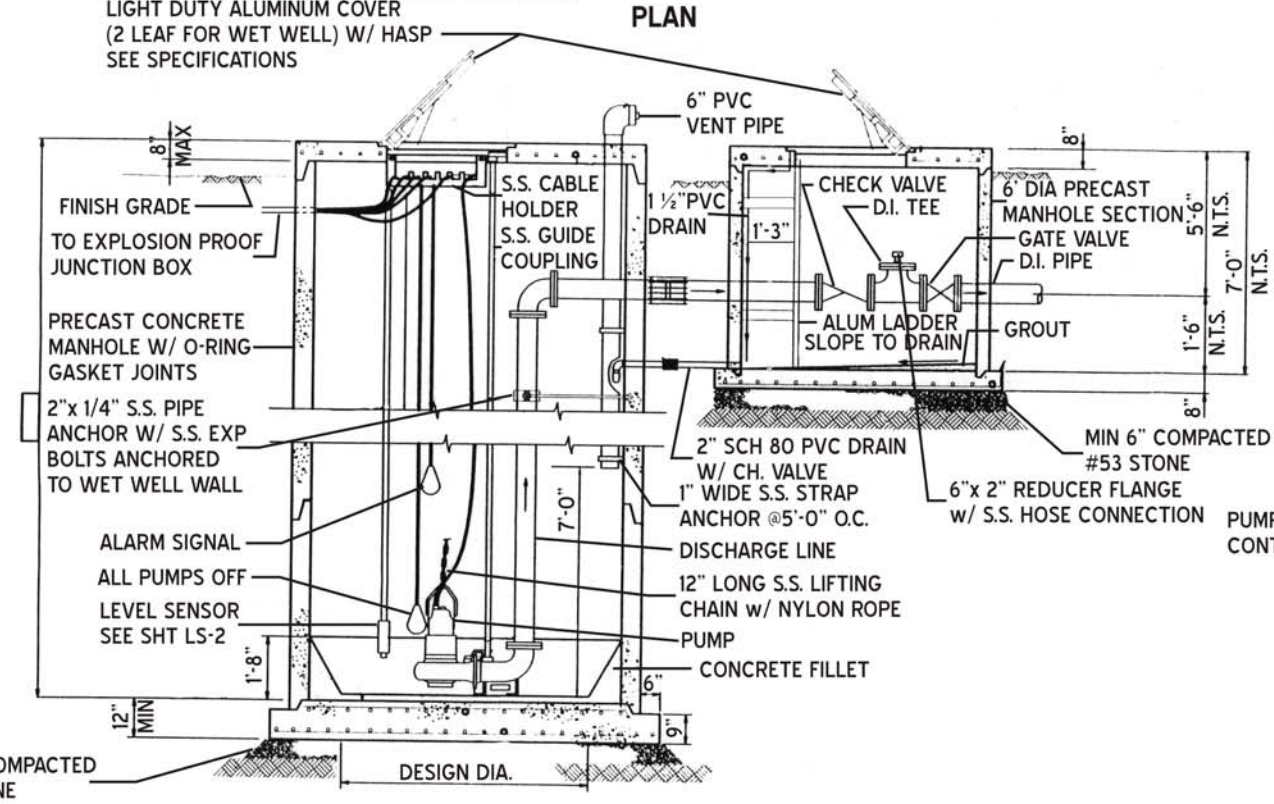
- A. Four (4) manuals shall be presented to the receiving wastewater utility.
- B. Manuals shall include, at a minimum
 1. Operation Instructions
 2. Maintenance Instructions
 3. Recommended Spare Parts List
 4. Lubrication Schedules
 5. Structural Diagrams
 6. As-built Wiring Diagrams
 7. Bill of Materials

