February 17, 2020
BOARD OF COUNTY COMMISSIONERS
ORANGE COUNTY, FLORIDA
Y20-732 / ADDENDUM # 3
OAK MEADOWS WATER SUPPLY FACILITY WELL HOUSES

REVISED Bid Opening Date: <u>March 12, 2020</u>

This addendum is hereby incorporated into the bid documents of the project referenced above. The following items are clarifications, corrections, additions, deletions and/or revisions to and shall take precedence over the original documents. <u>Underlining</u> indicates additions, deletions are indicated by ~~strikethrough.~~

A. THE BID OPENING DATE HAS CHANGED FROM ~~FEBRUARY 20, 2020~~ TO <u>MARCH 12, 2020 at 2:00pm.</u>

B. CLARIFICATIONS

1. Q: Are the bar joists in the well houses to be field coated or factory coated?

A: Metal bar joist shall be painted in the field with the metal decking, masonry walls, and miscellaneous metal.

2. Q: Please refer to the Erosion Control Plan and Grading Plan. Due to the bold contour lines across the whole site, is it the County's intent to regrade the entire site? Also, there isn't a Seed & Mulch spec. sect., can the open areas be Seeded and Mulched, or is Solid Sodding required in all disturbed areas?

A: Drawing C11 that shows the entire site is an Erosion Control Plan. The contour lines are existing. Grading areas are shown on each individual grading drawing. Disturbed areas are to be sodded.

3. Q: The meter call out on plan profile page M04 is for a Propeller Flow Meter, fairly normal for raw water or HSP application. Specification page 13300-8 & 9 call for an Ultrasonic Mag Meter. This is unusual for this application. My past experience has been that mag meters require a certain amount of particulate inclusion or a constant small air bubble entrainment. Please provide clarification of the intended requirement.

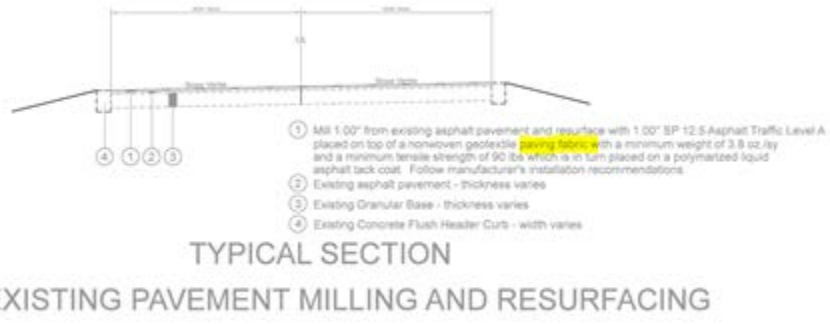
A: Refer to Revised specification 13300, attached and labelled this addendum.

4. Q: In addendum #1, question #12, you list 3 manufacturers of geocells and state they all provide 4" x 4" cells. Attached are specification sheets for all three of those manufacturers. The Standartpark product has 8.8" x 10.2" cells, the Cell-Tek product has 8.8" x 10.2" cells and the Agtec product has 12.6" x 11.3" cells. Our GW20V 4" Geoweb,

manufactured by Presto Geosystems, has cells that are also 8.8" x 10.2". Will this product be acceptable as an alternate? I have included some additional information on the Geoweb for your review.

A: The 4" dimension is the depth not the length and width. All three manufacturers have a 4-inch deep product that is acceptable.

5. Q: Please clarify whether or not a paving fabric is going to be required on this project, as shown in the detail below



That clip is from page C04 in the plans.

A: The paving fabric is required as shown on the detail.

6. Q: The specifications indicate the Turbine Pump installer must be a licensed well driller, is this correct? See 11215 – 4, 1.05, paragraph A.

A: Specification Section 11215, 1.05, A, shall be revised as follows:

The person or persons responsible for carrying out the well pump installation shall be a licensed well drilling contractor or licensed general contractor in the State of Florida with at least 15 years' experience with deep well installation and pump installation.

Revised specification section 11215 is attached and labelled this addendum.

7. Q: The plans indicate one wet tap is required, will any temporary stops be required?

A: If a tapping sleeve and valve is used, temporary stops should not be required.

C. All other terms, conditions, and specifications of the IFB remain unchanged.

D. The Bidder shall acknowledge receipt of this addendum by completing the applicable section in the solicitation or by completion of the acknowledgement information on the addendum. Either form of acknowledgement must be completed and returned not later than the date and time for receipt of the proposal.

Receipt acknowledged by:

_____ _____

Authorized Signature **Date Signed**

_____

Title

_____

Name of Firm

SECTION 13300
PROCESS INSTRUMENTATION AND CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Work includes engineering, furnishing, installing, programming, testing, documenting and placing in operation a modified Process Instrumentation and Control System (PICS) at Orange County, Florida's Oak Meadows Water Supply Facility (WSF). This involves the following major elements:

1. New field instruments as shown on the Process and Instrumentation Diagrams.

2. Modification of the existing Process Control Panel (PCP) to accommodate new field signals associated with the process improvements and network connections with other new control system equipment.

3. Modifications to the System Wide SCADA system HMI and historian to add new well and associated equipment at the Eastern Regional Facility.

4. New Programmable Logic Controller (PLC) based panels at raw water well (Well OM-5).

5. Re-programming the Programmable Logic Controller (PLC) and HMI computer in PCP with a new well and associated process graphic screens.

B. It is the ultimate responsibility of the CONTRACTOR to furnish a complete and fully operable system that reliably performs the specified functions. However, it is the intent of these Contract Documents that a single entity (henceforth referred to as the SYSTEM SUPPLIER) be retained by the CONTRACTOR to have overall responsibility for designing, furnishing, interfacing, adjusting, testing, documenting, and starting-up the equipment described in the Contract Documents.

C. The work defined in this Specification Section shall be performed by the following listed below and henceforth referred to as the SYSTEM SUPPLIER.

1. Curry Controls Company, Lakeland, Florida

2. Revere Control Systems, Lakeland, Florida

3. No equal

D. The CONTRACTOR shall be responsible for:

1. Equipment storage and protection until installed following the storage and handling instructions recommended by the SYSTEM SUPPLIER. Anti-static and winterization requirements shall be per the SYSTEM SUPPLIER's instructions and the SYSTEM SUPPLIER shall periodically verify that these instructions are followed.

2. Including within the electrical subcontractor's scope the provision, installation and termination of field and power wiring to the PCP. Termination shall be

made in accordance with final accepted interconnection diagrams developed by the SYSTEM SUPPLIER. The electrical subcontractor shall mark on the interconnect diagram the field wire numbers used for each termination point. The SYSTEM SUPPLIER shall finalize the interconnect diagrams by including these field wire numbers in the final as built version.

E. All engineering development required by the SYSTEM SUPPLIER will be in accordance with the Conditions of this Contract.

F. Equipment found to be defective prior to system acceptance shall be replaced and installed at no additional cost to the OWNER.

G. In the bid price, the SYSTEM SUPPLIER shall provide for obtaining the services of authorized field personnel from the manufacturers of components or systems provided under this section but not manufactured by the SYSTEM SUPPLIER. Should these personnel be required during installation, start-up and checkout of the PCP, such services shall be provided at no additional cost to the OWNER.

1.02 RELATED WORK

A. Installation of field instruments is performed under Division 15.

B. All conduits, power and field wiring and cables are provided and installed under Division 16.

C. Specification Section 13591, Network Cables. The System Supplier shall be responsible for furnishing and ensuring correct installation and termination of all network cables.

1.03 SUBMITTALS

A. Furnish, as prescribed under the General Requirements, all required submittals covering the items included under this section.

B. Submit complete, neat, orderly, and indexed submittal packages. Handwritten diagrams are not acceptable, and all documentation submittals shall be made using CADD generated utilities.

C. Partial submittals or submittals that do not contain sufficient information for complete review or are unclear will not be reviewed and will be returned by the ENGINEER as not approved.

D. Provide all shop drawing submittals on disk in PDF format.

E. Submit the following Field Instrumentation Shop Drawings in a single package:

1. Catalog information, descriptive literature, wiring diagrams, and shop drawings on all components of the field instruments, including all miscellaneous electrical and mechanical devices furnished under this section.

2. Complete part numbers for all instruments, including any options, shall be identified. Provide manufacturer’s data that correlates to the complete part number.

3. Individual data sheets for all components of the field instruments to supplement the above information by citing all specific features for each specific component (e.g. scale range, materials of construction, special options included, etc.). Each component data sheet shall bear the component name and instrument tag number designation shown in the Drawings and Specifications.

4. Installation details for all field mounted devices to show conformance with the Contract Documents.

5. Configuration documentation for all programmable devices to indicate actual settings used to set the device scale, range, trip points, and other control parameters.

F. Provide a PICS hardware shop drawing submittal containing the following:

1. A system block diagram showing all interconnections between networked equipment.

2. Loop diagrams, consisting of complete wiring and/or plumbing diagrams for each control loop showing all terminal numbers, the location of the dc power supply, the location of any booster relays or common dropping resistors, surge arrestors, etc. The loop diagrams shall meet the minimum requirements of ISA S5.4 plus divide each loop diagram into four areas for identification of element locations: PLC I/O point(s), panel face, back-of-panel, and field, respectively.

3. System interconnect diagram that shows all connections required between component parts of the items covered in this section and between the various other systems specified in this Contract. Number all electrical terminal blocks and field wiring. Identify each line at each termination point with the same number. Do not use this number again for any other purpose in the complete control scheme.

4. Panel Layout Drawings and Bill of Materials: An internal layout of all panels cross-referenced to a list of all components. Group components by type and include component model number and part number, component description, quantity supplied, and reference to component catalog information.

5. Descriptive Information: Catalog information, descriptive literature, performance specifications, internal wiring diagrams, power and grounding requirements, power consumption, and heat dissipation of all elements. Clearly mark all options and features proposed for this project.

6. Installation Details. Equipment installation drawings showing external dimensions, enclosure material and spacing, mounting connections, and installation requirements.

7. A list of, and descriptive literature for, spares, expendables, and test equipment.

G. Submit a PICS programming shop drawing document that meets the following requirements.

1. This submittal shall be Approved or Approved As Noted prior to any PLC programming Work.

2. The programming shop drawing shall provide a flow diagram of each control strategy showing the logical steps.

3. Provide specific definition of all computation formulae required for the strategy,

4. For this submittal, simply repeating the wording contained within this Specification Section will not be acceptable and the submittal will be returned without review.

H. Test Procedures: Submit the procedures proposed to be followed during all system testing. Procedures shall include test descriptions, forms, and check lists to be used to control and document the required tests.

