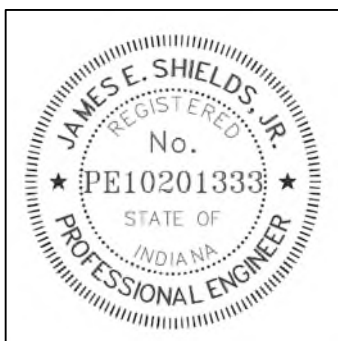




Aqua Indiana State Standards

Lift Station Construction

January 2021



James E. Shields, Jr.

Revision Schedule		
No.	Description	Date
1	X	X

Contents

PART 1 - GENERAL	1
1.1 SCOPE OF WORK.....	1
1.2 WORK AND MATERIALS TO BE PROVIDED BY THE CONTRACTOR.....	1
1.3 REFERENCE STANDARDS AND SPECIFICATIONS	1
1.4 SAFETY	2
1.5 COORDINATION OF WORK.....	2
1.6 SCOPE OF WORK.....	2
1.7 ADDITIONAL REQUIREMENTS.....	3
PART 2 - PRODUCTS	6
2.1 MANUFACTURING REQUIREMENTS.....	6
2.2 SIZES OF MATERIAL AND ADDITIONAL MATERIAL REQUIREMENTS	6
2.3 SEWAGE PUMPS.....	6
2.4 ACCESS COVERS.....	7
2.5 WET WELLS, VALVE VAULTS AND METER VAULTS	8
2.6 CHECK VALVES	8
2.7 RESILIENT WEDGE GATE VALVES.....	8
2.8 PRESSURE GAUGES:	9
2.9 ELECTROMAGNETIC FLOW METER.....	9
2.10 PORTABLE PUMP CONNECTIONS.....	10
2.11 PERMANENT MOUNTED BYPASS PUMP (IF REQUIRED BY OWNER).....	10
2.12 CONTROL PANEL.....	10
2.13 PUMP STATION CONTROLLER	12
2.14 LEVEL DEVICE SYSTEM.....	15
2.15 REDUNDANT FLOAT BACK-UP	15
2.16 ALARM/DATA MONITORING	16
2.17 ADDITIONAL ELECTRICAL MATERIALS	17
2.18 SITE REQUIREMENTS	17
PART 3 - EXECUTION OF THE WORK	19
3.1 GENERAL.....	19
3.2 ELECTRICAL WORK.....	19
3.3 PUMPS	20
3.4 FENCE.....	20
3.5 LIFT STATION TESTING	20

3.6 PUMP WARRANTY..... 21
3.7 LIFT STATION WARRANTY 21
3.8 POST CONSTRUCTION..... 21

PART 1 - GENERAL**1.1 SCOPE OF WORK**

- A. The purpose of these specifications is to provide the main framework for the construction of sanitary sewage lift stations for Aqua Indiana (Aqua-Owner), and to outline the requirements for the design and construction of sanitary sewage lift stations by a person or entity (Applicant) seeking to construct a lift station for inclusion in, or connection to, the AQUA sanitary sewer system. The content of this document is therefore by necessity of a general nature which applies to all projects.
1. The term "Owner", where used in these specifications, refers to AQUA or the authorized representative of AQUA.
 2. The term "Applicant", where used in these specifications, refers to a person or entity seeking permission to connect, construct, alter or disturb, or cause to be connected, constructed, altered or disturbed, any sanitary sewage lift station directly or indirectly tributary to the Owner's sewer system.
 3. The term "Contractor", where used in these specifications, refers to a person or entity engaged by AQUA or Applicant to construct a sanitary sewage lift station.

1.2 WORK AND MATERIALS TO BE PROVIDED BY THE CONTRACTOR

- A. Unless otherwise indicated, all work, equipment and materials described in these specifications shall be provided by the Contractor.
- B. The Contractor shall warrant work and materials for a period of one year from the date of putting the facilities in service. Contractor shall be responsible for full cost of repairs made under warranty.
- C. The Contractor shall provide all materials and equipment necessary to clean and test the lift station prior to placing it into service.
- D. The Owner is exempt from sales tax for the materials used for lift station construction. However, if lift station is constructed by and for Applicant, Applicant and Contractor shall pay all required sales tax.
- E. When tie-ins to the existing system are made, the Contractor shall advise the Owner at least one week in advance of when the connection will be needed. The Contractor shall assert no claims due to delays allegedly caused by the Owner.
- F. The Contractor shall obtain and pay for all temporary office facilities, utilities, and material or equipment storage areas which the Contractor desires and that are not shown on the drawings as "to be provided by the Owner".

1.3 REFERENCE STANDARDS AND SPECIFICATIONS

- A. These Specifications refer and incorporate other standard specifications. The referenced specifications include the latest version of:
1. Indiana Administrative Code, Section 327-3
 2. "National Electrical Safety Code" (NESC)
 3. "American National Standards Institute Standards" (ANSI)
 4. "Institute of Electrical and Electronic Engineers Standards" (IEEE)
 5. "Insulated Power Cable Engineers Association Standards" (IPCEA)
 6. "National Bureau of Standards" (NEB)

7. "National Electrical Manufacturers Association Standards" (NEMA)
 8. "National Electrical Contractors Association Standard of Installation" (NECA)
 9. "National Fire Protection Association Standards" (NFPA)
 10. "Underwriters Laboratories Publications" (U.L.)
- B. All Contractors are advised to obtain a copy of each specification for their review during bidding and construction.
- C. In case of a conflict between these specifications and the reference specifications, AQUA specifications shall rule. Contractor shall notify Owner of discrepancies between specifications.
- D. When reference is made to a reference specification, that specification shall be followed as if it were an integral part of the AQUA specifications.

1.4 SAFETY

- A. The Contractor is responsible for the protection of persons from injury and prevention of property damage at the project site.
1. All OSHA regulations regarding proper working practices shall be used.
 2. All INDOT safety requirements on the marking and performance of construction in roadways shall apply whether the construction is along INDOT roadways or not.
 3. The Contractor shall take whatever steps necessary to protect the public from open trenches, material piles, and all other site obstructions.
 4. Contractor shall adhere to all requirements listed in 29 CFR 1910 – Occupational Safety and Health Standards.
 5. The electrical contractor or control panel manufacturer shall perform an arc flash study for the project if requested by Owner.

1.5 COORDINATION OF WORK

- A. The Contractor shall coordinate all subcontractors, affected utilities, and governmental agencies that have an involvement in the construction of the project.
1. Roadways shall remain open to the degree satisfactory with the affected governmental agency.
 2. Utility service shall remain in near continuous operation to the satisfaction of the utility. During bidding, and prior to construction, the Contractor shall determine if nighttime or other off-time work will be necessary to maintain the desired level of service.
 3. All subcontractors shall coordinate their work and arrangements directly through the Contractor.

