PUMP CONTROLS SYSTEM

PART 1 GENERAL

1.1 SCOPE

A. Provide a complete Pump Control System for wastewater pump stations by monitoring liquid level in wet well using conductive sensing-type level probe input. For integration with the present BCWS supply system, the controller/RTU shall be the MultiTrode MultiSmart unit. The controller along with all electric power, SCADA radio with its associated components, and the level controls and its associated components are located inside the Pump Control Panel.

B. The Pump Control Panel with all associated appurtenances constitutes the Pump Controls System. Refer to Sewer Panel section 3 of this specification for additional information.

C. The major Pump Control Panel components include: MultiSmart well level controller/RTU, SCADA Radio, Reduced Voltage Solid-State (RVSS) motor starters, shorting (bypass) and isolation contactors, protective relays, intrinsically safe relay, control relays, pushbuttons, 12-Volt DC power supply/battery charger, battery, control power transformer, terminals, circuit breakers, fuses, surge protective device, enclosure, wiring, wire-ways, and all other necessary appurtenances and associated materials lists as indicated on Sewer Panel Section 3 of this specification

D. Major components required in the complete pump control system are specified herein. Other components are not directly specified but are nonetheless required and shall be provided by the pump control panel fabricator as per the attached materials list on the pump control panel drawings. The panel fabricator shall provide a completely operational, prewired, pretested pump control system.

E. Panel Fabricator shall provide and install SCADA communications equipment that belongs inside the Pump Control Panel as recommended by the Communications Equipment supplier(s) identified in Section 1.3 below. The SCADA equipment is specified in Section 2.13 herein. The site Contractor shall provide and install remaining SCADA equipment (antenna, pole, coaxial cable, connectors, Path Study, system radio testing, grounding) that interfaces with the Pump Control Panel in accordance with project design drawings and manufacturer’s recommendations. The SCADA system shall be complete in all regards, and functioning properly per BCWS acceptance.

F. The Pump Control System supplier shall purchase and install new, good quality materials to provide a completely functioning UL 698 or 698A listed system, as intended. Any materials in the material list in Sewer Panel 3J that could possibly jeopardize the panel's UL listing shall be substituted by the Pump Control Panel supplier/fabricator with UL acceptable products. The Contractor is responsible to immediately notify the Engineer of any and all changes to the materials list as a result of this requirement. Detailed justification shall be provided for each substituted part. BCWS and Engineer retain the right to reject or require other components be used per specifications at no additional cost to BCWS. Schedule delays caused by review of substituted parts in the Pump Control Panel are the responsibility of the Contractor.

1.2 SUBMITTALS

A. Section 01300 - Submittals.

B. Shop Drawings: Comply with NEMA ICS 1 and indicate control panel layouts, wiring connections and diagrams, dimensions, and support points. The layout shall exactly match BCWS' control panel drawing. Only BCWS-approved, justified changes are allowed and written approval is required prior to deviation from BCWS' control panel drawings. The Engineer will require 21 calendar days to review design deviations. Schedule for submittal review is the Contractor's responsibility.

C. The Pump Controls System supplier/fabricator shall provide to BCWS and the Engineer a completely "As-Built" set of drawings in ACAD format and in PDF format. Complete materials list, with manufacturer and part numbers shall be included. Drawings and Materials Lists shall be provided on read/write CDs, three (3) copies are required.

D. Product Data: Submit catalog data for each component showing electrical characteristics, physical dimensions and connection requirements. Product Data for components may be provided as PDF catalog cut-sheets on CD, or neatly bound and tabbed in 3-ring binders with table of contents. All component selections shall be highlighted or otherwise outlined to indicate to the Engineer and BCWS which components are selected. If proper marking has not been done, the submittal will be returned to the Contractor without comments and will be unequivocally rejected.