END OF SECTION 02750



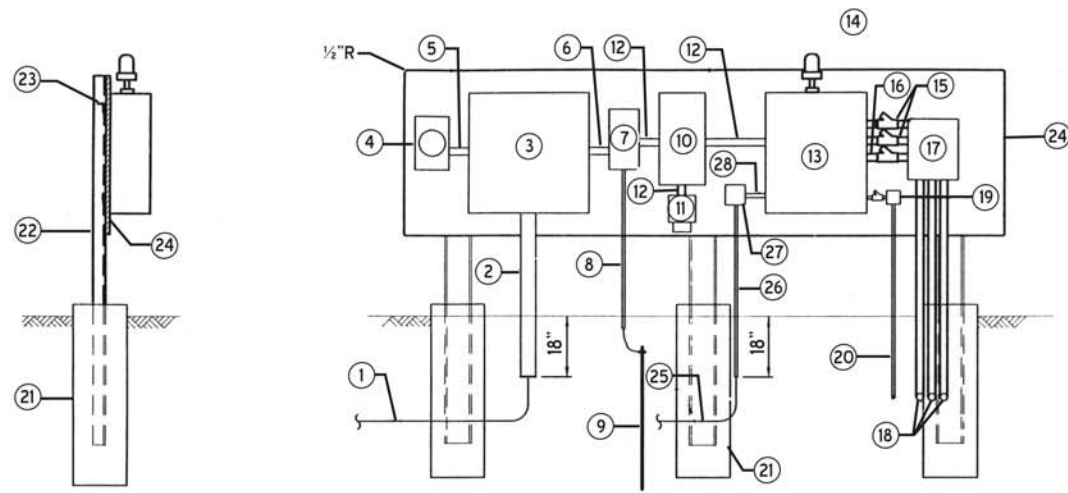
SITE PLAN THIS AREA

- NOTE:**
1. NON-SHRINK GROUT SHALL BE USED AROUND ALL PIPES WHERE EXTENDING THROUGH WALLS.
 2. ALL INTERIOR PIPING SHALL BE COATED WITH TNEC 66 HB EPOXY OR EQUAL.
 3. ALL ANCHOR BOLTS, EXPANSION BOLTS SHALL BE 304 STAINLESS STEEL.
 4. INSTALL A "RED VALVE" PRESSURE SENSOR SERIES 40 ON FORCE MAIN. PLACE AN ASHCROFT TYPE NO. 1009 STAINLESS STEEL, 4 1/2" PRESSURE GAUGE & VALVE ON THE PRESSURE SENSOR. THE PRESSURE GAUGE SHALL HAVE A RANGE AND VALVE FROM 0 TO 75 PSI.
 5. A HYDROSTATIC PRESSURE CONTROL SYSTEM SHALL BE USE FOR LIFT STATION THAT EXCEED 15' DEEP IN LIEU OF FLOAT CONTROLS.