1.6 SCOPE OF WORK

- A. Furnish and install sanitary sewage lift station as shown on the plans, including submersible pumping equipment with power and sensor cable, wet well with wet well level device with cable and wet well standby float control switches with cables, valve vault with magnetic flow meter/flow tube (if requested), secondary electrical service conductors and conduits, electrical service meter and sump pump, main fused disconnect, Peterson box/generator connection capable of accepting portable generator wires, lift station controls and enclosure with Omni-site equipment or SCADA monitoring and electronic flow recorder (only if requested by Owner), power and control junction boxes located prior to the control panel, conduit cable seals, explosion proof conduit seal-off fittings, concrete equipment pads, electrical service grounding triangle, all conduits, conductors and

electrical connections, equipment structural supports, and appurtenances as a fully operable system compatible with the current AQUA specifications, as indicated on the approved plans.

1.7 ADDITIONAL REQUIREMENTS

- A. Lift station shall be located within a fenced area with manually operated gates having a total minimum opening width of 16-ft. The gates shall be capable of being padlocked. The fence shall be 7 -ft tall (minimum height) chain link fence. The fence shall be heavy gauge PVC coated, and the poles shall be heavy gauge PVC coated. The fence shall also have vinyl slats that are green or black matching fence and post. The completed fence assembly shall be grounded in accordance with the National Electrical Safety Code.
- B. A single exterior site light shall be mounted 12 ft above ground on an aluminum pole set in a concrete base. Floodlight shall be a heavy-duty aluminum fixture with manual activation switch, impact resistant glass and a 500-watt LED lamp. Light shall be equipped with a manually operated toggle switch. Lamp shall be installed in a metal cage to protect it from impact. Exterior site light shall be Lithonia DSXF1 LED P1 40K WFL MVOLT THK DDBXD, or Owner approved equal.
- C. Each lift station shall be accessed by a paved driveway and be provided with a paved parking area. Driveway shall be heavy duty rated bituminous or concrete surface, minimum 16-foot wide providing access directly adjacent to the wet well, valve vault, and meter vault. Provide enough turnaround and parking area for one vehicle if requested.
- D. Contractor shall provide a permanent bypass pump if requested by Owner.
- E. Minimum pump suction and discharge diameter shall be 4-in.
- F. No grinder pumps are allowed unless otherwise approved by the Owner.
- G. Minimum force main diameter shall be 4-in.
- H. Contractor shall provide a magnetic flow meter with data logging with electronic flow recorder if requested by Owner.
- I. Each lift station shall have, as a minimum, two pumps. Station shall be designed to provide the design peak hour flow with the largest pump out of service (firm capacity).
- J. Electrical requirements:
 - 1. The service entrances and all equipment shall be properly grounded in accordance with Article 250 of the National Electrical Code utilizing a ground triangle.
 - 2. The Contractor shall install the electrical meter (provided by the power company) on a pedestal base approved by the electrical utility company.
 - 3. Electrical service to the lift station shall be three phase configuration. If only single-phase power is available, Contractor shall utilize a VFD for each pump to make three phase configuration from single phase power. In this case, the VFD will not be used for pump speed variation.
 - 4. Electrical service voltages may be:
 - a. 120/240 vac, single phase, three wire
 - b. 240 vac, three phase, three wire
 - c. 240/120 vac, three phase, four wire
 - d. 208Y/120 vac, three phase, four wire
 - e. 480 vac, three phase, three wire (preferred)

f. 408Y/277 vac, three phase, four wire

5. All conductors shall be routed in conduit. In applications where there is anticipated population growth and the potential for increases in pump horsepower, one spare power and control conduit shall be provided from the wet well to the pumps power and wet well control junction boxes, and from the electrical service source (transformer) to the main fused disconnect.
6. The junction boxes shall have epoxy conduit seals between the junction box and control panel.
7. The conduits between the wet well and the junction box for the pumps shall be a minimum of 4-inch.
8. The lift station controls enclosure shall be mounted a minimum of eighteen inches above the wet well vent outlet and five feet horizontally from all openings.
9. The lift station pumps power, wet well level device, and float switches control junction boxes shall be mounted a minimum of eighteen inches above the wet well vent outlet.
10. The lift station main fused disconnect switch enclosure shall be mounted a minimum of eighteen inches above the wet well vent outlet.

K. Applicant shall provide the following:

1. Buoyancy calculations demonstrating that the wet well and valve vault will remain submerged given saturated soil conditions and using a safety factor of 1.5.
2. Pump sizing calculations, including design average and peak flow rates, total dynamic head, pump cycle times, and wet well detention time. Calculations shall indicate the service area tributary to the lift station, including the number and nature of existing, planned and future units to be served by the lift station.
3. Pump selection documentation to include pump efficiency, impeller diameter, design peak flow rate (in gallons per minute), horsepower, and design rpm's. Provide pump and system curves.
4. For developments that are planned to be constructed in phases, the calculations and documentation shall address the ultimate demands on the station as well as the demands for each phase of the development.
5. Design drawings and structural calculations for concrete slabs used to support the standby generator and other exterior equipment.
6. Electrical sizing calculations to include electrical service size load calculations, and standby generator sizing calculations

L. After plan approval, and prior to construction, applicant shall provide shop drawings to Aqua Indiana and Owner's Engineer for the following:

1. Wet well top slab, bottom slab and risers, including reinforcing steel.
2. Valve and Meter Vaults.
3. Selected lift station equipment including pumps, pumps power and sensor cables, wet well level device and cable, wet well standby float control switches and cables, float switches suspension method, valve vault sump pump, magnetic flow meter / flow tube, electrical service meter pedestal, main fused disconnect, manual transfer switch, lift station controls enclosure and components to include SCADA equipment and electronic flow recorder, pumps power and wet well controls junction boxes, conduit cable seals, explosion proof conduit seal-off fittings, electric service grounding triangle, ground rods, wire and cable, EMT and PVC conduits, waterproof electrical connections,

equipment structural supports, site lighting to include fixture, pole, lamp, and pole foundation and grounding details, site fencing and fence grounding details.

4. Lift station controls electrical power and control diagrams indicating all control components, component sizes, ratings, and functions.

M. Operation and Maintenance Manuals: Contractor shall submit two (2) Operation and Maintenance Manuals to Owner. Manuals shall include, at a minimum, the following:

1. Warranty Statement;
2. Pump down test procedures and results from the start-up tests;
3. Operation Instructions;
4. Maintenance Instructions;
5. Recommended spare parts list;
6. Lubrication schedules;
7. Structural diagrams;
8. As-built wiring diagrams;
9. Piping and Instrumentation Drawings (P&ID); and
10. Bill of materials.

N. FACTORY TESTS

1. Each pump to be delivered under this Section shall be tested for performance at the pump manufacturer's factory to determine head versus capacity, efficiencies, and kilowatt draw required for the operating points that are specified. All tests shall be run in accordance with the latest edition of the American Hydraulic Institute Standards and Submersible Wastewater Pump Association and at the appropriate voltage and frequency. Testing shall also include, but not be limited to, the following:
2. Head vs. flow with five (5) equally spaced points including shutoff and maximum flow shall be certified.
3. The input KW, speed, power factor, no load current, and torque characteristics shall be certified.
4. Impeller, motor rating, and electrical connections shall first be checked for compliance to the specifications.
5. Insulation Test: A motor and cable insulation test for moisture content or insulation defects shall be made.
6. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
7. Operational Test: The pump shall be run for 30 minutes submerged, under a minimum of six feet of water.
8. After the operational test has been conducted, the insulation test shall be performed again.
9. After testing, the pump shall be inspected to ensure that the pump maintains full watertight integrity.
10. A written report stating the tests have successfully been completed and providing the results of the test shall be provided for each pump. The pump manufacturer shall also certify that similar tests have been conducted on pumps of a similar size for a period of not less than five (5) years.

