Section 10

Submersible Wastewater Pumping Station

Section 10

Submersible Wastewater Pumping Station

10.01 General

A. The station shall be complete with pumps, motors, piping, valves, and electrical work, including motor controls, structure, connections and all other needed appurtenances. The station shall be tested and ready for service prior to the sign off or acceptance by IRCDUS. Refer to Section 14.02 for general design requirements.

B. These specifications are intended to give a general description of what is required, but do not cover all details, which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, shop testing, delivery and complete installation and field testing of all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in these specifications or not.

C. For all units, there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries, whether specifically mentioned in these specifications or not, and as required for an installation incorporating the highest standard for the type of service, including field testing of the entire installation and instructing the IRCDUS's regular operating personnel in the care, operation, and maintenance of all equipment. All Operation and Maintenance Manuals, along with warranty information shall be supplied to IRCDUS.

D. A terminal manhole shall be constructed within 20' upstream of a lift station. There shall be only one pipe connection from this manhole to the lift station. The pipe between the lift station and manhole shall be C-900, DR-18 PVC pipe.

E. Paint outside walls, underside of wetwell top slab and valve vault with two coats of water base epoxy.

10.02 Description of Systems

A. The pump station shall be comprised of a concrete wet well, concrete valve vault, Remote Telemetry Unit (RTU), at least two submersible wastewater pumps and controls, discharge piping and all appurtenances as specified herein or needed. The pump station will pump raw, unscreened, domestic wastewater into a force main.

10.03 Qualification

A. To assure unity of responsibility, the motors and control system shall be furnished and coordinated by the pump manufacturer. The Engineer of Record shall assume responsibility for the satisfactory installation and operation of the entire pumping system, including pumps, motors, and controls as specified.

B. The pumps covered by these specifications are intended to be standard pumping equipment of proven ability as manufactured by a reputable manufacturer having extensive experience in the production of such pumps. The pumps furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards.

C. The control system shall have an established record of successful performance for similar service and be approved by IRCDUS.

D. All equipment furnished under this specification shall be new, and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of five years.

E. The pumps shall be furnished complete with controls and accessories required, and shall be as on the Approved Manufacturers' Products List. Grinder pumps shall be permitted for pumps 5.0 HP or less, unless otherwise approved by IRCDUS. Three phase electrical power will be required for all pumping stations. 120/240 volt service will be required for pump stations up to 20 HP. 277/480 volt service will be required for pump stations larger than 20 HP.

10.04 Operating Instructions

A. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for the installation and shall include all required cut sheets, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

B. An authorized representative of all major component parts of the lift station, with complete knowledge of proper operation and maintenance, shall be present on start-up of the lift station to instruct IRCDUS personnel on proper operation and maintenance of the station, and to provide operation manuals. If there are difficulties in operation of the equipment due to the manufacturers design or fabrication, the authorized representative shall be responsible for all corrective action to the satisfaction of IRCDUS. This service shall be provided at no cost to IRCDUS.

10.05 Tools and Spare Parts

A. Any special tools required shall be provided.

B. The manufacturer shall furnish a complete set of recommended spare parts necessary for the first three years of operation of the pumping system, which shall include at least the following:

1. 1 set of upper bearings for the pumps
2. 1 set of lower bearings for the pumps
3. 1 set of upper and lower shaft seals for the pumps
4. 1 relay and phase monitor for each type supplied with the pump control panel for each station
5. Grinder Pump Station (2 Complete Sets) Impeller and Bottom Plate is one set.
6. Solids Handling Pumps (2 Impellers)
7. 1 –TCU001 Programmed to the corresponding Frequency
8. Impeller puller.

C. Spare parts shall be properly bound and labeled for easy identification without opening the packaging, and suitably protected for long-term storage.

10.06 Warranty

A. The Contractor and the equipment manufacturers shall warrant all equipment supplied under this section for a period of five years. Warranty period shall commence on final date when IRCDUS accepts the project.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to IRCDUS.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to the provision shall be allowed.

10.07 Materials and Equipment

A. The pumping units required under this section shall be complete, including pumps and motors with proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness, and to be especially adapted for the work to be done. Ample room shall be provided for inspection, repairs, and adjustments.

B. Each foundation plate for each pump shall be rigidly and accurately anchored into position. The same pump manufacturer shall furnish all necessary foundation bolts, plates, nuts, and washers for installation by the Contractor. Each foundation plate shall be ½" thick Type 316 stainless steel. Foundation bolts, nuts, washers, and spare parts shall be Type 316 stainless steel.