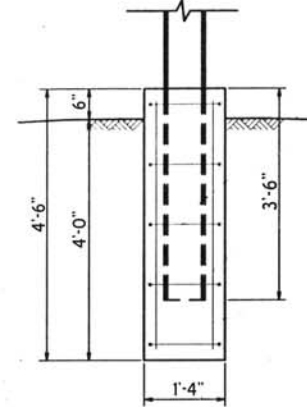


**LIFT STATION
DETAIL**

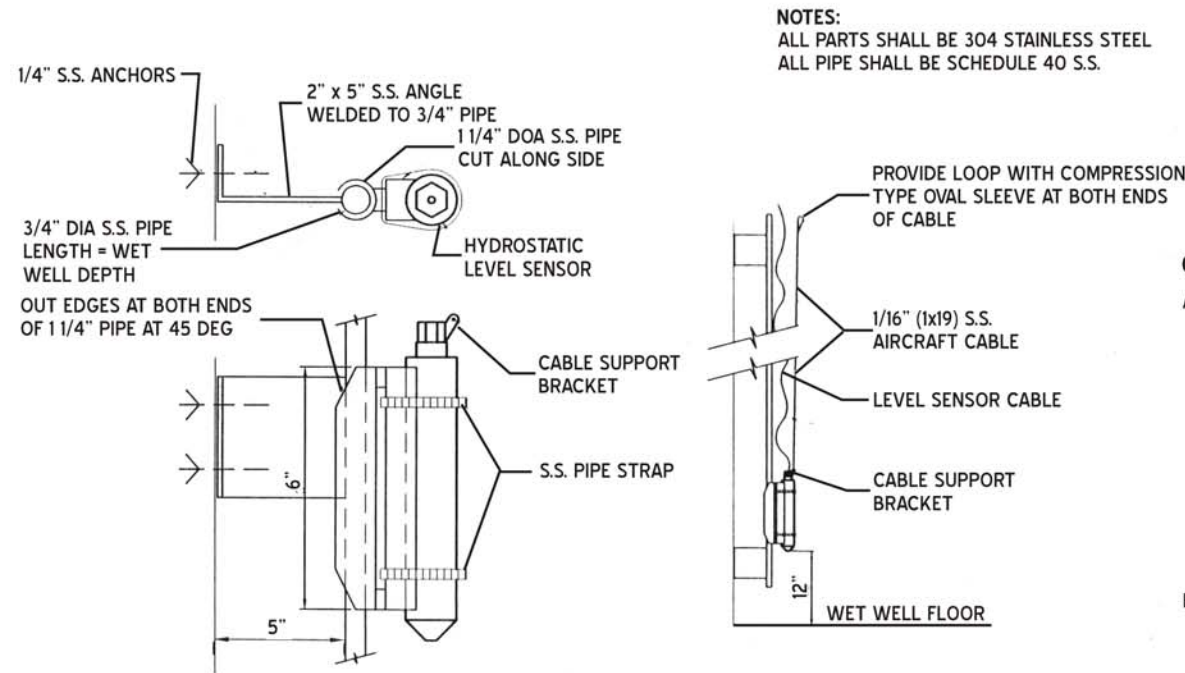




PUMP STATION CONTROL PANEL INSTALLATION DETAIL



CONCRETE FOOTING DETAIL



LEVEL SENSOR MOUNTING BRACKET DETAIL

NOTES:
ALL PARTS SHALL BE 304 STAINLESS STEEL
ALL PIPE SHALL BE SCHEDULE 40 S.S.

GENERAL NOTES

- A. THE AREA AROUND THE LIFT STATION SHALL BE CLASSIFIED AS A HAZARDOUS LOCATION. ANY SPACE WITHIN 3' (ANY DIRECTION) FROM A VENT IS CLASSIFIED AS CLASS I, DIVISION 1, GROUP C & D; WITH THE SPACE FROM 3' TO 5' FROM A VENT CLASSIFIED AS CLASS I, DIVISION 2, GROUP C & D. IN ADDITION, ANY SPACE EXTENDING OUTWARD 3' PAST THE EDGE OF ANY HATCH OPENINGS IN THE TOP OF THE STRUCTURE, TO A HEIGHT OF 18" SHALL BE CLASSIFIED AS CLASS I, DIVISION 2, GROUPS C & D. ALL ELECTRIC WORK MUST CONFORM WITH THE N.E.C. REQUIREMENTS FOR THESE AREAS. EXPLOSION-PROOF CONDUIT SEALS MUST BE INSTALLED WHEREVER THE CONDUIT PASS THROUGH THE BOUNDARIES OF THE HAZARDOUS LOCATION.
- B. FINAL DIMENSIONS ARE BASED ON THE SIZE OF PUMPS AND DESIGN FLOW.