PART 2 - PRODUCTS**2.1 MANUFACTURING REQUIREMENTS**

- A. For most products, Owner has limited the number of manufacturers approved for use in its systems. Contractor shall provide the listed manufacturer(s) unless written approval is given by Owner prior to bidding. "Owner approved equal" means that for a specific project, Owner has given written approval that a different manufacturer or model may be used.
- B. Electrical system and components in the raw sewage wet well must comply with NEC requirements for Class I, Group D, Division 1 locations.

2.2 SIZES OF MATERIAL AND ADDITIONAL MATERIAL REQUIREMENTS

- A. Where specific sizes of materials are not listed in paragraphs below, sizes will be shown on the Drawings.
- B. Contractor shall verify all field dimensions.
- C. Refer to AQUA Standard Details for additional dimension and material requirements.

2.3 SEWAGE PUMPS

- A. Furnish and install submersible non-clog sewage pumps capable of passing a 3 in. diameter spherical solid. Pump suction and discharge openings shall be 4 in. or greater in diameter. Pumps shall be Myers, Hydromatic, Flygt, Grundfos, or Owner approved equal.
- B. Pump Construction:
 - 1. Submersible pumps and motors shall be designed specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle and shall meet the requirements of the National Electrical Code (NEC) for such units. If pump and motor are not fully submerged at shut off level, explosion proof motors shall be provided.
 - 2. The pump body, seal plates, impeller, and motor housing shall be constructed of high-quality ASTM Class 30 cast iron or better. A coat of air dry enamel shall be applied before and after assembly. All exposed hardware shall be 300 series stainless steel.
 - 3. The impeller shall be of the two-vane, non-clog design with pressure vanes on the back side and of the key drive design. The impeller shall be dynamically balanced and shall be capable of handling solids, fibrous materials, and other matter found in normal sewage applications. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller.
 - 4. Each pump shall be provided with a tandem mechanical shaft seal consisting of two independent seal assemblies operating in an oil-filled seal cavity. The materials of construction shall be carbon and ceramic lapped and polished to a tolerance of one light band, stainless steel hardware, and with all rubber parts of Buna-N. A moisture sensor detection system shall be included within the oil-filled seal chamber.
 - 5. The motor shall be a premium efficiency motor that is the standard product of an established American motor manufacturer. The motor shall be designed to be non-overloading over the entire pump curve. The rotor and stator assembly shall be of the standard frame design. The motor housing shall be of submersible construction and shall be filled with high dielectric oil. The motor windings shall be of Class F insulation rated at 155 degrees C. The combined service factor shall be a minimum of 1.15. The motor shall be able to operate dry without damage while pumping under load. The

motor shall meet the standard for enclosure, type of mounting and basic electric design for NEMA Design B. The motor shaft shall be of 416 stainless steel, or carbon steel with a replaceable type 420 stainless steel shaft sleeve. The thrust bearing shall be of the double row ball type with the upper radial bearing of the single row ball type.

6. Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with a thermal switch embedded in the end coil of the stator winding. This shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel.
 7. The pump shall be equipped with adequate power cord and sensor cord to connect the pumps to the control panel. Pump motor cords shall be designed for flexibility and serviceability under conditions of extra hard usage and shall meet the requirements of the NEC for flexible cords and cables in sewage pumping stations. Each flexible cable, or cord, shall be provided with a watertight seal and separate strain relief at the motor.
 8. The cable entry design shall be such that it insures a watertight and submersible seal. All incoming lead wires shall be spliced in the motor terminal housing. After splicing, the terminal housing shall be filled with epoxy to seal the outer cable jacket and the individual strands to prevent water from entering the motor housing. In lieu of the epoxy seal, a terminal board shall separate the junction chamber and motor. A secondary rubber pressure grommet shall be provided as an additional sealing point and strain relief at the point of cable entry.
- C. Pump Lift-Out Assembly: For each pump, the discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump(s) shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection and service. There shall be no need for personnel to enter the wet well. A simple linear downward motion of the pump shall accomplish sealing of the pumping unit to the discharge connection. A stainless-steel sliding guide bracket shall be an integral part of the pump unit. Two stainless steel guide rails shall guide the entire weight of the pumping unit. Provide stainless steel lifting chain of appropriate diameter for pump size, length as required for the installation (minimum of 50 feet), for each pump. Provide a stainless-steel hook underneath the access cover for attaching the cables.

2.4 ACCESS COVERS

- A. Access covers shall be aluminum, designed and constructed to withstand water intrusion.
- B. The doors shall be minimum 1/4" aluminum tread plate reinforced as required and attached to the frame with stainless steel hinges. A lock tab for pad locking shall be provided for securing the door closed. A positive guided open-door latch shall engage automatically when door is fully opened to 90 degrees. The open-door latch must be released for closing. A retractable handle shall be provided on the outside of the door to assist opening and closing. Access hatches are to be Halliday Model W1S single leaf or W2S multi-leaf or Owner approved equal. Wet well access shall be multi-leaf to provide adequate access for pumps.
- C. All wet well hatches shall be provided with a safety grate which allows visual inspection of the wet well with the grate in place. The grate shall have a separate hold open door latch that engages when fully opened to 90 degrees. The door latch shall have a release mechanism. Safety grate and latches shall be made from stainless steel or aluminum and be resistant to sewage, sewer gasses and moisture.

- D. Access dimensions shall be adequate for maintenance of equipment, accommodating removal of equipment when necessary.

2.5 WET WELLS, VALVE VAULTS AND METER VAULTS

- A. Construct wet wells of precast reinforced concrete sections. Wet wells constructed of steel are not allowed.
 - 1. Bases shall be one-piece precast base or cast-in-place concrete base section constructed to the dimensions shown on the Drawings and in accordance with ASTM standards. Steel reinforcement shall be as delineated on the Drawings and in accordance with ASTM Standards.
 - 2. Risers shall be precast reinforced concrete riser sections in accordance with ASTM C478, constructed to the dimensions shown on the Drawings and in accordance with ASTM Standards. Riser shall be the same dimensions as the base. Riser steel reinforcement shall be designed for the designated depth of the structure per ASTM standards. At each joint between precast manhole sections, provide a permanent, flexible, watertight, full perimeter external joint wrap in accordance with ASTM C-877, Type II and passing ASTM C-1244 vacuum test. Wrap shall be as manufactured by Mar Mac Construction Products, Inc. or Owner approved equal.
 - 3. Gaskets for seating precast sections shall be preformed gaskets joint straps conforming to Federal Specifications SS-S00210, Type I Rope Form, or Kent Seal Mastic.
 - 4. Resilient gasket pipe-to-manhole connectors, manufactured in accordance with ASTM C-923, shall be provided.
 - 5. Risers shall not have through-wall lift holes. All lift holes in precast sections shall be wetted and completely filled with non-shrink grout, smoothed.
 - 6. Top slabs shall be one-piece precast concrete, constructed to the dimensions shown on the Drawings and in accordance with ASTM standards. Top slab steel reinforcement shall be designed for the designated surface load of the structure per ASTM Standards.
 - 7. Manholes exterior shall be coated with bituminous waterproofing material to ensure water tightness.
 - 8. Furnish and install manhole steps at 16 inches on center in the valve vault. Provide plastic steps with steel bar reinforcement, as manufactured by M.A. Industries, or Owner approved equal.
 - 9. Provide a 2-inch minimum PVC drain from the valve vault to the wet well. Equip the drain with a check valve in the wet well to prevent backflow into the valve vault. Slope the floor of the valve vault to drain.
 - 10. Wet Well concrete shall have an antimicrobial admixture.
 - a. Antimicrobial Admixture: 1 gallon per cubic yard of concrete of ConmicShield® by Conshield Technologies Inc or Owner approved equal. Additive shall be included in the concrete mix design as part of the total water content. The additive shall be added to the concrete mix water to ensure even distribution throughout the concrete mixture.