I. Test Reports: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures to the ENGINEER.

1.04 FINAL DOCUMENTATION

A. After the demonstration tests have been completed and as a part of the final acceptance requirements, submit the system record drawings. Record drawings shall include, corrected for any changes that may have been made up through Substantial Completion:

1. Instrument loop wiring diagrams

2. Panel wiring diagrams

3. Panel elevations

4. Interconnection diagrams showing terminal numbers at each wiring termination

B. Record drawings shall be developed or converted to the latest version of AutoCAD. Provide two copies of all AutoCAD files on separate USB Drives.

C. Operating and Maintenance (O&M) Manuals: Provide the specified number of complete sets of three-ring bound O&M manuals in accordance with Division 1. Include descriptive material, drawings, and figures bound in appropriate places. Include:

1. Cross references to any 3rd party O&M manuals.

2. Additional operating and maintenance instructions in sufficient detail to facilitate the operation, removal, installation, adjustment, calibration and maintenance of each component provided.

3. All the submittal data for each component from the approved shop drawing submittals with corrections made on approved as noted items.

4. A USB Drive containing the shop drawing data in computer-searchable PDF format in the binder sleeve.

D. Provide the following additional final documentation:

1. A licensed copy in the Owner’s name for all programming software.
2. A one-year maintenance agreement in the Owner’s name for all programming software.
3. Final copies of all programming files on USB Drive.
4. A complete printout of all “Annotated” PLC program logic.

1.05 QUALITY CONTROL

A. The SYSTEM SUPPLIER shall be subcontracted by and paid by the CONTRACTOR.

B. The SYSTEM SUPPLIER shall meet all of the requirements of these specifications, and, unless specifically stated otherwise, no prior acceptance of any subsystem, equipment, or materials has been made.

C. All equipment furnished by the SYSTEM SUPPLIER shall be of the latest and most recent design and shall have overall accuracy as guaranteed by the manufacturer.

D. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.

E. Component equipment shall be as supplied by one of the manufacturers named or approved equal. The design of the system is based on the first-named manufacturer's equipment if there is a difference.

F. To facilitate the OWNER's operation and maintenance, products shall be of the same major MANUFACTURER, with panel mounted devices of the same type and model as far as possible.

G. In order to ensure the interchangeability of parts and the maintenance of quality, strict compliance with the above requirements shall be maintained.

H. The SYSTEM SUPPLIER shall designate a single point of contact for interface with the ENGINEER on this project. The ENGINEER reserves the sole right to approve or reject this point of contact.

I. The SYSTEM SUPPLIER shall provide experienced personnel on-site to coordinate and/or perform installation, termination, and adjustment; on-site testing; OWNER training; and startup assistance for the system.

1.06 STANDARDS

A. The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable state and local requirements. UL listing and labeling shall be adhered to under this Contract.

B. International Society of Automation (ISA) and National Electrical Manufacturers Association (NEMA) standards shall be used where applicable in the design of the system.

C. Any equipment that does not have a UL, FM CSA, or other approved testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that the equipment famished has been manufactured in accordance with the National Electric Code and OSHA requirements.

D. Any additional work needed resulting from any deviation from codes or local requirements shall be at no additional cost to the OWNER.

1.07 WARRANTY AND GUARANTEES

A. In accordance with Division 1, the SYSTEM SUPPLIER shall furnish to the OWNER a written two-year guarantee commencing with substantial completion, that all equipment and parts thereof, material and/or workmanship are of top quality and free from defects.

B. The SYSTEM SUPPLIER shall guarantee all equipment whether or not of his own manufacture.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Equipment to be installed in a hazardous area shall meet Class, Group, and Division classification as shown on the Contract Electrical Drawings, or comply with the local or National Electrical Code, whichever is the most stringent requirement.

B. All components supplied shall be of the MANUFACTURER's latest design and shall produce or be activated by signals, which are established standards for the water and wastewater industries.

C. Electronic equipment shall utilize printed circuitry suitably coated to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose, to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

D. All equipment shall be designed to operate on a 60-Hertz alternating current power source at a normal 120 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

E. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single MANUFACTURER, insofar as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion through the installation of plug-in circuit cards or additional cabinets.

F. The equipment furnished shall be designed to operate satisfactorily between 0 degrees

C and 40 degrees C at up to 95 percent Relative Humidity (non condensing).

G. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 volts-amperes (VA), unless specifically noted otherwise.

H. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

2.02 FIELD INSTRUMENTATION REQUIREMENTS

A. All instruments requiring plumbing shall utilize 316 stainless steel components as follows:

1. Test Tap: Shall consist of Crawford Fitting Co. Swagelock quick connects Series QC4-DE, no equal.

2. Tubing, Stainless Steel: Shall be ASTM A 312, TP 316, seamless, soft annealed with 0.065-inch wall. Fittings shall be ASTM A 276, TP 316 compression or socket weld type.

3. Valve, Ball: Shall be stainless steel ball valves, Whitey Series 40, Hoke Flamite Series 7100, or equal.

B. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks.

C. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent. Indicator readouts shall be linear in process units.

D. Surge suppressors and arrestors meeting the requirements of ANSI Standard C-62.41 (latest revision) shall be provided on all field instruments as further detailed below.

E. AC Powered Instruments. Lightning and surge protection shall be provided on both the AC power supply and signal lines. The protectors shall meet the following criteria:

1. Response time of less than five nanoseconds.

2. AC Power protection: IEEE/ANSI Std. C-62.41 rated C3 at 330 Volts clamping level.

3. Signal line protection: 10,000 Amp 8 x 20 microsecond surge, clamped at 36 Volts clamping level.

4. Test jacks for low level signal monitoring.

5. Manufacturer/model:

a. EDCO SLAC series.

b. Approved equal.

F. Loop Powered Instruments. Lightning and surge protection shall be provided on the 4-20 mA DC signal line. The protectors shall meet the following criteria:

1. Encapsulated in Stainless Steel Pipe nipples for in-line conduit mounting.

2. Response time of less than one nanosecond.

3. Capable of withstanding up to 400 occurrences of 500 Amps at 10 x 1 millisecond.

4. Series resistance of 5 ohms per line.

5. Protection of both lines plus shield.

6. Manufacturer/model: EDCO SS65 or approved equal.

2.03 FIELD INSTRUMENTS

~~A. Electro-magnetic Flow Metering System (LP-6250). The magnetic flow metering system shall comprise a flow through spool piece with sensing electrodes (Flow Element, FE) and an electronics unit (Flow Indicating Transmitter, FIT). The spool piece shall contain a coil energized by D.C. pulses from the electronics unit. The voltage induced in the process fluid shall be sensed by the electrodes and converted, by the electronics unit, into a derived flow signal.~~

~~1. System Performance:~~

~~a. Systems shall be wet calibrated at the factory using NIST traceable equipment.~~

~~b. Overall system accuracy shall be plus or minus 0.5 percent of rate between 1 and 30 feet per second.~~

~~c. It shall be possible to verify system calibration in the field. Methods which require removal of the spool piece or a second flow measurement (i.e. another meter or known volume) will not be acceptable.~~

~~2. Materials:~~

~~a. Tube – Carbon Steel~~

~~b. Liner – Neoprene rubber for clean water applications. All other applications shall be Teflon.~~

~~c. Flange – 316 Stainless Steel ANSI 150#~~

~~d. Electrodes – 316 Stainless Steel.~~

~~3. Ratings:~~

~~a. Vault located spool piece – Rated for continual submergence to 10 feet. This shall include potting of the able between the spool piece and electronics unit.~~

~~b. Other spool pieces – NEMA 4X.~~

~~c. Electronics Unit – NEMA 4X~~

~~4. Electrical:~~

~~a. Power Requirement - 120 VAC plus or minimum 10 percent, 60 Hertz.~~

~~b. Maximum Power Consumption – 20 Watts.~~

~~5. Functional:~~

~~a. Programmable low flow cut-out~~

~~b. Empty pipe detection~~

~~c. Electronic unit display: minimum of 2 x 16 character, backlit LCD.~~

~~6. Options~~

~~a. Provide grounding rings and/or integral grounding electrodes as required to establish potential matching.~~

~~b. Provide ultrasonic cleaning where necessary for coating sensitive systems~~

~~c. Provide special tools and software necessary to effect field calibration~~

~~d. Provide certificate of factory calibration~~

~~7. Manufacturer, Model series:~~

~~a. Siemens SiTran Mag3100 flow tub and FM Mag 6000 Transmitter~~

~~b. Endress + Hauser ProMag 400 magnetic flow tub, remote transmitter, and Heartbeat Monitoring and Verification~~

~~c. Approved Equal~~

A. **Propeller Flow Meter. The propeller flow metering system shall comprise an inline flow element (FE) with integral Flow Indicating Transmitter (FIT). Fluid causes a rotating propeller in the flow element to turn in proportion to the flow**

rate. This rotation is sensed via a magnetic coupling and converted to flow rate by the transmitter.

1. **System Performance:**
   - **d. Accuracy - Plus or minus 2 percent of rate between 1 and 30 feet per second.**
   - **e. Repeatability: Plus or minus 0.25 percent.**

2. **Materials:**
   - **a. Body – Carbon steel.**
   - **b. Flange – ANSI #300 Carbon steel.**
   - **c. Impeller: Corrosion resistant polymer.**
   - **d. Exterior Surface - Epoxy coated.**

3. **Ratings:**
   - **a. NEMA 4X plus rated for continual submergence to 10 feet.**

4. **Electrical:**
   - **a. Power Requirement - 120 VAC plus or minimum 10 percent, 60 Hertz.**
   - **b. Maximum Power Consumption - 1 watt per 5 mm (diameter).**

5. **Manufacturers:**
   - **a. Water Specialties Model ML-04 with digital flow rate/totalizer transmitter (FC101) that has 4-20mA output capabilities.**
   - **b. Sensus Model 101/102 with digital flow rate/totalizer transmitter (ROFI) that has 4-20mA output capabilities using ACT-PAK from Sensus.**
   - **c. Sparling FM104 with digital flow rate/totalizer transmitter FT194.**

B. Ultrasonic Level Element and Transmitter. The system shall consist of a sensor (Level Element, LE) that uses a non-contact ultrasonic measurement technique to measure the liquid level in a vessel, tank or basin, interconnecting cable, and electronics unit that produces an analog signal proportional to level (Level Indicating Transmitter, LIT) or, in the case of weir applications, flow (Flow Indicating Transmitter, FIT.)