E. Materials used shall be as per the attached material lists at the back of this specification section. "Or-equal" substituted components shall be noted in the panel fabricator's submittal with complete information required in paragraph C above. Only pre-approved substitute parts will be allowed. Any parts substituted that are unapproved will result in panel rejection at the

Contractors' expense. However, the Pump Controls System provider is encouraged to submit better-performing products and/or improved design ideas for review at the proper time.

PART 2 PRODUCTS

2.1 PUMP CONTROL SYSTEM OVERVIEW

A. System Requirements: The controller used for this project shall be the MultiTrode MultiSmart Model MSU3MP advanced microprocessor based pump controller, No exception. Standardization of pump control panel design and interchangeability of parts necessitate this fact. The following major equipment items compatible components shall be used:
   1. Level Controller: MultiTrode MSU3MP with included Motor Protection Monitoring Module, RTU and Flow Monitoring Function.
   2. Level Probe: Multitrode or MPE, 10 12 inch segments, 3 meter (approximately 10 ft) conductive sensing probe. VFD stations will require an ultrasonic level sensing unit for speed control. Flygt LSU100 or Pulsar DBI no substitutions. The probe will be installed as back up.
   3. Intrinsically Safe Barrier: Multitrode Model MTISB-10 or MPE ISB10.
   4. I/O Extension Module: Adams Model 6051.
   5. Flowmeter when required: Toshiba Mount Anywhere 600 series with integral display. Shade protection is required. Flowmeter required on all regional pump stations, stations flow pacing with VFDs, and any station that manifolds into existing FM.

B. The Pump Control Panel shall be provided with a main circuit breaker with handle operator or cutout. All circuit breaker handle operators shall properly fit respective circuit breakers and shall not impede swing-out door operation. Improperly fitted circuit breaker extension handles, or any problems caused by the circuit breaker handles shall be repaired by the Contractor at his expense and at no additional cost to BCWS.

C. Motor protection:
   1. The MultiTrode MSU3MP pump controller shall be used to provide advanced motor protection and data analysis of the system performance as well as integration with SCADA system. The SCADA system is specified in Section 2.13, herein.
   2. Individual RVSS motor starters shall be supplied with a properly sized, line-side, thermal magnetic-type circuit breaker to provide short circuit and ground fault overcurrent protection and act as a disconnecting means. Refer to paragraph 2.8, Motor Starters, below. In pump control panel, auxiliary contact on circuit breaker disconnecting means generates alarm to the MultiSmart controller when in the OFF position. Each motor shall

be provided with an isolation contactor sized per motor nameplate FLA, meeting requirements of NEC 430.32 and these specifications. Reset Push Buttons will be located on the on the inner door and will reset the RVSS fault conditions.

3. For panels serving submersible pumps, each pump motor shall be wired to an electrode relay providing high probe potential for the leak detection system built into the oil filled motor shaft housing. The electrodes will activate if moisture content in the oil sealed area reaches abnormal levels. Electrode activation shall open the control circuit to the pump motor starter preventing possible damage to the pump motor from water ingestion. Pump will be placed out of service until maintenance is performed on the unit and control system reset.
4. For panels serving aboveground suction-lift pumps, provide suitable provisions for motor protection per C.1 and C.2, above.

D. Enclosure: See Section 2.8 herein. All required equipment shall be installed inside a stainless steel enclosure equipped with a subpanel and interior swing open dead front door. The Enclosure is located in a non-hazardous but corrosive location, outdoors exposed to weather. Circuits originating from enclosure extend into an NFPA-820 and NEC rated C1 D2 Group D hazardous (classified) area. Separate all wiring for intrinsically safe circuitry in accordance with NEC Article 504.

E. Electrical Equipment Rack: A rack suitable for supporting the electrical equipment will be fabricated of Stainless Steel or Aluminum. All joints will be welded. Legs incased in concrete will have protective coating specifically designed for the purpose of protecting the associated metal in contact with the concrete and will be applied to a visible level of no less than two inches above the final grade of concrete.