2.6 CHECK VALVES

- A. Check valves shall be Swing-Flex Check Valve or Owner approved equal. Valve shall be equipped with a manual backflow actuator for manual backflow operation.
 - 1. Manufacturers: Val-Matic, Mueller, Clow, or Owner approved equal.

2.7 RESILIENT WEDGE GATE VALVES

- A. Valves shall conform to the latest revision of AWWA Standard C515 covering resilient seated gate valves for water supply service.
- B. The valves shall have a ductile iron body, bonnet, and O-ring plate. The wedge shall be totally encapsulated with rubber.
- C. The sealing rubber shall be permanently bonded to the wedge per ASTM D-429.
- D. Valves shall be supplied with O-ring seals at all pressure retaining joints. No flat gaskets shall be allowed.
- E. The valves shall be non-rising stem opening by turning left and provided with 2" square operating nut or a handwheel with the word "Open" and an arrow to indicate the direction to open.
- F. Stems shall be cast copper alloy with integral collars in full compliance with AWWA. All stems shall operate with copper alloy stem nuts independent of wedge and of stem (in NRS valves).
- G. All stems shall have two O-rings located above the thrust collar and one O-ring below. Stem O-rings shall be replaceable with valve fully opened and subjected to full pressure.
- H. The stems on 4"-20" shall have a low torque thrust bearing located above and below the stem collar to reduce friction during operation.
- I. Waterway shall be smooth, unobstructed and free of all pockets, cavities and depressions in the seat area. Valves 4" and larger shall accept a full size tapping cutter.
- J. The body, bonnet and O-ring plate shall be fusion-bonded epoxy coated, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 and be NSF 61 Certified.
- K. Each gate valve shall be installed in a vertical position with a roadway type valve box. Gate valves set with valve boxes shall be provided with a 2-inch square operating nut and shall be opened by turning to the left (counter-clockwise). There shall be a maximum 48" depth of valve operating nut. Contractor must use extension stems, if necessary, to raise operator nut within 48" of final grade.
- L. All buried gate valves shall have mechanical joint ends.
- M. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to the requirements of AWWA C515 (and UL/FM where applicable).
- N. Valves shall be as manufactured by Mueller, M&H, Clow, American Valve & Hydrant, Kennedy, or approved equal.

2.8 PRESSURE GAUGES:

- A. Provide a 2-inch saddle tap downstream of where the pump force mains join. Install a 2-inch stainless steel ball valve and a 2-inch x 1-inch stainless steel bushing with a 1-inch stainless steel pipe nipple and a 4 1/2 in. diameter, 0 to 60 psi, Bourdon tube type pressure gauge with shut-off cocks, as shown on the plans.

2.9 ELECTROMAGNETIC FLOW METER

- A. The following details apply to the flow meter, if requested.
 1. Approved Manufacturers ABB – Magmaster MFE Series Model, Krohne – AquaFlux Model, Owner approved equal

- B. Furnish and install a pulsed DC electromagnetic flow meter for flow measurement. The flow meter shall consist of a flow tube and a converter, which shall indicate, totalize and transmit flow to a digital recorder. The flow tube shall use a spool piece configuration with field-interchangeable sensors containing coils and electrodes. The flow tube shall not require removal from service in order to repair/replace liners or repair/replace coils. Magnetic flow meters requiring liners will not be acceptable.
- C. Provide and install flange adapter in the main line and provide spool piece (left in the meter vault) the length and diameter of the magnetic flow meter.
- D. The magnetic flow transmitter shall be furnished with a digital LCD display for flow rate, a six digit totalizer, alarm relays and 4 to 20 mA analog output. The meter shall include digital data logging for a minimum of 60 days.
- E. The flow tube shall be EMCO UniMag M carbon steel flanged Flow Tube, furnished with two UniMag sensors for 0.5% accuracy. The flow tube construction shall be suitable for submersible operation with a remote transmitter installation. Each flow sensor shall contain a coil, a pair of sensing electrodes, and an integral grounding electrode. The sensors shall use pulsed DC excitation.
- F. The flow tube shall be installed in a meter vault as shown on the plans. The transmitter and digital recorder shall be installed in the electric control panel specified in these specifications.
- G. Provide a minimum 1/3 horsepower, 115 vac sump pump in the meter vault if it cannot be drained by gravity. Provide a water in vault alarm.

2.10 PORTABLE PUMP CONNECTIONS

- A. The valve vault shall contain a 6-inch bypass ductile iron riser that extends above the pad on the valve vault with a cam lok fitting. Isolation valves for bypass pumping should be accessible from on top of the pad.
- B. A 6-inch ductile iron suction pipe shall be installed in the wet well for use in emergency pumping situations. The suction pipe shall be supported off the wall of the lift station and terminate above the pad with a cam-lok fitting.

2.11 PERMANENT MOUNTED BYPASS PUMP (IF REQUIRED BY OWNER)

- A. Permanent pump required if lift station has a capacity of 250 gpm or greater.
 - 1. Manufacturer to be Godwin, Thompson or Owner approved equal.
- B. Pump shall start automatically via the redundant float backup.

2.12 CONTROL PANEL

- A. The control panel(s) shall be constructed in compliance with Underwriter's Laboratories Categories 698A and 913 standards – “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions”.
- B. While the use of U.L. listed components is encouraged, their use alone and/or the alternate use of a U.L. 508A – “Enclosed Industrial Control Panel” serialized label will not be considered an acceptable or satisfactory alternate to the “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” serialized label specified above.
- C. Upon request from the Owner, the Contractor shall supply documentation from the control panel manufacturer to the Owner demonstrating that the manufacturer is a U.L. recognized

manufacturing facility for the type of equipment required. Only the labeled products of U.L.698A and 913 “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” recognized panel manufacturer shall be considered acceptable.