1. System Performance
   a. Overall system accuracy shall be plus or minus 0.25 percent of span or 0.1 inches, whichever is greater, automatically compensated for temperature.
   b. The electronics unit shall contain preset algorithms containing the necessary factors to convert a weir level into a flow value.

c. The system shall be field calibrated without the use of external calibrators.

2. Sensor Materials:

a. Chemical and Sludge tank locations – All Teflon.
b. Other locations – PVC and Teflon.

3. Ratings:

a. Electronics Unit – NEMA 4X remote mount sunshield.

b. Output: 4-20mA with surge suppression.

4. Functional:

a. Span, output, linearization and digital output scaling shall be adjustable at the transmitter.

b. Echo status and loss indication shall be provided at the transmitter.

c. Electronic unit display: 16-character, backlit LCD.

5. Manufacturer, Model series:

a. Siemens Hydroranger 200 and Echomax sensors
b. Endress + Hauser, Prosonic
c. or Approved Equal

C. Pressure Switch. The pressure switch shall sense pressure variations by means of a diaphragm and operate a snap action switch when the pressure reaches an adjustable level. Pressure switches shall be equipped with diaphragm seals where shown on the drawings.

1. Performance:

a. Adjustable deadband between 5% and 50% of maximum range.
b. Automatic reset.
c. Dual SPDT contacts.
d. Setpoint and deadband adjustments visible from outside the enclosure.

2. Materials:

a. Pressure Chamber Wetted parts – 316 Stainless Steel.
b. Diaphragm and O-ring – Buna-N.
c. Housing – Low copper aluminum with polyurethane paint.

3. Ratings:

a. NEMA 4X.
b. Electrical:
c. Contacts rated 15 Amps at 120 V AC.

4. Manufacturer, Model series:

a. Mercoid, SA 1100 series.
b. Approved equal.

D. Limit Switch. The limit switch shall detect the closed position of a hatch, door, etc.

by means of an actuator. The actuator shall energize the switch while the door is closed.

1. General:

    a. Actuator orientation: As required for application
    b. Actuator mechanism: Adjustable lever roller.
    c. Switch shall not be mounted on the moving portion of the door or hatch.

2. Materials:

    a. Normal applications: Phosphate coated zinc with Epoxy coating.
    b. Corrosive locations: All 316 Stainless Steel including actuating lever.

3. Ratings:

    a. NEMA 4X for normal applications.
    b. NEMA 6 where potential submergence exists.
    c. Use explosion proof switches with factory installed cable for all Class I rated locations.

4. Electrical:

    a. Normally open and normally closed dry contacts
    b. Dry contact rated to 10 Amps at 120 VAC

5. Options

    a. Provide stainless steel supports/mounting and strike plates as required.

6. Manufacturer, model:

    a. Honeywell, model HDLS or LSX as applicable
    b. Approved equal.

E. Pressure Transducers - The pressure transducer shall sense variations in pressure and produce a standard current output signal linear with gage pressure (Pressure Indicating Transmitter, PIT), differential pressure (Differential Pressure Indicating Transmitter, DPIT), flow via square root extraction of differential (Flow Indicating Transmitter, FIT) or, via inference, level (Level Indicating Transmitter, LIT). The transducer shall use a diaphragm activated cell method to monitor process pressure via impulse piping connected through a valve manifold and, where noted, diaphragm seals

1. Performance:

    a. Total accuracy of less than or equal to 0.2% of span for +/- 50 degree temperature changes from 1:1 to 10:1 range down.

    b. Adjustable zero and span values anywhere within the nominal range.

    c. Differential transducers shall provide direct reading or integral square-root extraction.

2. Materials:
    a. Metallic Wetted parts – 316 Stainless Steel.
    b. Wetted O-rings – Glass filled TFE.
    c. Fill liquid - NSF approved for use in drinking water applications.
    d. Electronics Housing – Low copper aluminum with polyurethane paint.
    e. Mounting hardware – 316 Stainless Steel.

3. Ratings:
    a. Enclosure – NEMA 4X
4. Electrical:
    a. Transmitter excitation: 10.5 to 32 Volts DC at up to 18 mA.
5. Options:
    a. Provide surge/lightning protection within the transmitter.
    b. Provide 3-way SS valve manifold.
    c. Provide integral LCD indicator with displayed value in process units.
    d. Provide minimum half inch process connection.

6. Manufacturer, Model series
    a. Rosemount, 3051 Series
    b. No equal.

F. Pressure Gauges

1. Pressure gauges shall be installed on each pump station discharge pipe as indicated on the Drawings.

2. Pressure gauge shall be direct mounted, diaphragm (type) gauge, stainless steel case, stainless steel sensing element, liquid filled, with a 4-1/2-inch diameter dial and furnished with a clear glass crystal window and 1/4-inch shut-off (isolation) valve. Gauges shall be weatherproof.

3. The pressure gauge face dial shall be white finished aluminum with jet-black graduations and figures and shall indicate the units of pressure measured in psi. Gauges shall be provided with pressure at normal operation at the mid-range of the gauge.

4. As wastewater flows through the housing, the cylinder shall transmit pressure through the sensing liquid. Gauge outlet in the spool or ring shall be threaded, 1/4-inch, per ANSI B2.1.

5. Nipples for connecting gauges to piping shall be Schedule 80S, Grade TP 316 seamless stainless steel, conforming to ASTM A 312. Fittings shall conform to ASTM A 403, Class WP316. Threads shall conform to ANSI B2.1. Size of pipe nipple shall match the gauge connection size.

G. Flow Switches

The flow switch shall use thermal dispersion and be capable of monitoring low flow rates in viscous fluids. The sensor head employs two temperature sensors with a constant low power heating source attached to one. The other temperature sensor compensates for process temperature changes. The difference in temperature between the two sensors varies with flow. Alternate flow switches to those specified that employ physical deflection to detect flow will not be acceptable except for clean water applications.

1. Performance:
    a. Operating Temperature – 0 to 65 degrees Celsius.
    b. Operating pressure – Up to 500 psig.
    c. Response time – less than 5 seconds.
    d. Adjustable setpoint down to 0.01 feet/second in liquid and 0.1 feet/second in air.
2. Materials:
    a. Sensor Head – 316L stainless steel.
3. Ratings:
    a. Electrical Class – UL approved explosion proof.
    b. Electronic enclosure – NEMA 4X
4. Electrical:
    a. Power Requirement – 120 VAC plus or minimum 10 percent, 60 Hertz.

b. Maximum Power Consumption – 5 Watts

c. Output – DPDT relay contact rated 10 Amps resistive at 120 VAC.

5. Manufacture, Model:

a. Magnetrol, model TSF.

b. Ameritrol, model FX.

c. Approved equal.

2.04 CONTROL PANELS

A. General:

1. All conduit entry shall be from the top and/or bottom only.

2. The panel shall be provided with an isolated copper grounding bus to ground all signal shield connections.

3. The panel shall be a ventilated NEMA 4X, Type 316 stainless steel enclosure with 30% spare mounting space for future, additional equipment. The enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel

4. The panel shall be equipped with an internal, hand-switch controlled, 40-watt fluorescent light and 120V, 15 amp, duplex utility receptacle. These shall be serviced through a dedicated breaker.

5. The panel shall be protected from internal corrosion by the use of corrosion – inhibiting vapor capsules. Provide:

a. Northern Instruments Model Zerust VC-6-2
b. Hoffman, model A-HC15E
c. Approved equal.

B. DC signal surge protection. Lightning and surge protection shall be provided on all 4-20 mA signal wires and discrete signal wires entering or leaving a Control Panel. The protectors shall meet the following criteria:

1. 35 mm DIN rail mounted.

2. Response time of less than five nanoseconds.

3. Automatic reset.

4. Operating signal voltage: As required by the signal level.

5. Capable of withstanding 1,200 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.

6. Capable of withstanding 100 Amps at IEEE/ANSI C-62.41 10 x 1 milliseconds long wave.

7. Nominal series resistance of 5 ohms each leg

8. Manufacturer/model: MTL Series SD**X, no equal.

C. Single phase AC Power (to 15Amps) surge protection. Lightning and surge protectors for AC power supply lines up to 15 Amps service shall meet the following criteria:

1. Serial protection with replaceable fuse.
2. Failure indicator
3. Response time of less than five nanoseconds.
4. Capable of withstanding up to 10,000 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.
5. Manufacturer/model: MTL Series MA15, no equal.

D. Finish:

1. All front panel openings for panel-mounted equipment shall be cut with counter-boring and provided with trim strips as required to give a neat finished appearance.
2. All non-stainless-steel panel surfaces shall be treated with phosphatized treatment inside and out, and then finished on the exterior with two coats of baked enamel of the approved color. Interiors of panels shall be white, ANSI No. 51.

E. Doors:

1. All control panels shall have a continuous piano hinge door for ease of access. A minimum of 80% of the panel interior shall be exposed by doors.
2. The inside of each door shall be equipped with a print pocket.
3. Two-door enclosures shall have a removable center post.

F. Nameplates:

1. All front-face panel mounted controls shall be equipped with screw mounted laminated plastic nameplates to completely define their use.
2. All internal components shall be equipped with identification tags

G. Power Supplies.

1. An Uninterruptible Power Supply (UPS) shall be provided as follows:
   a. Size the UPS for all internal equipment.
   b. Provide 15 minutes battery back-up capability at full load.
   c. Provide Invensys Powerware Ferrups or approved equal.

H. Electrical:

1. Main circuit breaker and branch circuit breaker for each branch circuit as required to distribute power from the main power feed.
2. All breakers accessible when the panel door is open.

3. No more than 20 devices on any single circuit.

4. No more than 12 amps for any branch circuit.

5. Panel (or site) lighting, receptacles, heaters, controls, telemetry and fans on separate branch circuits.

I. Wiring:

1. Power wiring shall be 300-volt, type THWN stranded copper, No. 14 AWG size, for 120V service.

2. Discrete wiring shall be 300-volt type THWN stranded copper, sized for the current carried, but not smaller than No. 16 AWG.

3. Analog signal wiring shall be 300-volt, stranded copper in twisted shield pairs, no smaller than No. 16 AWG.

4. Panel wiring shall be routed within wire troughs or panduits.

5. Hinge wiring shall be secured at each end with the bend portion protected by a plastic sleeve.

6. Analog or dc wiring shall be separated from any ac power or control wiring by at least six inches.

7. Each wire shall be uniquely identified at all terminations using machine printed plastic sleeves

J. Construction:

1. Minimum metal thickness: 14-gauge.

2. Stiffeners as required to prevent deflection under instrument loading and permit lifting without racking or distortion.