C. Stainless steel nameplates giving the name of the manufacturer, head, speed, and all other pertinent data shall be attached to each pump and motor.

10.08 Pumps

A. General

1. The pumps shall be totally submersible centrifugal pumps with close-coupled motors designed to pump sewage. The design shall be such that the pumping units shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose, or need for personnel to enter the wet well. Each pump shall be fitted with a 316 stainless steel lifting cable of adequate strength, and shall be five (5) feet longer than wet well depth to control panel to permit raising the pump for inspection and removal.

2. The impeller shall be constructed of nodular iron SP (spheroidal graphite). The hydraulic design shall incorporate a single vane centrifugal impeller. The design shall permit low liquid velocities and gradual acceleration and change of flow direction of the pumped media. The impeller/casing design shall result in a passage free of surfaces to which solid or fibrous materials can adhere. The overall pump design shall combine high efficiency, low required Net Positive Suction Head (NPSH), large ball passage and the ability to handle high solids concentrations efficiently. All other parts shall be of close grain gray iron construction, with all parts coming into contact with sewage protected by a coat of rubber-asphalt paint. All external bolts and nuts shall be of Type 316

stainless steel. The impeller shall be of a centrifugal type, capable of passing 3-inch minimum diameter solids, fibrous material, and heavy sludge. If riser pipes are less than 3 inches in diameter in the wet well, then the pumps must be grinder pumps.

3. Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten-carbide or silicon carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. The pumped liquid shall be sealed from the oil reservoir by one face seal and sealed from the oil reservoir from the motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces, shall not be considered equal to tandem seal specified and required.

4. A sliding guide bracket shall be an integral part of the pumping unit, and the pump casing shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wet well with stainless steel anchor bolts and so designed as to receive the pump connection without the need of any bolts or nuts. Sealing of the pumping units to the discharge connection shall be accomplished by a simple linear downward motion of the pump, with the entire weight of the pumping unit guided by 316 stainless steel guide rails which will press it tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the sump, and no rotary motion of the pump shall be required for sealing.

5. Pump motors shall be housed in an air-filled, watertight casing. Motors shall be a NEMA Design B with a 1.15 service factor. Insulation shall be moisture-resistant NEMA Class F with a maximum temperature rise of 90 degrees Celsius above ambient temperature (4 degrees Celsius). Motor characteristics are noted on the Drawings. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. Each motor shall incorporate an ambient temperature compensated overheat sensing device and a moisture sending device wired in series. The

protective devices shall be wired into the pump controls in such a way that if either device operates, the pump will shut down. The devices shall be self-resetting. The cable shall be fixed to the pump using a watertight trumpet assembly. The pump shall be capable of running continuously in a totally dry condition under full load, without damage, for extended periods. Before final acceptance, a field running test demonstrating this ability, with four hours of continuous operation (water supplied by the contractor) under the above conditions, shall be performed for all pumps being supplied, if required by the IRCDUS. Pump motor cables shall be suitable for submersible pump applications and shall be properly sealed.

6. Motor windings shall be treated with a mildew preventative.

B. Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine runaway speed of the unit due to backflow through the pump.

C. Performance Requirements, refer to IRCDUS Standards, Pumping Station Data Table on Drawing No. L-8.

10.09 Access and Frame Guides

A. The pumping station shall be furnished with the necessary aluminum access frames, complete with hinged and hasp-equipped covers, stainless steel upper guide rail holder, power cable holder and level sensor cable holder. The frames shall be securely mounted above the pumps. Access covers shall have safety locking handles in open position. Access covers shall be of aluminum-checkered plate with 316 stainless steel hinges and hardware. The access cover and frame shall be as sized on the Drawings.

B. Lower guide rail holders shall be integral with the discharge connection. Guide rails shall be of Schedule 40, 2” Welded 316 stainless steel pipe of the size indicated on the Approved Drawings and of the length required by the pump manufacturer.

C. A safety grate with 316 stainless steel hardware is required for all wet wells and shall be in accordance with IRCDUS Approved Manufacturers’ Products List.

10.10 Pump Control System-Manual System (Non-remote Telemetry Unit)

A. General

1. A pump controller shall be provided for the wastewater pumping station. The controller shall respond to the liquid

level sensor to automatically start and stop pumps to pace pump station influent flow, and shall be approved by IRCDUS.

2. The pump controller shall be the standard system of the manufacturer as modified for this application. The wet well levels to be used in operation are as shown on Detail Drawings L-2A and L-8 of the IRCDUS Standards.