- D. Provide a NEMA 4X, 14-gauge, stainless steel enclosure with dead front door. Enclosure shall be of appropriate dimensions for the equipment provided. All hardware and hinges shall be stainless steel. Chassis plates shall be .125" grade 6061-T6 aluminum. Each door shall have a drip shield, continuous hinge door with 3-point latching mechanism. The latching mechanism shall be a lever type locking device (lockable exterior door), no screw down clamps shall be allowed to secure door. The enclosure shall have a separate section for controls as described below. Reserve 12 inches below each enclosure for conduit entrance. The panel shall be supplied by pump manufacturer, or Owner approved equal.
- E. Provide the following equipment in the power section of the enclosure:
1. Main circuit breaker or disconnect.
 2. Branch circuit breakers for each pump motor.
 3. NEMA Size motor starters with Type 10 overload relays for each pump motor.
 4. Low voltage relay for single phase electrical service applications or phase failure relay for three phase electrical service applications, each with integral surge protection, to provide motor and control equipment protection in the event of low voltage, voltage unbalance, phase loss, or phase reversal.
 5. Phase/Voltage monitor.
 6. Lightning Arrestor.
 7. Incoming power terminal block.
 8. Ground fault interruption protection shall be provided to de-energize the circuit in the event of any failure in the electrical integrity of the cable to each motor.
 9. LED Panel Light
 10. Site lighting circuit breaker
 11. Control Power Transformer with Primary Fuses.
 12. Control Power Circuit Breaker and Fuse.
 13. Motor heat sensor circuits.
 14. Individual pump Ammeter.
- F. Provide the following equipment in the control section of the enclosure:
1. Telemetry Circuit, 15A, single pole circuit breaker 120V GFI
 2. Spare Circuit 20A, single pole circuit breaker and 20A, 120V GFI duplex receptacle.
 3. Control Circuit, 15A, single pole circuit breaker for controls.
 4. Circuit breakers as required for all other power needs.
 5. Level controller with isolation transformer.
 6. Hand-Off-Automatic (H-O-A) switches for each pump.
 7. Run lights (green) push-to-test for each pump.
 8. Run failure lights (red) push-to-test for each pump.
 9. Seal failure lights (amber) push-to-test for each pump.
 10. Elapsed time meters (99999.9 hours) for each pump.
 11. Primary transducer, intrinsically safe, 4-20 Ma output

12. Back-up float control relay intrinsically safe, to automatically operate the pumps in the event of level controller failure. This relay shall also activate the high-water alarm and alarm light.
 13. Panel heater with thermostat.
 14. Omni-site Crystal Ball Micro RTU, Wireless Alarm Monitor, with 12V DC power supply and battery backup, if requested by Owner.
 15. A digital data logger shall be installed in the control cabinet, if requested by Owner.
 16. Magnetic flow meter transmitter for use with remotely mounted Magnetic flow tube, if requested by Owner. Provide 120 vac, 1 pole, 15-amp circuit breakers for the flow transmitter, if requested by Owner.
 17. Red alarm light, test push button (NO HORN).
 18. 22 mm LED Indicating Lights, NEMA Type 4/4x/13 IP66 suitable for wash down environments.
 19. 22mm oil tight lenses.
 20. ETM's (Elapsed time meters)
- G. Solderless, marked terminals shall be used for control wiring. Mount control devices on the inner door within the enclosure. The seal failure sensor shall be wired to relays to activate seal failure lights. The heat sensing thermostat in the motor windings shall be wired in series to the motor starters.
- H. On the outside of the enclosure mount the following:
1. High Water Alarm LED Light, red in color.

2.13 PUMP STATION CONTROLLER

- A. Furnish a NE250 (VFD pump controller) or NE152 (non-VFD pump controller) general-purpose pump controller designed to control up to 2 pumps in pump down applications. The controller shall have an integral programmable logic controller (PLC) and human machine interface (HMI) unit in one. It sequences pumps on and off in response to changes in level, pressure, or flow. The primary sensor input is a 4 to 20 mA. current loop which can be connected to any sensor which has a 4 to 20 mA output connected to a pressure transducer. The controller also allows for a float backup system. It is the intention of this specification that a standard controller be provided, with all the control and communications features described as a fully integrated assembly. The controller shall be manufactured by N.E. Controls LLC (315) 299-5161 <https://www.necontrols.com/> (7048 Interstate Island Rd Syracuse, NY 13209) or Owner approved equal.
- B. The pump controller shall be a standard, catalogued product of a water and wastewater pumping automation equipment manufacturer regularly engaged in the design and manufacture of such equipment. The PUMP CONTROLLER shall be specifically designed for wastewater pumping automation utilizing built-in preconfigured control and telemetry strategies allowing pump up or down mode pump control of 1 to 2 pumps. "One of a kind" systems using custom software with a generic programmable controller will not be acceptable.
- C. The pump controller shall be able to operate on either 120 AC or 10–30 VDC power sources. The unit shall be battery backed to provide continued system monitoring and alarm annunciation in the event of primary power failure. Unit shall have built in battery charging circuitry to maintain and charge battery. Battery shall be sized to provide a minimum of 4 hours of backup power. Back up battery power will extend to necessary

process sensors, local alarm lights, horns and telemetry equipment. A power on LED shall be built on board providing local indication that power is available to the unit.

- D. The pump controller shall be furnished with a user-friendly touchscreen operator interface allowing adjustment and viewing of all system parameters and status. The operator interface shall be NEMA 4X rated suitable for front door mounting including locations requiring wash-down and moisture protection.
1. The process variable signal, pump 1, 2 on/off and high & low set points, shall be displayed simultaneously via front panel mounted long lasting Ultra Bright LED bar graphs. These bar graphs shall be vertically mounted in parallel fashion to provide relational viewing of all set points vs. the measured process. Each display column shall have a minimum of 40 segments of resolution. Each set point column shall have a status LED mounted on top of the associated set point providing indication of set point activation status. Units that require operator action to view the above parameters are not acceptable.
 2. To assure the highest resolution and accuracy, the process display shall be configured to display the full range of the actual measured process. Range can also be offset allowing display of a pressure or level range that does not start at zero. The display ranges shall be field configurable.
 3. System Pump On/Off and Alarm set point parameters shall be easily adjustable via individual up and down pushbutton arrows located next to the associated set point display column(s).
 4. The unit shall have a built-in process simulation capability allowing the operator to verify system operation by forcing the process variable up or down via pushbutton arrows located next to the process display. To prevent accidentally leaving the unit in simulation mode, the PUMP CONTROLLER shall be configured to automatically restore monitored process display within 2 minutes after last keypad usage or immediately upon operator initiated restore.
 5. The display unit shall incorporate a high contrast LCD panel allowing for viewing of higher-level functions including the following:
 - a. Process display to XX.X of the full scale process range.
 - b. Time and Date Stamped Alarms & Events
 - c. Pump Statistics (Including Run Time, Number of Starts, Daily Average Number of Starts)
 - d. System diagnostics
 - e. Controller Security
 - f. Unauthorized Station Entry Detection
- E. The pump controller shall provide on board 24 VDC loop power output for external loop powered sensor. A built-in Analog Supply Voltage Status LED shall indicate availability of loop power. Unit shall be able to monitor a user selectable – 4-20 mA or 0-10 Volt analog input representing the process to be controlled. The analog digital conversion shall not be less than 16 bit to allow accurate measurement of the process variable. The analog input circuitry shall provide optical isolation from the main board to the field device. A minimum of 1000 volts electrical isolation shall be required. The analog process signal shall be displayed locally via 40 segment vertical LED display and the LCD digital display as specified above. This signal shall also be available for telemetry transmission.
- F. The pump controller shall have the ability to monitor up to 16 digital inputs to be used to provide monitoring of local station status. Each discrete input shall provide optical

isolation from the main board to the field device. A minimum of 1500 volts electrical isolation shall be required. An on board LED shall be provided indicating that digital Input isolation is not compromised. All discrete inputs shall be available for telemetry transmission. The following inputs shall be monitored:

1. Pump 1, 2 Run – This signal shall be used to provide local display of pump run status, pump total run time, and pump average daily starts for each pump.
 2. Pump 1, 2 In Auto – This signal shall be used by the controller to determine pump availability. A pump in this mode cannot be called into operation.
 3. Pump 1, 2 High Temperature/Seal Failure – This signal shall be used by the controller to disable the pump required when a High Temperature is the cause of the failure and provide local alarm display. Controller shall be able to differentiate alarm. A seal failure shall not disable pump operation.
 4. High & Low Float/Pressure – This signal shall be used by the controller to provide back up control of the pumps in the event of primary (analog) sensor failure.
 5. Pump Inhibit – This signal shall be used by the controller to inhibit pumps from operating.
 6. Power Quality – This signal shall be used by the controller to disable pumps in the event incoming station power is unsuitable for use as determined by an optional external power monitoring device.
 7. Alarm Silence – This signal shall be used by the controller to monitor an optional external silence push button and will temporarily disable the alarm horn output.
- G. The pump controller LCD shall operate in a manual scrolling menu mode with the various displays shown in sequence as selected by the keypad's up/down arrow keys. The display shall indicate the specific function entered on the keypad to confirm that selection of a particular output or other function from the keypad during adjustment or review routines.
- H. The pump controller shall provide outputs for interface to local pumps and alarm annunciation equipment. Relay isolated contact outputs for activation of Pump 1, Pump 2, Common Alarm shall be provided. Each contact shall be rated for a minimum of 10 amps at 120 VAC or 5 Amps at 240 VAC. Open collector outputs for Low and High Level Alarm shall be provided for interface to off board monitoring equipment. Open collector outputs shall have a minimum operating range of 5-30 VDC @ 100 mA.
- I. The pump controller shall provide 4-20 mA output signal for interface to external equipment including VFDs, flow meter or other monitoring devices. Analog output can be configured to provide output representing process variable for retransmission or as a process control output for interface to VFDs, valves, or other process-controlled device.
- J. The pump controller shall support contact closure inputs from float or pressure switches representing high and low (Level/Pressure). The pump controller shall annunciate these inputs as alarms and use them to provide back up control in the event the primary (analog) sensor fails. Unit will provide local alarm indication and utilize the inputs to cycle pumps on and off to maintain system operation.
- K. The pump controller shall include built-in pump failure detection logic. In the event the pump has been called into operation and the pump run signal is not received within a pre-adjustable time period. A motor failure shall be produced. The failed motor shall be disabled, an alarm shall be displayed and the next available pump based on the selected alternation sequence shall be requested to start.

- L. PUMP CONTROLLER shall provide pump performance related information. Pump station performance data shall be viewable locally through built in LCD or available for telemetry transmission to master station. The following information is to be provided:
1. Pump 1, 2 Low Flow Rate Alarm (Set point) – each pump
 2. Pump 1, 2 Run Time – each pump
 3. Pump 1, 2 Number of Starts – each pump
 4. Pump 1, 2 Average Number of Starts – each pump
- M. All connections shall be made via plug-in terminal blocks with a minimal rating of 10 amps, 300 volts and capable of accepting 30-12 AWG wire.

2.14 LEVEL DEVICE SYSTEM

- A. The liquid level of the wet well shall be sensed by a submersible level pressure transducer device. The level device shall be Dwyer Instruments, Inc. PBLTX-5-50-PU or Owner approved equal.
- B. The level device shall be provided with a 50-foot cord.
- C. The level device assembly shall be installed where directed by the Engineer and connected with other system elements and placed in successful operation.
- D. The control panel shall include a UL Listed intrinsic safety barrier that has been UL tested with the specific submersible level device furnished for this application to render the level device suitable for use in Class 1, Division 1 or 2, Groups A, B, C and D; Class II, Division 1 or 2, Groups E, F and G; and Class III, hazardous locations (which includes a sewage wet well).

2.15 REDUNDANT FLOAT BACK-UP

- A. An independent high-level alarm and redundant pump control capability with features as hereinafter listed shall be provided in addition to the specified primary control system. It shall be powered by a 120 VAC circuit breaker.
- B. The high-level alarm shall be a float system that activates when the float rises 45-degrees.
- C. The independent alarm/control panel equipment shall be designed to UL Industrial Control Panel standards and shall incorporate 120 VAC input power transient protection, a fused primary and a DC power supply with limited 12 VDC to power the intrinsic safety barrier level sensing float circuit(s). The front face of the controller accessible through the operator's door and shall incorporate four red LED indicators; a "control hold" LED, a redundant control "turn on" LED, a high level alarm/monitor LED, a "control contacts" energized LED and a pump "off delay" time control adjustment with a 0-5 minute range.
- D. The controller shall operate in conjunction with necessary direct-acting float switches (as specified elsewhere) to provide back up control of lift pumps, detection of high level and to protect the pumps from damage that may result from low wet well levels. The system shall monitor the float switch inputs and provide local indication of system operation via LEDs. Built in relay contacts shall be interfaced to alarm circuitry and pump motor starter pilot circuitry. The backup system shall not interfere with primary controller operation when wet well levels are within normal operating range. The backup system will only become active and bypass the primary control and sensor system and assume full control, in the event wet well levels go outside of normal operating range. Back up sensors shall be mounted and configured to operate outside primary controller set point settings.

- E. Upon detection of abnormally high wet well level the backup system shall provide independent dedicated high-level alarm indication and contact closure output for activation of common alarm system. The backup system shall also provide independent dedicated control output active indication and dual isolated outputs suitable for direct interface to motor starter pilot circuits to activate both lift pumps. The high-level alarm signal shall be deactivated upon lowering of wet well level below the high alarm sensor. The pumps will remain on until wet well level drops below a separate pump off sensor. Pump off sensor shall be mounted at a level that is below the normal operating range of the primary controller set point setting.
- F. The contractor shall furnish, install, and wire the float switches as shown on the drawings. Each float shall have molded polyethylene body, internal redundant polyurethane foam flotation, potted switch and cable connections and fine-stranded AWG #18 cable with heavy-duty synthetic rubber jacket in lengths as required to run unspliced to the control panel. The floats shall include internal weight allowing suspended operation without the use of special pipe or suspension mounting systems.
- G. Float switches shall be provided by the control panel supplier. They are to be a catalogued item of the control panel manufacturer. The float bracket shall be made of stainless steel.