3. When required, removable lifting rings and fill plugs to replace rings after installation.

4. All components and terminals shall be accessible without removing other components except for covers.

5. The panel shall be a manufactured item, Hoffman Engineering, or equal.

2.05 PANEL DEVICES

A. All panel devices provided shall be as listed in Orange County Utilities Standards list of approved products.

2.06 PROCESS CONTROL PANEL NO. 1 (PCP-1) MODIFICATIONS.

A. The existing PCP shall be modified as generally summarized below, as shown on the drawings and further detailed below:

1. Implement a revised network between the wells and PCP. The new network topology shall be Ethernet using Modbus TCP/IP protocol.

2. Revise the I/O to delete signals which will no longer be connected to the PCP.

3. Revise the I/O to accommodate new signals associated with new and replaced equipment.

4. Provide new I/O to accommodate new signals associated with new equipment.

5. RVSS Monitoring (Network I/O):

   a. In addition to the hard wired I/O shown on drawings, each RVSS that is connected to the PICS shall be configured in the PICS database and the following values shall be displayed on a RVSS monitoring pop-up display:

      i. Input Current per phase
      ii. Output Current per phase
      iii. Running
      iv. Efficiency
      v. Phase Loss
      vi. Configured Alarm value 1
      vii. Configured Alarm value 2
      viii. 4 other parameters chosen by the Owner.

6. Revise PLC and HMI programming to implement modified well pump control strategies.

B. Network modifications are shown on the Contract Drawings and include but no be limited to:

1. Install a new Hirschmann mixed media Ethernet switch for the new network connections and connect one of the RJ45 ports to a spare port on the existing 5 port Hirschmann Switch in the main PLC panel.

2. Connect the new RVSS to the other RJ45 ports on the new mixed media Ethernet switch.

3. Install an additional fiber patch panel.

4. Connect the fiber patch panels to the fiber ports on the new mixed media switch using fiber patch cables.

5. Interconnect the PCP and the three new well PCP via the new and existing fiber cables.

C. I/O revisions are shown on the Contract Drawings.

D. Programming modifications are further defined herein.

E. Mixed Media Ethernet Switch. Provide a fully managed Ethernet switch with the required quantity of full duplex fiber ports and copper TX ports to implement the system shown on the Contract Drawings. Provide a minimum of one fiber and one copper port as additional spare ports. Use only Hirschman, no equal.

F. Fiber Patch Panel. Provide a patch panel with a minimum of 12 ST connections. Corning model WCH-12, no equal.

2.07 WELL PROCESS CONTROL PANELS (PLC-OM5)

A. The Well PCP shall be NEMA 4X 316 stainless steel enclosure with 3-point latch.

B. The PCP shall be PLC based and be in strict compliance with the control panel requirements defined herein.

C. The PLC shall be implemented using the Schneider M340 series modules housed in a DIN-rail mounted chassis:

1. Power Supply Module. Each PLC rack shall be equipped with its own regulated power supply module energized from a standard, commercial 120 VAC 60 Hz, single phase source. Any power transformation, rectification, regulation, or other conditioning necessary shall be provided as part of the unit's power supply package. Provide Schneider P/N BMXCPS3020

2. Central Processor Unit (CPU). The CPU module shall include a math coprocessor and a minimum of 8 MBytes of SRAM memory shall be installed. However, the actual amount of memory supplied shall be sufficient to provide 20% unused capacity when the entire PLC program, as provided, is loaded and running. The CPU module shall have one integral Modbus Plus and two integral Modbus ports. Provide Schneider M340 P/N BMXP342020 as necessary to perform the required functions.

3. Ethernet Module. Interfaces the CPU rack with an Ethernet network, either 10 Base-T/100 Base-TX or 100 Base-FX. Provide Schneider P/N BMXNG0100.

4. Process I/O modules. Provide process I/O modules sufficient to accommodate the required I/O as shown on the Contract Drawings plus a minimum of 15% fully wired spares of each signal type. All I/O modules shall be provided with screw-type terminal blocks with barriers between adjacent terminals for connection of field wiring. Terminals shall be suitable for accepting up to and including No. 14 AWG wire. All terminal blocks shall be key coded to prevent connection to other I/O modules. The following modules shall be used:

    1. Discrete inputs: Schneider model BMXDDI3202K.
    2. Analog inputs: Schneider model BMXAMI0810.
    3. Discrete outputs: Schneider model BMXDRA0805.
    4. Analog outputs: Schneider model BMXAMO0410.

5. Ethernet Backplanes. Used to interface I/O modules to the CPU. The following models are acceptable:

    1. 4 Slot Ethernet Backplane: Schneider model BMEXBP0400
    2. 12 Slot Ethernet Backplane: Schneider model BMEXBP1200

6. Memory Card. The Memory card shall be a 4GB SD memory card which will be used for program backup. Provide Schneider P/N BMXRMS004GPF

D. The PCP shall be equipped to support network communications with the PICS over 100 Base FX Ethernet using the following components:

1. Mixed Media Ethernet switch. Equipped with a minimum of four RJ45 and one ST fiber ports. Use only Hirschman, no equal.

2. Fiber optic patch panel. Terminating up to 12 fiber connections. Corning model WCH-12 or approved equal.

2.08 SPARES

A. Provide the following spare parts:

1. One spare PLC module of each type used in the well PCP.

2. One spare D.C. power supply of each type provided.

3. Five percent (rounded up) spare relays of each type provided.

4. Five percent (rounded up) spare surge suppressors of each type provided.

B. Provide the following expendables:

1. Two-year supply of corrosion inhibitor capsules

2. Ten percent (rounded up) spare fuses (minimum of 10) of each type and rating supplied.

PART 3 - EXECUTION

3.01 GENERAL

A. Prerequisite Activities and Lead Times: Do not start the following key project activities until the listed prerequisite activities have been completed and lead times have been satisfied:

1. Hardware Purchasing, Fabrication, and Assembly: Associated design related submittals completed (no exceptions, or approved as noted).

2. Shipment: Completion and approval of all design related submittals and satisfactory completion of the Factory Acceptance Test.

3. Startup: Operational Checkout Tests.

4. OWNER Training: Owner Training Plan completed and O&M manuals delivered.

5. Demonstration Tests: Operational Check-out Tests, Startup, OWNER Training, and Demonstration Test Procedures must be complete. Give 4 weeks' notice prior to the planned test start date.

B. Substantial Completion: Substantial Completion for the project is as defined in the General Conditions. However, the following requirements must be fulfilled before consideration will be given for Substantial Completion of the system:

1. All system submittals have been completed.

2. The system has successfully completed the Demonstration Tests.

3. The required OWNER training has been completed.

4. All spares, expendables, and test equipment have been received by OWNER.

C. Final Acceptance: system final acceptance is defined as the date when the

ENGINEER issues a written notice of final acceptance. For this Section, the following must have been completed before consideration will be given to the issuance of notice of final acceptance:

1. All punch-list items have been checked off.
2. Revisions to the system O&M Manuals have been made (that may have resulted from the Demonstration Tests).

3.02 PRODUCT HANDLING

A. Adequately pack manufactured material to prevent damage during shipping, handling, storage and erection. Pack all material shipped to the project site in a container properly marked for identification. Use blocks and padding to prevent movement.

B. Ship materials that must be handled with the aid of mechanical tools in wood-framed crates.

C. Ship all materials to the project site with at least one layer of plastic wrapping or other approved means to make it weatherproof. Anti-stat protection shall be provided for all sensitive equipment.

D. Inspect the material prior to removing it from the carrier. Do not unwrap equipment until it is ready to be installed. If any damage is observed, immediately notify the carrier so that a claim can be made. If no such notice is given, the material shall be assumed to be in undamaged condition, and any subsequent damage that is discovered shall be repaired and replaced at no additional expense to the OWNER.

E. Store and protect equipment until installation following the storage and handling instructions recommended by the equipment manufacturers. Place special emphasis on proper anti-static protection of sensitive equipment.

F. ESD Protection: Provide for the proper handling, storage, and environmental conditions required for the system components deemed static sensitive by the equipment manufacturer. Utilize anti-stat wrist straps and matting during installation of these items to prevent component degradation.

G. Protection During Construction: Throughout this Contract, provide protection for materials and equipment against loss or damage and from the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Provide covers for panels and other elements that may be exposed to dusty construction environments. Specific storage requirements shall be in accordance with the SYSTEM SUPPLIER's recommendations.

H. Corrosion Protection: Protect all consoles, panels, enclosures, and other equipment containing electrical or instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to shipment, include capsules in the shipping containers, and equipment as recommended by the capsule manufacturer. During the construction period, periodically replace the capsules in accordance with the capsule manufacturer's recommendations. Replace all capsules just prior to Final Acceptance.

I. The CONTRACTOR shall be responsible for any damage charges resulting from the handling of the materials.

3.03 INSTALLATION

A. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish. Clean and polish the exterior of all panels and enclosures upon the completion of the demonstration tests.

B. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance. Coordinate I&C work with the OWNER and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the existing plant during construction.

3.04 TRAINING

A. The cost of training programs to be conducted with OWNER's personnel shall be included in the Contract price.

B. All training schedules shall be coordinated with, and at the convenience of the OWNER. Shift training may be required to correspond to the OWNER's working schedule.

C. Provide a minimum of three days training for up to twelve of the OWNER’s personnel in the maintenance of the hardware which shall include:

1. Training in standard hardware maintenance for the equipment provided.
2. Specific training for the actual hardware configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up.
3. Test, adjustment, and calibration procedures.
4. Troubleshooting and diagnosis.
5. Component removal and replacement.
6. Periodic maintenance.

D. Provide a minimum of three days training for up to twelve of the OWNER’s personnel in the use of the operator graphic screens.

3.05 TESTING - GENERAL

A. All elements of the system, both hardware and software, shall be tested to demonstrate that the total system satisfies all of the requirements of the Contract Documents

B. As a minimum, the testing shall include shop tests, operational check-out tests, and

Demonstration Tests.

C. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and, upon the system producing the correct result (effect), the specific test requirements will have been satisfied.

D. All tests shall be conducted in accordance with, and documented on, prior approved procedures, forms, and checklists. Each specific test to be performed shall be described and a space provided after it for signoff by the appropriate party after its satisfactory completion. Copies of these signoff test procedures, forms, and checklists will constitute the required test documentation.

E. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation. Define these simulation techniques in the test procedures.

F. The SYSTEM SUPPLIER shall coordinate all of their testing with the CONTRACTOR, the ENGINEER, all affected suppliers, and the OWNER.

G. The ENGINEER reserves the right to test or retest any and all specified functions whether or not explicitly stated in the approved test procedures. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing.