NUMBER NOTES

- ① ELECTRIC SERVICE CONDUCTORS TO BE INSTALLED BY ELECTRIC UTILITY SERVING AREA. SERVICE TO BE xxx/xxx VOLTS, 3 PHASE.
- ② CONTRACTOR TO PROVIDE AND INSTALL AN EMPTY 4" SCHEDULE 80 PVC CONDUIT FROM C.T. CABINET TO POINT OF SERVICE CONNECTION BY ELECTRIC UTILITY. CONDUIT TO BE BURIED 18" BELOW GRADE.
- ③ C.T. CABINET TO BE PROVIDED BY ELECTRIC UTILITY AND INSTALLED BY CONTRACTOR USING STAINLESS STEEL HARDWARE.
- ④ METER SOCKET, PROVIDED BY ELECTRIC UTILITY, INSTALLED BY CONTRACTOR. MOUNTING HEIGHT 5'-0" ABOVE GRADE TO CENTER OF METER. USE STAINLESS STEEL HARDWARE.
- ⑤ 1" RIGID GALVANIZED STEEL CONDUIT (RGS) NIPPLE FOR METERING CONDUCTORS TO BE INSTALLED BY ELECTRIC UTILITY.
- ⑥ RGS CONDUIT SIZE BASED ON DESIGN.
- ⑦ SERVICE ENTRANCE RATED FOR DESIGN VOLTAGE, PHASE AND AMPERAGE IN A NEMA 3R ENCLOSURE. ENCLOSURE SHALL BE EQUIPPED WITH RATED CIRCUIT BREAKER, NEUTRAL AND GROUND TERMINATIONS. CONTRACTOR SHALL INSTALL USING STAINLESS STEEL HARDWARE.
- ⑧ 1/2" RGS CONDUIT FOR GROUNDING CONDUCTOR.
- ⑨ 3/4" x 10' LONG COPPER GROUNDING ROD. PROVIDE MECHANICAL CLAMPS AS REQUIRED BY CODE.
- ⑩ NON-FUSIBLE, DOUBLE THROW SAFETY SWITCH IN A NEMA 3R ENCLOSURE, STAINLESS STEEL HARDWARE.
- ⑪ PORTABLE GENERATOR RECEPTACLE TO MATCH GENERATOR.
- ⑫ RGS CONDUIT SIZE BASED ON DESIGN.
- ⑬ PUMP CONTROL PANEL. INSTALL USING STAINLESS STEEL HARDWARE.
- ⑭ ALARM BEACON LIGHT.
- ⑮ RGS CONDUIT WITH EXPLOSION PROOF SEALING FITTINGS, SIZE BASED ON DESIGN.
- ⑯ RGS CONDUIT WITH EXPLOSION PROOF SEALING FITTINGS, SIZE BASED ON DESIGN. CONDUCTORS SHALL BE SPLICED WITH FLOAT SWITCH CONDUCTORS IN EXPLOSION PROOF JUNCTION BOX.
- ⑰ NEMA 7 EXPLOSION PROOF JUNCTION BOX SIZE BASED ON DESIGN.
- ⑱ THREE 2" RGS CONDUITS BETWEEN THE LIFT STATION AND THE EXPLOSION PROOF JUNCTION BOX. TWO FOR PUMP CABLES AND ONE FOR FLOAT SWITCH CABLES. EXTEND NEAR HATCH OPENING FOR MAINTENANCE OF PUMPS AND FLOAT SWITCHES. CABLE SHALL BE SUPPORTED WITHIN THE WET WELL FROM A CABLE RACK USING STAINLESS STEEL OR NON-METALLIC "KELLUMS GRIP" CABLE SUPPORTS.
- ⑲ LEVEL TRANSMITTER JUNCTION BOX. USE STAINLESS STEEL HARDWARE.
- ⑳ RGS CONDUIT UNDERNEATH TOP SLAB OF WET WELL COVER. EXTEND TO JUST NEXT TO THE HATCH COVERS, EXTEND SENSOR CABLE TO LEVEL SENSOR.
- ㉑ CONCRETE FOOTING.
- ㉒ 8" x 4.25" ALUMINUM CHANNEL. EACH CHANNEL SHALL BE INSTALLED IN CONCRETE BASES AS SHOWN IN THE FOOTING DETAIL. CHANNEL SHALL BE COATED WITH BITUMINOUS COATING UP TO 4" ABOVE THE TOP OF CONCRETE.
- ㉓ 3 x 2 x 1/4" ALUMINUM ANGLE STIFFENERS, WELD TO ALUMINUM CHANNELS.
- ㉔ 1/4" THICK ALUMINUM MOUNTING PLATE. WELDED TO ALUMINUM CHANNELS FOR EQUIPMENT MOUNTING. ALL CORNERS SHALL BE ROUNDED 1/2" RADIUS AND ALL SHARP EDGES SHALL BE FIELD SMOOTH. ALL HARDWARE SHALL BE S.S.
- ㉕ TELEPHONE SERVICE CABLE BY PHONE COMPANY.
- ㉖ 1" RGS CONDUIT FROM TELEPHONE NETWORK MODULE TO POINT 18" BELOW GRADE..
- ㉗ TELEPHONE NETWORK INTERFACE MODULE.
- ㉘ 1/2" RGS CONDUIT WITH TELEPHONE WIRE FROM TELEPHONE NETWORK INTERFACE MODULE TO AUTODIALER WITHIN THE PUMP CONTROL PANEL.

Decatur County

DWG #LS-2



BARTH & ASSOCIATES

**LIFT STATION
ELECTRIC CONTROL
DETAIL**