F. System Voltage Protection: Transient Voltage Surge Suppressor (TVSS) or surge protective device shall be provided, prewired inside the enclosure and on the main service. The UL 1449, 2nd Ed., surge protective device (SPD) shall provide 4-mode, line-voltage surge protection for the control panel incoming power supply. The SPD shall have a minimum surge rating of 200kA/phase, with each phase having its own status indicator. Surge current modes are Line to Neutral, Line to Ground, Neutral to Ground, and Line to Line, and each mode shall have a minimum of 100kA/phase protection. The TVSS shall be provided with a line-side, manual disconnecting switch inside the panel to simultaneously disconnect all ungrounded conductors for maintenance. Lead lengths shall be as short as possible. The model shall be resettable and have a minimum of 20-year warranty on the main service and 5-year warranty inside the enclosure. Disposable modules are not acceptable. Design basis for the service is Eaton PTX160 or Total Surge Protection Service Track series. Inside the panel is Leviton 32277-DY3

G. Backup power supplies: Provide a 12 Volt DC supply inside Pump Control Panel for the SCADA Radio system. The system shall accept 120 VAC input voltage and consist of a DC power supply/charger, and battery:
   1. The 12 Volt DC power supply/ charger shall be 55 Watts, minimum, with automatic reset for over currents. Output current 0-4 Amps; ± 0.5% load regulation, ± 1% output voltage is nominal 13.8 VDC with regulation 100 mV Peak-peak ripple. The charger shall be integral with power supply.
   2. The 12 Volt DC rechargeable battery shall be SLA, 12 Ah, with nut and bolt, or spade lug terminations.

H. Remote Alarm Reporting - The Pump Control Panel shall report alarms remotely via the SCADA system. Alarms shall be reported through SCADA for any of the following reasons:
   1. Multitrode Probe indicates a high water level in wet well.
   2. The moisture detection system indicates moisture in the oil chamber between the motor seals.
   3. The motor winding temp switches indicate high motor temperature caused by improper motor cooling or motor overload.
   4. Overload protective devices in motor controls circuit indicate motor overload.
   5. Electrical failure detected by the power failure control relay, or by the phase monitor.
   6. RVSS failure.
   7. Motor branch circuit breaker disconnecting device left in “off” position.
   8. Three phase power monitoring via the Multismart standard input terminals
   9. Other alarm events as shown on the pump control panel drawings.

I. Wiring:
   1. Control wire shall be MTW, 90 degree C, #14 AWG, stranded copper. Signal wiring may be #16 AWG.
   2. All wiring should be neatly grouped in plastic wire trough except wiring from the backplate to the door shall be done in separate bundled harnesses.
   3. All wires shall have a wraparound wire identification number as shown in the wiring diagram at both ends.
   4. All components shall be identified with the same number as shown in the control panel schematic drawings.

2.2 CONTROL SWITCHES AND STATIONS

A. Manufacturers:
   1. ABB.
   2. Siemens
   3. Eaton/Cutler-Hammer.
   4. Square D.
   5. Substitutions: Permitted if approved by BCWS

B. Product Description: NEMA ICS 5, heavy-duty, corrosion resistant devices.

C. Contacts: Form Z, or as required by control panel drawings.

D. Contact Ratings: Class A600.

E. Pushbutton Operator: Non-illuminated, momentary contact, flush type. Use pushbuttons listed as suitable for outdoors, weather-exposed applications.

2.3 MAGNETIC CONTROL RELAYS

A. Manufacturers:
   1. ABB.
   2. Siemens
   3. Eaton/Cutler-Hammer.
   4. Square D.
   5. G.E.
   6. Substitutions: Permitted if approved by BCWS

B. Product Description: NEMA ICS 5, Class A300 magnetic control relay. Relays shall have industry standard wiring and pin arrangements. Control relay coils shall be equipped with appropriate voltage-transient protection.