3.06 FACTORY ACCEPTANCE TEST (FAT)

A. The SYSTEM SUPPLIER shall perform a Factory Acceptance Test on all PICS equipment being furnished.

B. This test shall be witnessed by the OWNER.

C. The SYSTEM SUPPLIER shall provide a minimum of two week’s notice and shall pay all travel costs for two OWNER representatives to attend the testing.

D. The test set-up shall consist of the new PCP (PLC-OM5) and a test HMI package, connected over an Ethernet network. The test HMI package shall contain the new graphics intended for the SCADA system as required by the modifications of this project.

E. As a minimum, the testing shall verify the following:

1. Wiring within the panels.
2. Correct operation of all field I/O up to and including the HMI using simulated field signals.
3. Correct operation under loss of power (i.e. operation on UPS) for the required minimum of 15 minutes.

F. This test shall be successfully completed before shipment of the PICS to the site.

3.07 OPERATIONAL READINESS TEST (ORT)

A. Prior to startup and demonstration testing, certify that the system (inspected, tested and documented) is ready for operation. These inspections and tests shall include

Loop/Component inspections and tests. The SYSTEM SUPPLIER shall fully debug problems in the system as a whole. Final approval of control software will not be based on written descriptions of software functions alone, but on actual performance in the field.

B. Check the entire system for proper installation, calibration and adjustment on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and the Specifications.

C. The Loop/Component Inspections and Tests shall be implemented using approved forms and checklists. These shall be developed by the SYSTEM SUPPLIER and submitted for approval.

D. Loop Status Report: Each control loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. These reports shall include the following information and check-off items with spaces for sign-off by the SYSTEM SUPPLIER:

1. Project Name
2. Control Loop Number or description
3. Tag Number or description for each component of the control loop
4. Check-offs/sign-offs for each component for proper installation, termination, and calibration/adjustment
5. Check-offs/sign-offs for the control loop for proper panel interface terminations, I/O interface terminations, I/O signal operation relative to the computer network, and total loop operation ready
6. Space for comments

E. Component Calibration Sheet: Each field instrument element and each PLC I/O module shall have a Component Calibration Sheet. These sheets shall have the following information, spaces for data entry, and a space for signoff by the SYSTEM SUPPLIER:

1. Project Name
2. Component Identification or I/O Module Number
3. Manufacturer, Model Number/Serial Number of field element
4. Summary of Functional Requirements (scale, range, computing equation, control action, etc.)
5. Calibrations of span, setpoints, and preset adjustable parameters
6. Space for comments

F. Maintain the Loop Status Reports and Component Calibration Sheets at the jobsite and make them available to the ENGINEER at any time.

G. Witnessing: These inspections and tests do not require witnessing. However, the ENGINEER will review the Loop Status Sheets and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational

Check-out Tests. Correct any deficiencies found.

3.08 FIELD ACCEPTANCE TEST (FAT)

A. Once the system has passed the ORT, the SYSTEM SUPPLIER shall perform a witnessed Field Acceptance Test (FAT) on the complete system. The FAT shall demonstrate that the system is operating and in compliance with the Contract requirements. Each specified function shall be demonstrated on a paragraph-by-paragraph, and site-by-site basis.

B. Prior to the FAT, the entire installed system shall be certified in writing by the CONTRACTOR that it is ready for operation.

C. The system shall operate for a continuous 100 hours without failure before this test will be considered successful.

D. The FAT shall cover the entire system, including control functions, alarms, and status monitoring. Test procedures used for shop tests may be adopted for these tests if modified as required.

3.09 30-DAY SITE ACCEPTANCE TEST (SAT)

A. After completion of the Field Acceptance Test, the entire system shall operate for a period of 30 consecutive days, under conditions of full plant process operation, without a single non-field repairable malfunction.

B. Provide complete O&M Manuals for the system at the jobsite at least two weeks prior to the SAT.

C. During this test, plant operating and SYSTEM SUPPLIER personnel shall be present as required. The SYSTEM SUPPLIER is expected to provide personnel for this test who have an intimate knowledge of the hardware and software of the system.

D. While this test is proceeding, the OWNER shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes.

E. Any malfunction during the tests shall be analyzed and corrections made by the SYSTEM SUPPLIER. The ENGINEER and/or OWNER will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

F. Any malfunction, during this 30 consecutive day test period, which cannot be corrected within 24 hours of occurrence by the SYSTEM SUPPLIER's personnel, or more than two similar failures of any duration, will be considered as a non-field-repairable malfunction.

G. Upon completion of repairs, by the SYSTEM SUPPLIER, the test shall be repeated as specified herein.

H. In the event of rejection of any part or function, the SYSTEM SUPPLIER shall perform repairs or replacement within 90 days.

I. All data base errors must be corrected prior to the start of each test period. The 30-day test will not be considered successful until all databases are correct.

J. The total availability of the system shall be greater than 99.5 percent during this test period.

1. Availability is given by “(Total Time-Down Time)□/ Total Time".

2. Down times due to power outages or other factors outside the normal protection devices or back-up power supplies provided, shall not contribute to the availability test times above.

K. Upon successful completion of the 30-day Site Acceptance Test and subsequent review and approval of complete system final documentation, the system shall be considered substantially complete and the warranty period shall commence.

3.10 CONTROL STRATEGIES

A. Provide control strategies that meet the following general conditions:

1. Wherever in the descriptions the control strategy refers to the operator, it is intended to mean via the operator graphic screens on the HMI.

2. All control strategies shall run within the PLC. Data manipulation (calculated analog values, elapsed time functions, event determination) shall be performed by the PLC for the associated equipment it is monitoring. Any resulting values from these manipulations shall be reported as individual registers. The intent is to avoid utilizing the HMI software for this purpose.

3. The control functions described herein are not intended to be complete comprehensive programming logic descriptions. They describe only the general intended control operation required. Provide complete program logic to completely fulfill the functional requirements indicated.

4. Provide all programming necessary to support the functional requirements of the operator graphic screens.

5. Provide complete debugging services to address issues identified by the OWNER or ENGINEER during and after startup until final acceptance.

B. HMI Programming. Modify/Create the process graphics as necessary to incorporate the operator interfaces defined in the control strategies.

C. Well Pump Control. The existing PLC program shall be modified to transmit the start and stop signals for individual wells to the PLC in the well PCP. The latter PLC shall be programmed as follows:

1. Provide an operator controllable HAND/OFF/AUTO software select switch.

2. While the switch is in HAND, run the pump.

3. While the switch is in OFF, stop the pump and prevent any further control commands.

4. While the switch is in AUTO, run the well pump as directed by commands from Main PCP.

5. Manage control and operations of limit switch, solenoid valves, etc. as shown on the drawings.

END OF SECTION

SECTION 11215
OPEN LINE SHAFT VERTICAL TURBINE WELL PUMPS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required, install, complete and ready for operation and field testing, one (1) product lubricated open line shaft vertical turbine well pumping unit as shown on the Drawings and as specified herein meeting NSF approval for potable water.

B. The term "pumping unit" shall be defined as a pump, couplings and complete with motor; the “pumping system” shall include the “pumping unit” and associated ancillary equipment.

C. The pump manufacturer shall be responsible for supplying the complete pumping unit as defined above and shall assume complete system responsibility.

D. All necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this Section or not shall be furnished and installed as required for an installation incorporating the highest standards for this type of service. Also included shall be supervisory services during installation and field testing of each unit and instructing the regular operating personnel in the proper care, operation and maintenance of the equipment.

E. Provide leveling base plate for mounting pump to existing well flange as approved by pump Supplier.

1.02 RELATED WORK

A. Concrete work and the installation of anchor bolts are included in Division 03; however, anchor bolts for these units as recommended by the pump manufacturer shall be furnished by the Contractor under this Section.

B. Field painting is included in Division 9.

C. Electrical, Variable Frequency Drives and Motors, in addition to specifications herein, are included in Division 16. Units shall meet performance standards on emergency power and on utility power supply.

D. Valves, mechanical piping and appurtenances are included in Division 15.

E. Instrumentation and control work, except as specified herein, is included in Division 13. Instrumentation and controls provided in this section shall adhere to Instrumentation and Control Specifications Sections in Division 13.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data. Submittals shall include the following:

1. Certified by the Manufacturer, dimensional drawings of each item of equipment and auxiliary apparatus to be furnished.

2. Certified by the Manufacturer, foundation, pump support and anchor bolt plans and details complete with all dimensions and written description of procedure for the installation of a pump head base plate.

3. Schematic electrical wiring diagram and other data as required for complete pump installation if a change from the wiring diagram shown on the Drawings is proposed.

4. Literature, catalog data and detailed drawings describing the equipment in sufficient detail, including parts list and materials of construction, specification designations such as ANSI, ASTM, etc. to indicate full conformance with the detailed specifications. Indicate linings and coatings for the pump.

5. Submit electric motor data.

6. Total weight of pumping unit and of the motor.

7. Submit pump manufacturer ISO 9001 certification. Provide a letter from the pump manufacturer accepting warranty responsibility for the entire assembly including the pump, motor, and baseplate unit.

B. Design Data

1. Manufacturer's certified rating curves, to satisfy the specified design conditions, showing pump characteristics of discharge, specified operating points, anticipated field head, brake horsepower, bowl efficiency, required pump submergence and guaranteed net positive suction head required (NPSHR). Curves shall show the full recommended range of performance and include shut-off head. This information shall be prepared specifically for the pump proposed. Catalog sheets showing a family of curves will not be acceptable.

2. Submit shaft diameter and bearing spacing. Submit calculations showing shaft critical frequency and determination of bearing spacing. Show calculated bearing life.

3. Submit moment of inertia of the complete pumping unit including driver, impeller and liquid pumped.

C. Test Reports

1. Certified motor test data as described in Division 16.

2. Tabulated data for the drive motors including rated HP, full load rpm, power factor and efficiency curves at 1/2, 3/4 and full load, service factor and kW input, including when the pump is at its design point.

3. Description of pump factory test procedures, equipment and results, including but not limited to, performance curves. Submit manufacturer's sample form for reporting performance test results at least two weeks prior to the tests. The

test form shall contain the data presented in the sample form in Section 2.6.6 of ANSI/HI 2.6.

4. Submit manufacturer's certified performance curves for review at least two weeks prior to shipping the units from the factory. Show pump total head, torque, brake horsepower, pump efficiency, required submergence, and required NPSH. Provide copies of the data recorded during the test and methods of data reduction for determining certified test results.

5. As part of the field test procedure for the pumps, record measurements for impeller adjustment at the top of the shaft and total radial shaft deflection (shaft runout) above the packing box.

D. Operation and Maintenance Data

1. Complete operating and maintenance instructions shall be furnished for all equipment as provided in Section 01730. The maintenance instructions shall include troubleshooting data and full preventative maintenance schedules and complete replacement parts lists with ordering information.