B. Operation Requirements

1. The control panels shall consist of a main circuit breaker and generator breaker with mechanical interlock, an emergency generator receptacle, a motor control breaker (MCB) and magnetic starter for each pump motor, and 20 ampere, 120/240 volt circuit breakers as required. The motor control panel (MCP) shall meet all requirements of service entrance by properly bonding neutral or shall be Underwriters Laboratories service entrance rated. A low and high level alarm and pump shutoff shall be accomplished by float type, liquid level control system, with all components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the “lead” and “lag” pumps after each pumping cycle. A three position alternate switch labeled “hands-off-auto” (H-O-A) shall be provided to manually select which pump shall be the lead pump, when necessary, and also be able to test the alternator to see if it is still operational.

2. A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps, and shall operate on a 24-volt circuit.

3. A non-fused safety switch shall be installed between the meter and panel. This switch shall be in a NEMA 4X, UL rated, stainless steel waterproof enclosure, in accordance with IRCDUS Approved Manufacturers’ Products List. Amperage shall be at least equal to that of the main breaker.

C. Construction

1. The electrical control equipment shall be mounted within a modified NEMA 4X, UL rated, white powder coated stainless steel (316), dead front enclosure. The enclosure shall be equipped with a door and may incorporate a removable back panel on which control components shall

be mounted. Back panel shall be secured to enclosure with collar studs. All lines entering the enclosure shall be protected by conduit seal bushings (supplied by pump manufacturer) at the source and shall be behind the dead front enclosure, entering from the side or bottom only. The seals shall prevent moisture and gas from entering the enclosure. Two cable connectors (shall be in accordance with IRCDUS Approved Manufacturers' Products List) shall be provided to terminate the motor cables in the control panel. The connectors shall be suitable for a 2" conduit with a seal bushing suitable for the motor cables.

2. Components

a. All motor branch circuit breakers, motor starters, and control relays shall be of highest industrial quality, securely fastened to the removable back panels with screws and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component. A non-corrosive material shall be utilized for wire connection locations within the box.

b. A thermal-magnetic air circuit breaker, per Approved Manufacturers' Products List, shall be furnished for the main breaker. The manufacturer shall seal all circuit breakers after calibration to prevent tampering. A Motor Control Breaker (MCB) shall be provided for each motor starter. Each MCB shall be adequately sized to meet the pump motor and station operating conditions.

c. An open frame, across-the-line, NEMA rated, magnetic motor starter, Class 8536, in accordance with IRCDUS Approved Manufacturers' Products List, shall be furnished for each pump motor. Reduced voltage motor starters, Class 8606, per Approved Manufacturers' Products List, are required for all 30 HP and larger motors. All motor starters shall be equipped to provide under-voltage release and overload protection on all three phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. Overload reset push buttons shall be located on the inside of the control compartment door.

d. An emergency generator receptacle (EGR) shall be installed in the side of the control panel and connected to the line side of the generator breaker.

The receptacle shall be in accordance with IRCDUS Approved Manufacturers' Products List.

e. Provide surge protector on utility side of generator transfer switch.

f. A ground fault interrupter (GFI) duplex utility receptacle providing 120 volt, 20 amp, 60 hertz, single phase current shall be mounted on the internal door.

g. The control panel shall include an adjustable time delay relay to prevent both pumps from starting simultaneously. Time delay relays shall be electronic type.

h. A light shall be installed in the panel with a door switch. An overhead flood light shall be installed adjacent to the panel operated by a switch in the panel.

3. Operating Controls and Instruments

a. All operating controls and instruments shall be securely mounted on the control compartment door. All controls and instruments shall be clearly labeled to indicate function.

b. Pump mode selector switches shall be Hand-Off-Auto type to permit override of automatic level control and manual actuation of shutdown of either pump motor. Operation of pumps in manual mode shall bypass all safety shutdown circuits except pump motor overload shutdown. Switches shall be oil-tight, in accordance with IRCDUS Approved Manufacturers' Products List, providing three switch positions, each of which shall be clearly labeled according to function. Separate indicator lamps, which shall operate at 115 volts input, shall be provided mounted above H.O.A. selector switches. Lamps shall be easily replaceable from the front of control compartment door without removing switch modules from their mounted positions.

c. Indicator lamps shall be mounted in oil-tight modules, in accordance with IRCDUS Approved Manufacturers' Products List. Lamp modules shall be equipped to operate at 115-volt input. Lamps shall be easily replaceable from the front of the control compartment door without removing lamp module from its mounted position.

d. A six-digit, non-reset elapsed time meter shall be connected to each motor starter to indicate the total running time of each pump in “hours” and “tenth of hours.” The elapsed time meters shall be in accordance with IRCDUS Approved Manufacturers’ Products List.

e. Provide an amperage meter on the control compartment door.

f. Phase Monitor: An 11-pin 3-phase monitor shall be installed and wired to disconnect control power from the motor starters in the event of loss of power, phase reversal, loss of any phase or phase balance, or low voltage. The phase monitor shall automatically reset following any of those conditions.