C. Contacts: Form C, or as selected by panel fabricator.

D. Contact Ratings: Class A150, minimum.

E. Coil Voltage: 120 Volts, 60 Hz. AC; or 12 Volts DC, or as required on drawings.

F. Enclosure: NEMA ICS 6, Type to meet conditions of installation.

2.4 SOLID-STATE CONTROL RELAYS

A. Manufacturers:
   1. ABB.
   2. Siemens

3. Eaton/Cutler-Hammer.
4. Square D.
5. G.E.
6. Substitutions: Permitted if approved by BCWS

B. Product Description: NEMA ICS 5, solid-state electronic relay.

C. Contacts: Form C. or as selected by panel fabricator.

D. Contact Ratings: Class A150, minimum.

E. Coil Voltage: 120 60 Hz. AC, or 12 Volts DC, or as required on drawings.

F. Listing: UL Listed.

2.5 TIME DELAY RELAYS

A. Manufacturers:
1. Diversified electronics
2. Artisan.
3. Siemens
4. Eaton/Cutler-Hammer.
5. Square D.
6. Idec.
7. Substitutions: Permitted if approved by BCWS

B. Product Description: NEMA ICS 5, solid state, sealed switch timing relay. Unit is an initiate switch controlled, delay-on-break timer operating a set of contacts. Select optional timer settings as indicated on drawings.

C. Contacts: NEMA B600, 600VAC, 5 Amps.

D. Coil Voltage: 120 Volts, 60 Hz AC, or 12 Volts DC, as required on drawings.

E. Listing: UL Listed.

2.6 LEVEL PROBE

A. Manufacturers:
1. Multitrode
2. MPE
3. Substitutions: Not Permitted.

B. Probe Model Number: 3.0/10-33 or 115-10-50. 10ea 12 inch zones unless approved by BCWS.

C. Mounting Kit: provide and install matching integral cleaning and mounting bracket with all appurtenances. Hardware is stainless steel.

D. MOTOR STARTERS – RVSS/VFD

E. Manufacturers:
1. Square D. – Design basis is Altistart 48, Y-range, Soft-Start Controller. For Under 20Hp Altistart 22 are acceptable. VFD will be 630 series
2. Yaskawa VFD only GA500/GA800
3. Substitutions: Not permitted without approval.
4. Siemens 3RW RVSS or G120C VFD
5. ABB PSE or ACS310 VFD

F. Reduced Voltage, Solid State Soft-Starters (RVSS): For motors above 7.5 HP.
1. Provide a microprocessor controlled, RVSS for NEMA Design B type, squirrel cage, 3-phase induction motors that meets the following requirements.
2. The electronic “soft starter” shall be UL listed.
3. The manufacturer shall be a certified ISO 9002 facility.
4. The soft starter shall utilize an SCR, or IGBT bridge consisting of at least two power-electronic switches per phase to control the starting and stopping of industry standard motors. It shall provide torque control for linear acceleration independent of motor load or application type without external feedback. The gating of the devices will be controlled in such a manner to ensure stable and linear acceleration ramp.
5. The use of a shorting (or bypass) contactor on-board control relay shall be a standard on soft starters. Protective features and deceleration control options integral to the soft starter shall be available even when the shorting contactor is engaged.
6. The allowed shorting / bypass contactor sizes shall be based upon NEMA ratings, without exceptions. Refer to the table below for motor starter contactor sizes.

G. VFD (Variable Frequency Drives) 6 Pulse Standard
1. Will be required for flow pacing, stations that share force mains, Storage capacity reduction, and for single phase to three phase conversions. These are not typical designs and must be addressed on a case by case basis with BCWS approval. Approved suppliers are the same as the above listed reduced voltage starters