2.16 ALARM/DATA MONITORING

- A. A microprocessor-based monitor unit shall be provided for monitoring and control of the lift station based on alarm contact closures, universal voltage input signals, 4-20mA signals and relay outputs.
- B. The microprocessor-based monitor shall be a standard, catalogued product of a water and wastewater equipment manufacturer regularly engaged in the design and manufacture of such equipment. The pump/alarm monitor shall be specifically designed for wastewater pumping automation utilizing standard hardware and software. "One of a kind" systems using custom software with a generic programmable controller or pieces from many manufacturers that are "integrated" together will not be acceptable. The controller shall be Crystal Ball™ as mfg. by Omni-site, Inc. or Owner approved equal.
- C. The controller shall accept (14) universal DI configurable to monitor dry contacts or any voltage range between 12VDC/VAC to 120 VAC/VDC or to act as pulse counters; (4) 4-20 mA isolated analog inputs, (4) 20 amp relay outputs, (1) rain gauge input, and (1) crew on-site intelligent key reader input in its base form, and the ability to monitor up to two IP enabled infrared cameras. It shall have Phoenix type removable terminal blocks. One additional expansion I/O module can be added providing an additional (10) universal DI voltage inputs, and (4) 4-20mA inputs.
- D. Gel Cell Battery: On-board 12VDC, 800mAH gel cell battery provides backup for up to 24 hours in the event of power loss. Battery is automatically recharged using temperature compensated floating battery charging Circuit.
- E. The controller shall monitor and transmit the following points:
 - 1. Power Fail
 - 2. High Wet well Level
 - 3. Bypass Pump Run
 - 4. Bypass pump Fail
 - 5. Pump 1 Seal Fail
 - 6. Pump 2 Seal Fail

7. Pump 1 Run
8. Pump 2 Run
9. Pump 1 Thermal Fault
10. Pump 2 Thermal Fault
11. Pump 1 Elapsed Time
12. Pump 2 Elapsed Time
13. Float Backup Mode
14. Pump 1 Amp Draw
15. Pump 2 Amp Draw Level
16. Pump Station Flow
17. Level Device Fail
18. One (1) year cellular service thru Omni-site/Verizon shall be included with each unit.

2.17 ADDITIONAL ELECTRICAL MATERIALS

- A. Grounding for chain link fence shall consist of 3/4 inch diameter by 10 feet long copper clad steel ground rods connected to each corner post with minimum No.6 copper bonding jumpers, also used to tie each mesh fence section to its adjacent post and horizontal bottom and top support pole section. Each of the gates mesh fence sections shall be tied to its respective horizontal and vertical support poles. The hinged side vertical support pole of each gate section shall be tied to its adjacent fence post with a flexible No.6 copper bonding jumper. The fence grounding system shall be bonded to the electrical service ground triangle.
- B. The ground triangle for service entrances and all equipment shall be constructed of three 3/4 inch diameter x 10 feet long copper clad steel ground rods bonded together with a minimum No.6 bare copper conductor, (typical for 100 amp service, larger services require larger grounding/bonding conductors) attached to each ground rod with utility company approved ground clamps or exothermic weld. Resistance to ground shall be 10 ohms or less.
- C. Electrical conductors shall be solid or stranded copper, rated for 600 vac, with type THHN-THWN or XHHW insulation.
- D. Instrumentation cable shall be two conductor No. 16 awg twisted pair, stranded copper conductors with PVC insulation, aluminum polyester or aluminum mylar tape shield, or braided copper shield, tinned copper drain wire, black PVC overall jacket, 300 v working class.
- E. The lift station pumps power and wet well level device and float switches control junction boxes shall be aluminum or non-metallic, NEMA 4X, single door enclosures, capable of being padlocked. The pumps power junction box shall have an aluminum isolation divider providing a section of the junction box for control and low voltage sensor control wiring.

2.18 SITE REQUIREMENTS

- A. Concrete Pad: Contractor shall install a concrete pad around the wet well and valve vault as shown in the most recent AQUA standard detail.
- B. Fence: Contractor shall install a chain-link fence around the lift station site with a vehicle-access gate as manufactured by Merchants Metals, www.merchantsmetals.com or Owner approved equal.

1. Steel chain link fabric: 6-feet high. Class 2b fused and adhered, 2" or tighter, 9-gauge core, green, knuckle/twist selvage.
2. Round steel pipe fence framework: Round steel pipe and rail: Cold-rolled electric-resistance welded pipe in accordance with ASTM F1043 Materials Design Group IC (LG-40), minimum steel yield strength 50,000 psi. Type B external coating, hot dip galvanized zinc 0.9 oz/ ft² with a clear polymeric overcoat, Type D interior 90% zinc-rich coating having a minimum thickness of 0.30 mils).
 - a. Line post: 1.900" min. – 2.375" max. LG-40
 - b. End, Corner, Pull post: 2.875" min., LG-40
 - c. Top, brace, bottom and intermediate rails, 1.660 in. OD: LG-20 or heavier.
3. Tension Wire: COLORBOND® Polymer Coated Steel Tension Wire: 7-gauge core (0.177 in.) wire complying with ASTM F1664. Match color to that of the chain link fabric. Class 2b, fused and adhered.
4. Fittings
 - a. Tension and Brace Bands: Galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge (0.105 in.), minimum width of 3/4 in. and minimum zinc coating of 1.20 oz/ft² . Secure bands with 5/16 in. galvanized steel carriage bolts.
 - b. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves: In compliance to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz/ft².
 - c. Tension Bars: In compliance with ASTM F626. Galvanized steel one-piece length 2 in. less than the fabric height. Minimum zinc coating 1.2 oz. /ft . Bars for 2 in. and 1 3/4 in. mesh shall have a minimum cross section of 3/16 in. by 3/4 in.
5. Tie Wire and Hog Ring: Polymer coated COLORBOND®, match the coating, class and color to that of the chain link fabric.
6. Swing Gates: Galvanized steel pipe welded fabrication in compliance with ASTM F900. Gate frame members 1.900 in. OD LG-20 or heavier. Frame members spaced no greater than 8 ft. apart vertically and horizontally. Welded joints protected by applying zinc-rich paint in accordance with ASTM Practice A780. DAC Strong Arm gate latch, pressed steel galvanized after fabrication. Galvanized malleable iron or heavy gauge pressed steel post and frame hinges. Gate fabric is to match that of the described fence system. Gate Post, both hinge and latch, are to be no less than 2.375 in. in diameter for gate widths up to and not exceeding 48" in width. Hinge post for single gates wider than 4' and not exceeding 5' in width are to be no less than 4in. in diameter. All post weight is to be no less than LG-40. COLORBOND® Polymer coated gate frames and gateposts; match the coating type and color to that specified for the fence framework.
7. Concrete: Concrete for post footings shall be wet mixed and poured. No less than a 4,500 psi mix is to be used on all posts.

PART 3 - EXECUTION OF THE WORK**3.1 GENERAL**

- A. Refer to AQUA Standard Specifications for Sanitary Sewer for applicable requirements regarding site preparation, sewer and water separation requirements, trench excavation and maintenance, bedding and backfill, pipe laying and site cleanup and restoration.
- B. Install lift station, alarms and controls in accordance with manufacturer's instructions and applicable standards. Equipment and wiring shall be installed in a neat, workman- like manner by skilled workers. Conduits shall be rigidly supported.
- C. All wires shall be labeled.