1.04 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of the equipment specified herein shall be in accordance with, the following:

1. American Gear Manufacturers Association (AGMA)

2. American Institute of Steel Construction (AISC)

3. American Iron and Steel Institute (AISI)

4. American Society of Mechanical Engineers (ASME)

5. American National Standards Institute (ANSI)

6. American Society for Testing Materials (ASTM)

7. American Water Works Association (AWWA)

8. American Welding Society (AWS)

9. American Bearing Manufacturers Association (ABMA)

10. Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps; Hydraulic Institute, Vertical Pump Standards for Nomenclature & Definitions, Design & Application and Installation, Operation & Maintenance, ANSI/HI 2.1 – 2.4-2014 and Rotodynamic Pumps for Hydraulic Performance Acceptance Tests – ANSI/HI 14.6-2016

11. Institute of Electrical and Electronics Engineers (IEEE)

12. National Electrical Code (NEC)

13. National Electrical Manufacturers Association (NEMA)

14. Occupational Safety and Health Administration (OSHA)

15. Society for Protective Coatings (SSPC)

16. Underwriters Laboratories (UL)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. To assure unity of responsibility, the motors, supporting sole plates, discharge head, shafting and column pipe assembly shall be furnished by the pump manufacturer. The Contractor and manufacturer shall assume responsibility for the satisfactory installation and operation of the entire "pumping system" including pumps, motors, sole plates and associated items, as specified. The person or persons responsible for carrying out the well pump installation shall be a licensed well drilling contractor **or licensed general contractor** in the State of Florida with at least 15 years' experience with deep well installation and pump installation.

B. The equipment specified herein is intended to be standard pumping equipment of proven ability as manufactured by concerns having extensive experience in the production of such equipment similar to the applications stated in Paragraphs 1.01 and 1.06. Units specified herein shall be furnished by a single manufacturer. The equipment furnished shall be designed, constructed and installed to operate satisfactorily when installed as shown on the Drawings.

C. Pumps shall be statically and dynamically balanced and manufactured in accordance with the Hydraulic Institute Standards, except where otherwise specified herein.

D. The pump manufacturer shall be fully responsible for the design, arrangement, and operation of all connected rotating components, including supporting sole plate(s), if any, of the assembled pumping unit mounted on a fabricated steel base plate, to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.

E. The pump manufacturer shall perform a spread sheet calculation for both lateral and torsional critical speed analyses to identify and ensure that (a) the first lateral critical speed shall be at least 20 percent above the maximum pump speed and that (b) no torsional natural frequencies occur within a range extending from 20 percent below to 20 percent above the specified operating speed range and that (c) any blade excited resonant frequency shall be no closer than plus or minus 20 percent of the natural frequency of any part of the installed assembled pumping unit. Prior to manufacture, a statement must be forwarded to the Engineer indicating that the required analyses have been made and that the specified limitations will be met.

F. Vibration amplitude measured in the field while operating at design conditions shall comply with the requirements of ANSI/HI 9.6.4-latest edition or 0.17 in/sec at any location on the unit, whichever is more stringent.

G. The supplied pump shall be manufactured such that the $NPSH_R$ in the manufacturer's allowable operating region is not more than the $NPSH_A$.

1.06 SYSTEM DESCRIPTION

A. The well pump will pump water from the newly constructed on-site well, labeled OM-5.

1.07 DELIVERY STORAGE AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay (approximately 6 months) from the time of shipment until installation is completed and the unit and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during shipment. Store the equipment in accordance with manufacturer's recommendations.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. The finished surfaces of all exposed flanges shall be protected by wooden or equivalent blank flanges, strongly built and securely bolted thereto.

E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

F. No shipment shall be made until approved by the Engineer in writing.

G. For protection of bearings during shipment and installation, the bearing shall be properly processed. Anti-friction bearings, if pre-lubricated, shall be protected in accordance with the bearing manufacturer's recommendations against formation of rust during a long period of storage while awaiting completion of installation and start-up of the machine in which they are used. Anti-friction bearings which are not pre-lubricated shall be properly treated in accordance with the bearing manufacturer's recommendation against formation of rust during a long period of storage while waiting completion of installation and start-up by the application of Exxon, Rust-Ban No. 392 or equal treatment.

1.08 FIELD SERVICE REPRESENTATIVE

A. The Contractor shall provide the services of a trained, competent, qualified and experienced factory-employed field representative during inspection, testing and start-up of the equipment and for instruction of the Owner’s personnel in the proper operation and maintenance of the equipment. Factory personnel are required for this start-up and training. Manufacturer’s sales representatives are not deemed acceptable to provide the start-up service. The factory representative shall have a complete and full knowledge and experience in the installation, start-up procedures, and proper operation and maintenance of the open line shaft vertical turbine pumping equipment. The services of the factory technician shall be provided as follows:

1. Three (3) separate trips and a total of three (3) 8-hour days of service to inspect and certify the installation prior to startup and instruct the Owner's operation and maintenance personnel in proper operation and maintenance of the equipment.

a. One, 8-hour day to inspect the final installation and supervise the Contractors personnel to check-out, perform initial start-up of the equipment and perform the functional testing of the equipment.

b. Two, 8-hour days (includes two training sessions per 8 hour day) to instruct the Owner's personnel in the proper operation and maintenance of the equipment in accordance with a schedule approved by the Owner.

1.09 SPARE PARTS

A. All spare parts shall be properly protected for long periods of storage and packed in containers that are clearly identified with indelible markings as to contents.

B. Furnish the following spare parts.

1. One additional mechanical seal per pump

1.10 WARRANTY

A. The equipment shall be warrantied for three (3) years following Substantial Completion as defined under the General Conditions, Division 1, Section 01700. The Warranty shall be submitted per Section 01740.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PUMP MANUFACTURERS

A. The open line shaft vertical turbine well pump shall be manufactured by one of the following approved manufacturers:

- Goulds – Xylem,
- Peerless,
- Floway-Weir.

2.02 GENERAL

A. All equipment for the pump, including discharge head, shafting, column, couplings, motor and base, guards and anchor bolts, shall be provided as a complete unit by the pump manufacturer produced in an ISO-9001-certified facility or by a pump manufacturer accepting warranty responsibility for the complete pump unit. Pump units assembled by entities other than the pump manufacturer will not be acceptable.

B. Each pump shall be capable of at least a 5% head increase at normal operating conditions by installing a larger impeller or an impeller of different hydraulic design.

C. The following criteria shall be used for pump selection:

1. Bowl and pump connection to the discharge head diameters shall allow for installation into the well casing as constructed.
2. Pump discharge-head curve shall continuously decrease with increasing flow.
3. Pump discharge-head curve shall be continuously rising and shall be free of dips and valleys from the design point to the shutoff head. The shutoff head shall be at least 150% of the head that occurs at the design point.

4. Pump shall be of current manufacture. Pump characteristic curves are to be included in pump manufacturer's catalog.

D. The pumps and motors shall be designed and built for 24-hour continuous service at any and all points within the required range of operation, without overheating, without cavitation and without excessive vibration or strain. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be especially constructed to meet the specified requirements. Ample room and facilities shall be provided for inspection, repairs and adjustment.

E. All necessary foundation bolts, nuts and washers shall be furnished and shall be Type 316 stainless steel.

F. Each major piece of equipment shall be furnished with a stainless steel nameplate (with embossed data) securely mounted to the body of the equipment. As a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, head, speed and all other pertinent data. As a minimum, nameplates for motors shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles and power and service factors.

2.03 GENERAL CONDITIONS OF OPERATION

A. To ensure adequate clearance for pump installation and maintenance, the maximum allowable outside diameter of the bowl assembly and column assembly (including joints) to be installed is 14-inches.

B. The well pump shall be designed for the conditions of service as shown in **Table 11215-1** at the end of this Section.

C. Vertical turbine line shaft pumps shall be self-lubricated, completely equipped with motor support and guide bearings and shall conform to AWWA E103 (latest edition), Vertical Turbine Pumps, where not in conflict with the specific requirements contained herein.

D. Vertical turbine pump shall be utilize graphite packing for seals.

E. The natural frequency of the assembled pump, and its supporting structure, shall be at least 25 percent higher than the maximum pump speed.

2.04 DISCHARGE HEAD ASSEMBLY

A. Provide a discharge assembly for surface discharge. The discharge assembly shall have a bolted register or rabbet-fit connections for the motor. Discharge assembly shall have flanged connections for the pump column and discharge piping and shall support the loadings that they impose as well as contain the pump pressure.

B. Pump discharge head with integral base plate shall be the surface discharge type and shall be fabricated steel. Steel shall be in accordance with ASTM A36.

1. For all wells, 150-lb ANSI flanged ends shall be used.
2. Flanges shall be flat face.

3. Groove welds shall be full penetration welds. Fabricated flanges shall be welded both inside and out.
4. Fabricated steel 90 degree mitered discharge elbows for discharge heads shall have at least five (5) mitered pieces per AWWA C208.

C. Design columns and discharge assemblies for 150% of the pump discharge pressure (suction pressure plus pump differential pressure) at shutoff.

D. The pump discharge head shall include a 1/2”-NPT threaded connection with a Type 316 stainless steel quarter turn ball valve, pipe nipple and plug, located at the vertical centerline of the horizontal discharge.

E. The discharge head shall be designed to provide adequate space and clearances for removal and servicing of the graphite packing seals.

F. Access to the graphite packing seal shall be through windows placed 90 degrees from the discharge flange. Fit handholes and/or windows with Type 316 stainless steel expanded metal guards per OSHA requirements. Guards shall be bolted to the discharge head using Type 316 stainless steel hardware.

G. Pump head base plate shall have drilled and tapped holes for bolting down pump head complete with all Type 316 stainless steel bolts, nuts, washers, and anchor bolts as required. Bottom of plate shall be machined to suitable finish for matched connection to sole plate. Plate shall be so fabricated that the opening is a match for the diameter of the well casing as shown on the Drawings.

H. If the sole plate is not compatible with the well opening, the Contractor shall be responsible for supplying a machined adaptor sole plate with tapped bolt holes and of equal thickness to the surface discharge plate that incorporates the discharge head, as shown on the Drawings. The Contractor shall also be responsible for furnishing and installing a gasket as approved by the Engineer.

I. Provide lifting eyes on the discharge head that are designed to be capable of lifting the entire weight of the complete pumping unit less the motor, including the discharge head, pump column and shafting and the pump bowls and impellers.