Table of Motor Contactor Sizes

Motor HP	Motor Voltages	Phase	NEMA shorting Contactor Size	Starter Continuous Amp Rating
7.5	230 V	1ø *	2	45
7.5	230 V	3ø	1	27
7.5	460 V	3ø	1	27
10	230 V	3ø	2	45
10	460 V	3ø	1	27
15	230 V	3ø	2	45
15	460 V	3ø	2	45
20	230 V	3ø	3	90
20	460 V	3ø	2	45
25	230 V	3ø	3	90
25	460 V	3ø	2	45
30	230 V	3ø	4	135
30	460 V	3ø	3	90
40	230 V	3ø	4	135
40	460 V	3ø	3	90
50	230 V	3ø	5	270
50	460 V	3ø	4	135
60	230 V	3ø	5	270
60	460 V	3ø	4	135
75	230 V	3ø	5	270
75	460 V	3ø	4	135
100	230 V	3ø	6	540
100	460 V	3ø	5	270
125	230 V	3ø	6	540
125	460 V	3ø	5	270

* On 1ø stations, VFD will be used to convert to 3ø.

2. Contactors shall have continuous current ratings based upon NEMA standards. IEC contactors shall meet or exceed the NEMA starter continuous current ratings above for a particular size to be allowed.
3. RVSS Ratings shall be as follows:
   a. The soft start shall be designed to operate in an ambient temperature 0°C to 40°C (14°F to 104°F). For ambient temperatures between 40°C and 60°C (104°F and 140°F), derate the current by 2% per °C above 40°C (104°F).
   b. Storage temperature range shall be -25°C to 70°C (-13°F to 158°F).
   c. Maximum relative humidity shall be 95%, non-condensing or dripping water, conforming to IEC 60947-4-2.
   d. The soft starter shall be designed to operate in altitudes up to 3300 ft.
   e. The soft starter shall be capable of operation between + / - 10% of nominal voltage rating.
   f. The soft start shall automatically adapt for operation at 50 or 60 Hz, with a frequency tolerance of +/- 5%. By configuration, it will have to be capable of operation at a supply line frequency that can vary by +/- 20% during steady state operation.
   g. The soft start shall be capable of supplying 400% of rated full load current for 23 seconds at maximum ambient temperature. The soft starter shall also be capable of 10 evenly spaced starts per hour at 400% of full rated current for 12 seconds per start.
   h. The SCRs shall have a minimum P.I.V. rating of 1800 Volts AC. Lower rated SCRs with MOV protection are not acceptable.
4. All programming/configuration devices, display units, and field control wiring terminals shall be accessible on the front of the control module. Exposure to control circuit boards or electrical power devices during routine adjustments is prohibited.
5. Digital indication shall provide status on the RVSS, faults, and the motor.
6. RVSS shall have factory preset operational features for normal conditions. Parameters shall be field adjustable through the digital keypad. Motor FLA, starting current limits, linear acceleration ramps, torque adjustments, torque limits, starting time, voltage boost for starting, braking selections, deceleration ramps, braking torque and overload class selections shall be included as field adjustable parameters, as a minimum.
7. RVSS Output relays shall include one (1) NO contact for fault indication, one (1) NO contact for indication that acceleration ramp is complete and current is below 130% of motor FLA, for end-of-start, and one (1) programmable NO contact.
8. Additional RVSS I/O shall be provided as required on the project design drawings as a minimum. Provide two assignable control inputs for the force to freewheel stop, external fault input, disable serial link control, external motor overload reset or general fault reset. Include two assignable logic-level signal outputs for motor thermal overload alarm,

"motor powered" signal, motor overcurrent alarm, or motor underload alarm. Include one analog output for 4 to 20 milliamp indication of motor speed or motor current.