3.2 ELECTRICAL WORK

- A. Perform all electrical work as required for the installation of all electrical and process equipment as indicated in these specifications.
- B. All electrical work shall be performed in a neat and workman like manner in accordance with the provisions of The National Electrical Code (NEC), the guidelines of The National Electrical Safety Code (NESC), and the installation standards of The National Electrical Contractors Association (NECA), and applicable local codes.
- C. All conduit above ground shall be Aluminum Electric Metallic Tubing (EMT) or heavy wall PVC conduit. All conduit below ground shall be PVC coated Rigid Galvanized Steel (RGS). Minimum conduit diameter shall be 1/2 inch.
- D. Junction Boxes
 - 1. Separate junction boxes shall be provided for pumps power/sensor cables and for wet well level device and float switch control cables.
 - 2. The lift station control enclosure shall be protected by explosion proof epoxy conduit seal off fittings located in the conduits from the pumps power/sensor junction box and from the controls junction box to the lift station control panel enclosure, to prevent the atmosphere of the wet well from gaining access to the lift station control panel. This allows for the disconnection and removal of any of the pumps, the wet well level device or any of the float switches without disturbing the seal. The conduits from the pumps power/sensor cable junction box and from the wet well level device and float switches junction box to the wet well shall be sealed with OZ-Gedney type CSBG conduit seal fittings.
 - 3. Pump power/sensor cable in conduit shall be installed from the wet well to the pumps power/sensor cables junction box for each pump. Pump power conductors shall be installed in conduit from the power/sensor cables junction box to the lift station control enclosure for each pump. Pump sensor conductors shall be installed in conduit from the power/sensor cables junction box to the lift station control enclosure for each pump. Conduits shall be a minimum of 4-inch for power lines to the pumps. All conductor to cable terminations in the pumps power/sensor junction box shall be made with waterproof connections.
 - 4. Wet well level device cable in conduit shall be installed from the wet well to the controls junction box. Wet well level device conductors shall be installed in conduit with epoxy conduit seals from the controls junction box to the lift station control enclosure. Float switch cables (4) shall be installed in conduit from the wet well to the controls junction box. Float switch conductors shall be installed in conduit with epoxy conduit seals from the controls junction box to the lift station control enclosure. All conductor to cable

terminations in the controls junction box shall be made with waterproof connections. Additional float switch cables from the wet well to the controls junction box may be installed in the same conduit as the wet well level device cable.

5. Individual conduit with sump pump power conductors and an individual conduit with manufacturer's flow transmitter interconnecting cable shall be installed from the lift station control enclosure to the valve and flow meter vault as needed. These conduits shall be equipped with explosion proof conduit seal-off fittings prior to entering the lift station control enclosure.
6. All explosion proof conduit seal-off fittings shall be properly sealed to exclude the wet well atmosphere from the interior of the lift station control enclosure.

E. Manual Transfer Switch

1. The conduit between the manual transfer switch and the lift station control enclosure shall be Aluminum Electric Metallic Tubing (EMT) conduit.

F. Main Disconnect Switch

1. The lift station main fused disconnect shall be a heavy duty fused switch in a NEMA 4X enclosure.

G. Install the lift station control enclosure on a control panel rack per detail.

3.3 PUMPS

- A. Set pump discharge elbows level and plumb for proper pump operation. Install guide rails plumb to prevent binding of pump upon removal.
- B. Install piping plumb and level. Support valves and piping in wet well and valve vault as indicated in the standard details.

3.4 FENCE

- A. Install fence per manufacturer's instructions.

3.5 LIFT STATION TESTING

- A. The force main and all gravity sanitary sewers constructed as part of the project shall have passed all required tests prior to the startup and final acceptance of the lift station.
- B. Wet Well Leakage Testing All wet wells shall be watertight and free from leakage. The wet well shall be visually inspected for leakage by the Owner after assembly and backfilling. All dewatering activities shall be ceased a minimum of eight (8) hours prior to the leak testing. If the wet well shows signs of leakage, it shall be repaired to the satisfaction of the Owner and re-inspected.
- C. All equipment testing shall be observed by the Owner during the lift station's final inspection. Partial testing will not be accepted. The testing must be done on the complete lift station. It is not the Owner's responsibility to engage in ANY activity or supply ANY equipment to test and/or accept the lift station. The Contractor shall provide the clean water to run the pumps and perform all tests. The startup and final inspection shall be as follows:
 1. The waiting period shall be after BOTH of the following:
 - a. AFTER the force main, gravity sewers and manholes constructed as part of the project have passed all required tests
 - b. After ALL equipment has been installed, been determined to be in working order by the Contractor and manufacturer and been previously tested by the manufacturer.

2. Equipment: The Contractor or manufacturer shall provide all necessary equipment to safely complete all the tasks necessary to test and accept the lift station.
3. Testing Procedures: A lift station checklist provided by the Owner shall be completed during the start-up and final inspection. The test shall verify all equipment performs in accordance with the design and the requirements of this Specification. Procedures for each component shall be determined by the Owner at the time of startup. At a minimum, the following shall be tested:
 - a. Pumping rate for all pumps in gpm;
 - b. Communications equipment;
 - c. Controller;
 - d. All electronic equipment;
 - e. All mechanical equipment;
 - f. All instrumentation and control equipment;
 - g. Incoming power;
 - h. The overall operating condition of the lift station; and
 - i. Any other test the Owner deems necessary.
4. Calibration: All measuring equipment supplied for the lift station shall be calibrated prior to acceptance. Calibration test results shall be made available upon request. The measuring equipment shall include at a minimum the following:
 - a. Level Devices;
 - b. Flow Meters;
 - c. Gauges; and
 - d. Other equipment as deemed necessary by the Owner.
5. Determination of Lift Station Acceptance If the station performs to the satisfaction of the Owner, as designed, and per the requirements of this Specification, the lift station shall have passed the test.
6. Determination of Lift Station Failure If the station does not perform to the satisfaction of the Owner, as designed, and per the requirements of this Specification, the lift station shall have failed the test. The Contractor shall be required to correct all deficiencies and retest.

3.6 PUMP WARRANTY

- A. Pump warranty shall be provided by the pump manufacturer and shall warrant the units against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in printed form and apply to all similar units. A copy of the warranty statement shall be submitted with the approved shop drawings.

3.7 LIFT STATION WARRANTY

- A. Warranties for lift station and all equipment, except for the pumps, shall be three (3) years from the date of acceptance.

3.8 POST CONSTRUCTION

- A. Refer to AQUA Standard Specifications for Sanitary Sewer Construction Part 1 Paragraph 1.8 for close-out requirements, in addition to the following:
 1. Record drawings to include field location and elevation of all above ground improvements, including but not limited to wet well, valve vault and meter vault rims,

driveway and parking area, concrete slabs, buildings and enclosures, fencing and other above ground improvements.

2. Record drawings to include actual float switch elevations.
3. Record drawings to include wet well, valve and meter vault inside diameters and bottom elevations.
4. Testing to include testing pumps, controls and alarms in accordance with manufacturer instructions, to include one full pump cycle of each pump and each alarm as a minimum.
5. Spare parts as recommended by manufacturer(s).

END