10.11 Pump Control System (Remote Telemetry Unit)

A. A Remote Telemetry Unit (RTU) shall be supplied with the pump control system. The RTU shall be capable of acquiring analog and discrete data for transmission to the Central Telemetry Unit (CTU). The RTU shall also be capable of receiving instructions from the CTU for the operation of the pumps.
B. Provide TCU 800 with USB address kit, and TCU 001 address board.
C. Provide solar panel and battery backup.
D. See IRCDUS Approved Manufacturers’ Products List for the separate components.

10.12 Shop Painting

A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.

B. All pumps and motors shall be shop primed with primer compatible with the field painting.

C. All nameplates shall be properly protected during painting.

D. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to IRCDUS up to the time of final acceptance test.

E. Control Panels shall be made of stainless steel (316).

10.13 Field Painting

A. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.

B. All nameplates shall be properly protected during painting.

10.14 Lift Station- General

A. The Lift Station Wet Wells shall conform to the following size:

Depth (ft)	Diameter (ft)
0-10	6
11-15	8
16-20	10
21-25	12

or as approved by IRCDUS's Engineer.

10.15 Lift Station Liners

General

A. A protective liner or coating for the concrete shall be installed in the lift station/wet wells, re-pump lift stations, receiving manholes, drop manholes, and manholes as required by IRCDUS.

B. After the lift station lining/coating operation has been completed, the Contractor in the presence of the IRCDUS's representative shall visually inspect the lift station. In addition, at IRCDUS request, the Contractor shall be required within one year to visually inspect the lift station. The Contractor shall redo any work that has become defective.

HDPE Liners

A. The Lift Station Liner shall be High Density Polyethylene (HDPE) with a minimum thickness of 2 mm. All HDPE liner sheets shall be extruded with a large number of anchoring studs, a minimum of 39 per square foot, manufactured during the extrusion process in one piece with the sheet so there is no welding and no mechanical finishing work to attach the studs to the sheet. The liner shall have a pull out resistance of 112.5 lbs./anchoring stud.

B. Flat liner sheet, non anchored, used for overlapping joints, shall have a minimum thickness of 3mm. All joints shall be sealed by means of thermal welding performed by certified welders.

C. The lining shall have good impact resistance, shall be flexible, and shall have an elongation sufficient to bridge up to a 1/4-inch

settling crack, without damage to the lining. The liner shall be able to bridge any expansion cracks that may occur.

D. Lining shall be repairable at any time during the life of the structure.

E. A certified fabricator shall custom fit the liner to the form work in order to protect the concrete surfaces from sewer gases. The interior surfaces to be protected shall include the walls, ceiling, and pipe entries.

F. For all lined manholes the use of HDPE Grade rings shall be used in lieu of brick or precast grade rings. Grade rings shall meet HS-25 load rating. Butyl sealant shall be used between each ring to make a watertight joint. The first grade ring shall be welded to the liner to provide a gas tight seal.

C. Upon request, the manufacturer shall provide written certification that the liner used meets or exceeds the requirement of this specification.

D. Provide a five-year unlimited warranty on all workmanship and products. The work includes the surface preparation and application of the liner system, shall protect the structure for at least five years from all leaks, and from failure due to corrosion from exposure to corrosive gases such as hydrogen sulfide.

Fiberglass Liners

A. The lift station liner shall meet all requirements of ASTM Specifications D-3753 for glass fiber reinforced polyester manholes or lift stations. See IRCDUS Approved Manufacturers' Products List.

B. Fiberglass liners shall have a three-year warranty period.

Interior Coatings

A. The work shall include the furnishing and installation of an interior protective coating system including all necessary materials, equipment and tools as required for a complete installation. Coating shall be "Green Monster Structural System for Installation on New Structures manufactured by GML Coatings, LLC, or pre-approved equal. The completed system shall provide a waterproof, corrosion resistant liner to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be approved and furnished by, and coordinated with, GML Coatings LLC.

B. Provide a minimum ten (10) year unlimited warranty on all workmanship and products. The work includes the surface preparation and application of the liner system, shall protect the structure from all leaks, and from failure due to corrosion from exposure to corrosive gases such as hydrogen sulfide.

END OF SECTION