9. Protection - A microprocessor-based motor thermal protection system shall be included which continuously calculates the temperature-rise of the motor and soft starter and provides a motor overload pre-alarm that indicates by relay contact or logic output that the motor windings have exceeded 130% of its rated temperature rise. This function shall be for alarm only. A motor overload fault will stop the motor if the windings have exceeded 140% of temperature-rise. The soft starter shall provide line and motor phase loss, phase reversal, underload, stall, and jam protection. The integral protective features shall be active even when the shorting contactor is used to bypass the SCRs during steady state operation.
10. Communications – To directly connect the RVSS to Modbus, the soft starter will have to include a serial link. The soft starter shall be able to be connected to Ethernet and other networks, with connection to the communication bus as an option. The communication shall be able to provide access to the control, to the adjustment and to the supervision of the soft starter. VFD's will communicate via Modbus/Ethernet on all stations above 50Hp
11. Shorting / Bypass Contactor - A microprocessor shall control the operation of the shorting contactor via an output relay. The shorting contactor shall close, shorting the SCRs after the acceleration ramp is compete and motor current is below 130% of motor FLA, and open on a stop command to allow a deceleration ramp. Overload protection integral to the soft starter shall continue to protect the motor when shorting is engaged as stated in paragraphs 5 and 6 above.
12. Isolation contactor – A NEMA rated isolation contactor is required between the RVSS/VFD and the motor so that the Insulation Resistance Test (Megger) function of the Multismart may be utilized on all Stations unless approved by BCWS
13. Cabinet Cooling in the form of a stainless steel heat exchanger will be required on control panels utilizing an RVSS unless approved by BCWS. Cabinets containing a VFD will require a stainless steel air conditioning unit unless VFD heat sinks extend outside of the cabinet or the VFD's are installed in an air conditioned building.

2.7 CONTROL POWER TRANSFORMER

A. Manufacturers:
1. ABB.
2. Siemens
3. Eaton/Cutler-Hammer.
4. Square D.
5. G.E.
6. Substitutions: Permitted if approved by BCWS

B. Product Description: NEMA ST 1, machine tool transformer with isolated secondary winding. cULus listing file #E61239.

C. Power Rating: 5 kVA, or Less to reduce heat load.

D. Voltage Rating: 480 x 240 Volts primary; 120 Volts secondary.

2.8 CONTROL PANEL ENCLOSURES

A. Manufacturers:
1. Saginaw.
2. B-Line.
3. Hoffman. – Design basis Enclosure and Air Conditioning unit.
4. EMF.
5. Substitutions: per Section 01300.

B. Product Description: Cabinet conforming to NEMA ICS 6, Type 4X, 304 or 316 stainless steel powder coated white – no exceptions. The NEMA rating may be reduced to 3R based upon installation of the Air Conditioner unit and the 3-point, 90 degree turn lockable latch kits that are required on this panel. Panel shall have a hinged, interior door to provide mounting surface for controller displays, labels, and other required components.

C. Pump Control Panel Minimum Size: All pump control panels over 30 HP shall be free-standing, with the panel firmly secured to the finished floor. The minimum allowed free-standing enclosure size shall be 74x60x24 (inches). Triplex stations may be equipped with two (2) side by side free-standing enclosures; however, both enclosures will require separate air conditioners. Accessory feet kits shall be provided with adequate clearance from finished floor such that sufficient space is included to install conduit stub-ups from underground and their associated sealing fittings and hardware and hubs.

D. Equipment racks will be required for additional appurtenances such as the ATS, transformer, weatherproof receptacle, LED light, and mini power zone as required. Racks will be of welded aluminum and structurally capable of

supporting the equipment. Racks may be one or two sided with the control panel facing the wet well and the ATS facing the generator.

E. Shop-fabricate the Pump Control Panel to NEMA ICS 1.

F. Box Size: as required to meet project requirements. Ensure adequate wiring space is provided, and thermal/air flow needs of various components are considered in sizing of enclosure. RVSS usage will require a stainless steel heat exchanger. VFD usage will require a stainless steel air conditioner.

G. Fronts: 304 or 316 stainless steel, fully gasketed, dead-front, surface mounted type with 3-point, quarter-turn latching, lockable door handle with concealed hinge. Hinges shall be completely rust-free under all circumstances. Enclosures, hinges or hardware that rusts, including “surface” rust where pitting is evident, shall cause the entire panel be replaced and any and all associated repair work and materials shall be at the Contractors’ expense and at no additional costs to BCWS. Finish: manufacturer’s standard.