J. The pump discharge head, base plate and sole plate shall be coated internally and externally with a high build modified epoxy of 16 mils dry film thickness. Coating shall be compatible for pump service and suitable for potable water use as approved by the National Sanitation Foundation (NSF) Standard 61.

2.05 COLUMN PIPE AND SHAFTING

A. Bowl assembly shaft and line shaft shall be Type 416 stainless steel.

B. Each pump line-shaft and top shaft shall be one piece solid shaft construction with self-tightening threaded connecting Type 416 stainless steel couplings and suitable for adjustment of the pump impellers with a top shaft impeller adjustment nut, including locking screw. The top shaft shall incorporate a non-reverse ratchet. The pump line-shaft and top shaft shall be joined with a shaft coupling located above the stuffing box. The coupling shall be positioned to be easily removed through the

discharge head openings. The length of the pump line-shaft pieces shall be compatible with the lengths of the column pipe.

C. The top shaft of the string of line shafting shall be of two piece construction with the top shaft which extends through the stuffing box of the discharge head fabricated of Type 17-4PH stainless steel. The top piece shall be compatible with the top column and discharge head assembly.

D. Line shaft bearings shall be of cutless rubber type.

E. Aligning spiders for the line shaft bearing shall be Type 316 stainless steel or bronze or castings of material conforming to the material requirements of pump bowls specified above with ASTM A269, Type 316 stainless steel sleeves.

F. Column pipe shall be steel pipe conforming to ASTM A53, Grade B and shall have a Schedule 40 minimum wall thickness. Column pipe shall be 10-inch diameter for pump OM-5 and shall be threaded and coupled. The discharge column shall be installed in lengths not to exceed 10-ft except for 5-ft length columns at both the pump and discharge head ends. Each coupling shall provide for an aligning spider so that one such spider comes at every joint in the discharge column. The construction arrangement shall be such that the pump can be removed for repairs using normal methods of operation and handling without undue difficulties.

G. Column pipe shall be coated internally and externally with a high build modified epoxy of 16 mils dry film thickness. Coating shall be compatible for pump service and suitable for potable water use as approved by the National Sanitation Foundation (NSF) Standard 61.

2.06 OPEN LINE SHAFT PRE-LUBRICATION

A. Under normal pumping conditions, the open line shaft for vertical turbine pumps shall be self-lubricated. Since the static water level in the well casing will be 30 feet or more below the pump discharge head setting, the line shaft bearings shall be pre-lubricated with water before the pump motor is energized.

B. The pump manufacturer shall provide an electric solenoid actuated pre-lubrication system for the pump line shaft bearing. Controls for the pre-lubrication system will include an adjustable timer to open the solenoid valve to allow water to lubricate the pump bearings before the pump is energized. During the pre-lubrication operation, the well pump will not be allowed to start via a time delay. When the pre-lubrication timer times out, the well pump will be allowed to start.

C. Water for the pre-lubrication system shall be obtained from the raw water distribution system downstream of the Well OM-5 discharge to the system. The pre-lubrication system shall be capable of operating with a minimum operating pressure of 25 psig.

2.07 PUMP BOWLS AND IMPELLERS

A. Each bowl assembly shall consist of the bowl, impeller, impeller shafting, and impeller bearings. Bearings shall be located above and below the impeller. Bearings (other than sleeve type) shall have an AFBMA L-10 life of at least 20,000 hours at

any specified flow condition, excluding the shutoff head. Impellers shall be dynamically balanced.

B. Pump bowls, including suction bell, shall be ASTM A48, Class 30 cast iron, flanged and bolted construction with combination bronze and cutless rubber bearings. All bowl hardware shall be Type 316 stainless steel.

C. Bowls shall be sufficiently rigid to prevent adverse changes in bearing alignment and to maintain the running clearance of wear rings. Bowls shall be flanged with male and female rabbets or registers for joining to the suction bell and the discharge column. Waterways and the diffusion vanes shall be smooth and free from nodules, bumps, dips and blow holes.

D. Pump bowl interior shall be coated with porcelain or a smooth vitreous enamel. The exterior of the pump bowls shall be coated with a high build modified epoxy of 16 mils dry film thickness. The coatings of the pump bowls shall be compatible for pump service and suitable for use with potable water and approved by the National Sanitation Foundation (NSF) Standard 61.

E. Each impeller shall be Type 316 stainless steel, fully-enclosed type and shall be cast in one piece. Impellers shall be statically and dynamically balanced. Each bowl shall be provided with a replaceable Type 420 stainless steel bowl wear ring. Wear rings and running clearances shall not exceed 0.002-inch clearance per inch of diameter.

F. Impeller taperlocks and collet lock nuts shall be Type 316 stainless steel. Attach impellers to the shaft in such a manner that they cannot become loose under any operating condition or under reverse rotation.

G. Provide for adjustment of the axial position of the impellers at the motor connection to the head shaft so that proper clearance between bowls and impellers may be maintained.

H. Suction bell shall be provided with a cone-shape basket strainer. The strainer shall be fabricated of Type 316 stainless steel. Strainer shall be attached to the bell with Type 316 stainless steel nuts, bolts and other hardware. Strainer shall be provided by the pump manufacturer.

2.08 PUMP DRIVE MOTOR

A. The pump shall be driven by means of a squirrel cage induction motor suitable for driving the pump continuously over the entire allowable operating pumping range without overload or without operating in the service factor. Motor horsepower shall be as specified in **Table 11215-1**. The motor shall be furnished with thrust bearings having ample capacity to carry the full weight of all rotating parts and hydraulic forces developed by continuous pump operation including the total pump line shaft down thrust, and the motor bearings shall be designed to withstand any momentary total up thrust.. The pump motor shall be furnished by the pump manufacturer.

B. The pump motor shall be a vertical hollow shaft, high thrust, specially built NEMA Style "P" base, squirrel cage induction type, with low starting current and normal starting torque characteristics. The motor shall be designed for continuous operation with a 460 volt, 3 phase, 60 Hertz power supply with a maximum speed as in **Table 11215-1**.

C. Motor shall be a Premium Efficiency motor with a 1.15 service factor, Class F vacuum/pressure impregnated insulation with Class B temperature rise, copper windings. Motor windings shall be triple dipped and baked with epoxy and finally shall be coated with a fungicidal varnish suitable for tropical environments. Rotation of the vertical shaft shall be counter clockwise when viewed from above.

D. The motor shall develop ample starting and accelerating torque based on solid-state reduced voltage starting with the pump operating against a closed check valve. Terminal box on this motor shall be furnished with a grounding lug.

E. The electric motor shall be furnished with a non-reversing ratchet to prevent rotation in the reverse direction due to water receding into the pump column. An adjusting nut shall be provided at the top of the motor for varying the impeller clearance.

F. The motor shall be non-overloading, without use of the service factor, at any point on the driven pump's performance curve. The motor shall be NEMA Design B, and shall be designed, constructed and tested in accordance with applicable IEEE, NEMA, AFBMA and ANSI standards. Motors shall be given a short commercial test in accordance with IEEE standards and furnished with the following construction features before shipping to the pump manufacturer testing facility:

1. Construction: All cast iron construction for frame, end brackets, conduit box and fan shroud. Motor shall be supplied with lifting lugs or "O" type bolts on the top of the motor.
2. Enclosure: Totally Enclosed Fan Cooled (TEFC). Any openings for ventilation shall be uniformly spaced around the motor frame. Openings shall be screened with 1/8-inch 316 stainless steel mesh insects and rodents screen.
3. Horsepower: Motor horsepower shall meet requirements as specified in **Table 11215-1**.
4. Efficiency: Premium, guaranteed minimum efficiency of 94.7 percent at full load.
5. Insulation: Class F
6. Temperature Rise: Class B based upon 40 degrees C ambient.
7. Epoxy coated rotor and stator windings.
8. Motor windings for stator and rotor and motor leads shall be manufactured using solid copper wire.
9. Bearings shall be shielded, anti-friction, re-greasable, vacuum degassed steel ball bearings. Motor thrust bearings shall have ample capacity to carry the weight of all rotating parts plus the hydraulic thrust of the pump impellers with an ample safety factor. Bearings shall have a minimum B-10 life of 100,000 hours.
10. Type 316 stainless steel hardware and grease plugs.
11. Gasket between motor frame and conduit box.
12. Gasketed cast iron conduit box.
13. Type 316 stainless steel nameplate fastened with Type 316 stainless steel pins or screws.
14. Accessories: Each motor shall be provided with a heat overload protection device to protect the motor from overheating during operation. All devices shall immediately stop the drive motor in the event of excessive heat buildup. Motor shall be provided with a 120-volt single phase strip heater to maintain a motor

temperature of at least 40 degrees C, or 10 degrees C above ambient, whichever is greater.

15. Vibration and Sound limits: Vibration shall not exceed Hydraulic Institute Standards and sound pressure level shall not exceed 80 dbA at 5 feet under full load conditions in accordance with IEEE standard 85.
16. A grounding lug shall be provided in the conduit box.

2.09 SHOP TESTS

A. Each pump bowl assembly shall have a non-witnessed factory test with a Standard Performance Test as described in Hydraulic Institute Test Standards, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests – 14.6 and all test data submitted for approval by the Engineer prior to shipment. Certified copies of the calculated pump performance curves from the Standard Performance Test shall be submitted including anticipated head, capacity, bowl efficiency, total brake horsepower. Typical NPSHR and required submergence values typical for this pump shall be provided and certified by the pump manufacturer.

B. The discharge head and bowl assembly of each pump shall be hydrostatically tested in full compliance with the Hydraulic Institute Test Standards, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests – 14.6.

C. Each pump shall be guaranteed to meet all conditions to achieve an Acceptance Grade of "1U" has outlined in Table 14.6.3.4 of the Hydraulic Institute Test Standards, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests – 14.6.

D. Pump and motor test results as specified in Section 01300 shall be submitted for approval by the Engineer prior to shipment.

2.10 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. Each piece of equipment in the pumping system including pump and support system shall be prepared, shop-primed and finished coated as specified in Section 09900 and per Manufacturer's recommendations. The shop primer shall be compatible with the finish paint. Field painting is included in Division 9.

B. Each pump and associated equipment shall be shop-primed and any manufacturer's standard practice finished-coating shall be applied prior to shipment. Exterior color shall be standard raw water color as approved by the Engineer and an adequate supply of touch-up paint shall be supplied by the manufacturer.

C. All interior and exterior wetted surfaces of pump columns and discharge elbows and the exterior of the bowl assemblies shall be cleaned of all rust and mill scale.

D. All column pipe shall be supplied with a protective coating both inside and outside. All coatings on wetted surfaces shall meet NSF 61 Certification for use with drinking water systems. Surface preparation shall conform to the coating manufacturer's recommendations.