H. Knockouts: performed by field Contractor.

I. Furnish grounded metallic or other acceptable barriers to form separate compartments for wiring of different systems and voltages. Isolate Intrinsically Safe equipment per NEC Art. 504.

2.9 TERMINAL BLOCKS

A. Manufacturers:
1. ABB.
2. Cooper.
3. Eaton/Cutler-Hammer.
4. Square D.
5. G.E.
6. Substitutions: Permitted with BCWS approval

B. Product Description: NEMA ICS 4, terminal blocks.

C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 Volts. Suitable for use with copper wire.

D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 600 Volts. Suitable for use with copper wire.

E. Include ground bus terminal block, with each connector bonded to enclosure.

F. Terminals shall be properly secured to sub-panel or din rails. If conductors are causing terminals to become stressed by over tension, or improper bending space or any other reasons causing the terminals to bend, deform, or become over-burdened, the Contractor shall make repairs at his expense, at no additional cost to BCWS.

2.10 PLASTIC RACEWAY

A. Manufacturers:
1. ABB.
2. Panduit.
3. Hoffman.
4. Thomas&Betts.
5. Substitutions: Permitted as required by panel fabricator.

B. Product Description: Plastic channel with hinged or snap-on cover.

2.11 SCADA Communications Equipment

A. Required Equipment:
1. Radio. Cal Amp Viper model 140-5048-502 or as required by BCWS.
2. Antenna. Laird Y(B)4506 450-480 MHz frequency operation or as required by BCWS.
3. Coaxial Cable. Commscope FSJ4-50B or equivalent
4. Jumper inside panel Commscope RG142-TNMNM-3M or equivalent
5. Surge suppressor. Polyphaser IS-B50LN-C2
6. Coaxial Grounding Kit and miscellaneous appurtenances.
7. SCADA pole will be 65ft class 4 treated wood installed approximately 8ft below grade for final height of 57ft at ground level (AGL). Pole shall not exceed 60ft AGL in any circumstance.
8. Substitutions: Permitted as required by BCWS and SCADA equipment supplier.

B. System Description:
1. All control signals, status signals, alarm and or process variable data generated by the RTU shall be transmitted and received between the central location and the remote site via the SCADA radio communication system. Ensure that Radio Communication of Charleston performs a path study between remote pump station locations and repeaters or master stations as required.
2. The RTU is the Multitrode Multismart Controller with DNP3, flow calculation, logic engine, and ADAMS I/O expansion. The RTU provides signal input to the Radio. Power input to the Radio comes from the 12 VDC power supply unit that is in the Pump Control Panel described in 2.1, G, above.

3. Radio output is transmitted via a coaxial cable to the antenna. The Antenna shall be mounted by Contractor. All coaxial connections or terminations are to be made per the manufacturer's recommendations. Any damaged components, cable, or high losses found or discovered through testing will be repaired by the Contractor at no additional cost to BCWS.
4. Any additional components, testing, or required equipment for a completely operational SCADA radio communications shall be provided by the Contractor at no additional costs to BCWS.

C. SCADA System Assembly
1. The radio, coax surge suppressor, 6 ft. coaxial cable jumper, communications connectors and any other radio required hardware shall be provided to the Pump Control Panel fabricator for installation in the Panel. System shall be completely integrated.
2. Antenna, feed-line coaxial cable, coaxial cable supporting PVC or Nylon insulated straps (to secure coaxial cable to wood pole) and the raceway (heliax) cable bonding/grounding kit shall be provided by RCC to Contractor for installation.
3. Contractor shall install antenna, upper connector and waterproof kit, heliax and grounding/bonding kit in accordance with the scope of work. Additionally, the wood antenna pole, all raceway and raceway supports shall be provided and installed by the Contractor.
4. The Contractor shall ensure the radio installation is completely functional

PART 3 EXECUTION

3.1 EXISTING WORK

A. Where necessary, disconnect and remove abandoned controls and relays remaining at job site. Maintain station electrical service and control at all times except for switchover to new controls. Coordinate with BCWS prior to switchover.

B. Where existing equipment is present, dispose of equipment / materials as directed by BCWS.

C. BCWS may elect to salvage certain equipment. If BCWS decides to salvage any equipment, wiring or materials, it shall be returned to BCWS cleaned and in an undamaged condition. Coordinate with BCWS for a location to store or stage salvaged materials.

3.2 INSTALLATION

A. Install the assembled and pre-tested pump control panel on the electrical equipment rack, or bolt down to the concrete pad if free-standing, as shown on the project design drawings.

B. Install enclosures and boxes plumb.

C. Make electrical wiring interconnections as indicated on Drawings, and as otherwise required for a completely functioning control system.

D. Install engraved plastic nameplates. Pump Controls will be numbered from left to right in the panel Pump 1, Pump2, Pump3 etc. And the installed pumps must match also numbered consecutively from left to right.

E. Ground and bond control panels, raceway, and Intrinsically Safe barriers and relays.

F. Conduits entering the control panel from the wet well must be sealed in accordance with NEC Article 500, Class 1, Group D Specifications Separate wiring for intrinsically safe circuits for the level probe per NEC 504.

G. Clean the enclosure completely, vacuum out any wire strippings, clippings or metallic filings that may be found. Use manufacturer recommended cleaning agents. Improperly cleaned cabinets are cause for rejection of construction work.

H. Digital I/O will be located in accordance to the standard Multismart triplex diagram and the BCWS standard input diagram for all pump station configurations. In duplex stations all of pump 3 I/O will be unused - No Exceptions

I. Primary transformer location identified on the plans. Coordinated by Design Engineer with utility provider (BEC/Dominion) and approved location not to be deviated from unless conflict arises during construction requiring relocation. Power disconnect shall be inside station fencing unless otherwise specified and approved by BCWS.

J. Standard BCWS I/O

INPUT NAME	INPUT NAME	MULTISMART	ADAM 6051
Pump 1 Thermal	Flygt Seal	DI 12	
ABS Seal		DI 13	
Thermal Overload P1	Pump 1 Breaker	DI 14	
Pump 2 Thermal	Flygt Seal	DI 15	
ABS Seal		DI 16	
Thermal Overload P2	Pump 2 Breaker	DI 17	
Pump 3 Thermal	Flygt Seal	DI 18	
ABS Seal		DI 19	
Thermal Overload P3	Pump 3 Breaker	DI 20	
Ultrasonic Level	Level Control	AI1	
Flowmeter Rate		AI2	
Main Breaker Tripped/Off			DI 0
Gernerator Run			DI 1
Generator Fail			DI 2
Pump 1 VFD/SSS Fault	Low Level Float (where required)		DI 3
Pump 2 VFD/SSS Fault	Low Level Float (where required)		DI 4
Pump 3 VFD/SSS Fault	Low Level Float (where required)		DI 5
Utility Power Fail			DI 6
			DI 7
			DI 8
			DI 9
Flowmeter			DI 10
Rain Gauge			DI 11

Column A and B are wired in parallel

Adam Module Inputs DI 7, DI 8, DI 9 are spare inputs

Outputs

Output Name	Output Name	Multismart	Adam 6051
		DO1	
		DO2	
		D03	
		DO4	
		DO5	
		DO6	
		DO7	
		DO8	
		DO9	
		DO10	
	Pump 1 VFD/RVSS Reset	DO11 Bottom Board	
	Pump 2 VFD/RVSS Reset	DO12 Bottom Board	
	Pump 3 VFD/RVSS Reset	DO13 Bottom Board	
	Pump 4 VFD/RVSS Reset	DO14 Bottom Board	
	Pump 5 VFD RVSS Reset	DO15 Bottom Board	

END OF SECTION