E. Discharge head shall be supplied with a protective coating both inside and outside. All coatings on wetted surfaces shall meet NSF 61 Certification for use with drinking

water systems. Surface preparation shall conform to the coating manufacturer's recommendations.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate with other trades, equipment and systems to the fullest extent possible.

B. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this Contract. All pertinent data and dimensions shall be verified.

3.02 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the pump drawings. Anchor bolts shall be set in accordance with the pump manufacturer's recommendations and setting plans. Anchor Bolts shall be Type 316 stainless steel.

B. The Contractor shall supply the services of a qualified vertical turbine well pump installer with at least 15 years' experience to supervise the pump installation and testing to the satisfaction of the Engineer. Should the Contractor fail to have a qualified engineer and/or service person on the job during the installation, the Engineer may direct the Contractor to provide the services of a factory representative to check over the installation.

C. Qualified supervisory services, including manufacturers' engineering representatives, shall be provided for a minimum of 2 days to ensure that the work is done in a manner fully approved by the respective equipment manufacturer. The pump manufacturer's representative shall specifically supervise the installation and alignment of the pump with the driver, the grouting, the alignment of the connecting piping, and the installation of the field installed packing. If there are difficulties in the start-up or operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no additional cost to the Owner. Services of the manufacturer's representatives and training shall be provided when the pump is started up.

D. Connection of piping to pumps shall be done in the presence of the Engineer. All piping connections to the pump shall be done without bending and/or twisting the piping to mate with the pump flange connections.

E. A certificate from the equipment manufacturer shall be submitted stating that their installation of their equipment is satisfactory, that the equipment is ready for operation, and that the Owner's operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.03 FIELD COATINGS

A. All exposed portions of the pumps and motors shall be shop primed, with primer

compatible with field painting as specified in Division 9.

B. Field coating is specified under Section 09900 - Coatings. The primer and coating used in the shop shall be products of the same manufacturer as the field coating to assure compatibility.

3.04 FIELD SERVICE REPRESENTATIVE SERVICES

A. The purpose of the services provided by the factory representative as described in Paragraph 1.08 will be for the performance of the following work:

1. Verify that the Contractor has properly installed the vertical turbine pumping equipment.
2. Following installation, but before the equipment is operated by others, the representative shall inspect the completed installation for soundness, completeness, correctness, alignment, arrangement, proper lubrication, pump rotation, vibration, pump setting, and operation of the pumps. The field engineer shall make, or cause to be made, any and all adjustments, corrections, or repairs necessary.
3. Start-up of the equipment in the presence of the Contractor and Owner's operating personnel.
4. Training of Owner's operating personnel in proper operation and maintenance procedures, lubrication, startup/shutdown procedures, response to emergency conditions, and troubleshooting. The responsibility of the Contractor and the factory service representative with regard to start-up shall be fulfilled when the start-up is complete; the equipment is functioning properly and has been accepted by the Owner.

    a. The training period for the Owner's operating personnel shall be scheduled at least ten (10) days in advance with the Engineer and shall take place prior to the well pump acceptance by the Owner and the Engineer. The final copies of operation and maintenance manuals specified in Section 01730 must have been delivered to the Engineer prior to scheduling the instruction period.

B. Upon completion of his work, the manufacturer's field engineer shall submit to the Engineer, six (6) copies of a written report for each open line shaft vertical turbine well pump, as a result of his inspection, adjustments, corrections, repairs, start-up and testing. The report shall include descriptions of the inspection, adjustments, corrections and repairs made, testing and start-up, and training of the Owner's personnel. The report shall also include a notarized certification signed by the manufacturer's field engineer that the installed equipment:

1. Has been installed and lubricated per manufacturer's requirements.
2. Has been accurately aligned, set and leveled and proper running clearances set.
3. Is free from undue stress imposed by mounting bolts or pump setting.
4. The equipment has been tested as required below in paragraphs 3.04 through

3.06 and is in conformance with nominal operating parameters. Test procedures and results shall be included in the report.

5. Is ready for permanent operation on a continuous basis, is free from any known defects and that nothing in the installation will render the manufacturer's warranty null and void.

C. The Contractor's attention is directed to the fact that the services specified for the manufacturer's field engineer represent an absolute minimum acceptable level of service, and are not intended to limit the responsibilities of the Contractor to comply with all requirements of the Contract Documents. The Contractor shall procure, at no additional cost to the Owner, all services required, including additional or extended visits to the jobsite by manufacturer's representatives, to comply with said requirements.

3.05 FIELD TESTS

A. In the presence of the Engineer, the contractor shall conduct such tests as necessary to indicate that the pumps and motors conform to the efficiencies and operating conditions specified. A 30-day operating period of the pumps will be required before acceptance. If pump performance does not meet the specified requirements, corrective measures shall be taken or the pump shall be removed and replaced with a pump which satisfies the conditions specified. All test procedures shall be in accordance with factory test procedures specified above and HI standards for testing or these pump types. Manufacturer certified results of tests shall be submitted to the Owner and Engineer. Provide, calibrate and install all temporary gauges and meters, make necessary tapped holes in the pipes, and install all temporary piping and wiring required for the field acceptance tests. Written test procedures shall be submitted to the Engineer for approval a minimum of 30 days prior to testing.

B. After installation and as soon as conditions permit full speed operation, the contractor shall retain the services of a qualified independent mechanical testing firm to perform a detailed vibration signature analysis of each unit, including both "Bump Tests" and X-Y vibration profiles, to (a) prove compliance with the specified vibration limitations and (b) prove there are no field installed resonant conditions due to misalignment, the foundation, or the connecting piping and its supports, when operating at any speed within the specified operating range. A written report shall be submitted including a sketch of the unit indicating on where and in which direction the vibration readings were taken and recorded showing (a) peak-to-peak displacement, in mils, (b) frequency and (c) peak velocity level, in inches per second. The report shall contain a complete analysis of their findings, describing any problems encountered, if any, probable cause and specific recommendations for any required corrective action.

C. Motors:

1. The Contractor shall check the insulation resistance (megger) of each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

2. The Manufacturer's certified technician shall check all motors for correct clearances and alignment and for correct lubrication in accordance with Manufacturer's instructions. The pump manufacturer certified technician shall check direction or rotation of all motors and reverse connections if necessary.

D. After installation and as soon as conditions permit full speed operation, and in the presence of the Engineer, the contractor shall have the vibration tests performed on each unit to (a) prove compliance with specified limitations and (b) prove that there are no field installed resonant conditions due to misalignment, the foundation or the connecting piping and its supports, when operating at any speed within the specified operating range.

E. If required, take corrective action and have the units retested to ensure full compliance with the specified requirements. All costs associated with the field tests or any required corrective action shall be borne by the Contractor.

3.06 HYDRAULIC FIELD PERFORMNACE TESTING

A. The installation shall be certified correct by the pump manufacturer or certified representative of the pump manufacturer capable of performing all field testing. Testing dates shall be submitted for approval to the Engineer at least two (2) weeks in advance of the first date of testing proposed.

B. The pump manufacturer shall keep a field log of the test data. The manufacturer shall perform all the testing unless otherwise indicated to insure warranty. Upon completion, the test data shall be turned over to the Engineer of Record for the Owner's use.

1. The pump manufacturer shall establish sound Dba at 5 feet from the unit at full speed at design condition in 360 degrees using 90-degree increments. Baffles shall not be used to dampen sound.

2. The pumps shall be run at full speed, taking a minimum of five (5) readings of flow and head. At the full speed setting, one reading shall be at shut-off head conditions, and another reading shall be at the primary duty point. The other three shall be spaced evenly along the supplied pump curves. The readings shall be measured against static settings for suction and discharge based on gauge location to the center line and liquid levels supplying suction to that center line.

3. Amp draw, power factor and voltage will be taken at each point at each speed and recorded for the determination of horsepower drawn.

4. Speed shall be confirmed by use of a speed tachometer and recorded at each point taken.

5. Vibration reading shall be recorded at each test point by the pump manufacturer. These readings shall be in satisfactory range as outlined in the Hydraulic Institute Standards. Readings not taken at full speed shall be compared to the range outlined in the HI Standards and shall conform to those

ranges. Any equipment failing to meet these limits shall be corrected by the pump manufacturer and the contractor, at no additional cost to the Owner.

6. Pumps must be suitable to operate continuously at the specified primary design point without cavitation, excessive noise, or harmful vibration and without exceeding the motor nameplate rating without the use of the service factor. At a minimum, motor and pump vibration in any direction shall not exceed a velocity of 0.15 in/sec and shall not exceed a displacement of 100 um (4.0 mils) at any full speed.

3.07 CERTIFIED PUMP PERFORMANCE CURVES

A. Submit to the Engineer six (6) copies of the certified performance curve for each pump provided, 8 1/2-inch by 11 inch in size, laminated in plastic. The pump curve shall indicate the pump number, type of service, manufacturer, model number, serial number, location in the plant and other data specific to the pump as required above for submittals.

TABLE 11215-1 Raw Water Well Pump Design Criteria

Criteria	Well OM-5
Quantity	1
Pump Service	Raw Water Well Pump
Pump Design Speed, (rpm) (Maximum)	1,800
Pump Column and Discharge Head Assembly Diameter, (Inches) (Maximum)	10
NPSH Available, (Feet) (Maximum)	30
Line Shaft Diameter (Inches) (Minimum)	1.50
Shut-off Head (Feet) (Minimum)	250
Maximum Non-Overloaded Motor Size (HP)	150
Operating Point 2: Design Flow Capacity (gpm)	2,250
Operating Point 2: Design Anticipated (TDH) (Feet)	162
Operating Point 2: Design Point Minimum Pump Efficiency (%)	79
Operating Point 3: Maximum Flow Capacity (gpm)	2600
Operating Point 3: Total Dynamic Head at Maximum Flow (TDH) (Feet)	121
Operating Point 3: Minimum Pump Efficiency at Maximum Flow (%)	68
Discharge Elevation at Plant, (Feet) (NAVD 88)	157.40
Pump Discharge Pipe C.L. Elevation, (Feet) (NAVD 88)	85.89
Anticipated Lowest Well Static Water Level Elevation, (Feet) (NAVD 88)	11.0
Lowest Anticipated Well Drawn Down Elevation @ Design Capacity, (Feet) (NAVD 88)	20.90
Pump Column length (feet)	100
Existing Inner Well Casing Diameter (Actual, Inches)	15.25
Existing Inner Well Casing Depth from Surface (feet)	1,050
Top of Pump Setting Elevation in Well Casing, (Feet) (NAVD 88)	-15.37

END OF SECTION