

COLLIER COUNTY
ADDENDUM No.8
TO
CONTRACT DOCUMENTS
FOR
BID #18-7305
PROPOSED MASTER PUMP STATION 306.00

The following changes and additional information are hereby made part of the Contract documents:

BID SCHEDULE:

1. Replace Bid Schedule with **revised Bid Schedule** as provided on the BidSync website. The revised Bid Schedule was modified as follows:
 - a. Bid Item 6: (Allowance for FP&L Electrical Service), Unit Price increased to \$20,000.
 - b. Bid Alternate 1 added to Bid Schedule

SPECIFICATIONS

1. Specification Section 01 20 00 Measurement and Payment was modified:
Replace Specification Section 01 20 00 with revised version (Attachment 1)
2. Specification Section 40 93 00 Instrumentation and Control System was modified to address delineation of responsibilities between Contractor, System Supplier, and Programmer.
Replace Specification Section 40 93 00 with revised version (Attachment 2)

DRAWINGS

1. On Sheet I-107: Modify "NEMA 12 Enclosure Dimensions 72"H x 72"W x 24"D" Detail by replacing "19 Compact Panelview" with **"Allen Bradley 15" Panelview Plus 7 Performance Model Terminal"**

2. On Sheet I-108: Replace "19" Compact Panelview local HMI Operator Monitoring Panel" with "Allen Bradley 15" Compact Panelview Local HMI Operator Monitoring Panel"

ATTACHMENT 1

SECTION 01 20 00 MEASUREMENT AND PAYMENT

SECTION 01 20 00
MEASUREMENT AND PAYMENT
(REVISED PER ADDENDUM #8)

PART 1 – GENERAL

1.01 EXPLANATION AND DEFENITIONS

- A. The following explanation of the Measurement and Payment for the Bid Schedule items is made for information and guidance. The omission of reference to any item in this description shall not, however, alter the intent of the Bid Schedule or relieve the Contractor of the necessity of furnishing such as a part of the Contract. Measurement and payment for all Contract Items shall made be in accordance with this section or as modified by the Supplemental Terms and Conditions.

1.02 PAYMENT

- A. Make payment for the items listed on the Bid Schedule on the basis of the work actually performed and completed, such work including but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, clean up, temporary facilities, permitting, restoration of disturbed areas, and all other appurtenances to complete the construction and installation of the work as shown on the drawings and described in the specifications.

1.03 SCHEDULE OF VALUES

- A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with the General and/or Supplemental Terms and Conditions. Submit preliminary schedule of values within 10 calendar days after the Effective Date of the Agreement. Submit final schedule of values in accordance with the General and/or Supplemental Terms and Conditions.
- B. Format: Utilize a format similar to the Table of Contents of the Technical Specifications. Identify each line item with number and title of the major specification items. Identify site mobilization, bonds and insurance. Include within each line item, a direct proportional amount of Contractor's overhead profit.
- C. Revisions: With each Application for Payment, revise schedule to list approved Change Orders.

1.04 ALLOWANCES

- A. Payments from allowances funds included in the project will be made based on lump sum, unit price, or time & materials methods as approved by the County Project Manager. Use of allowance funds must be approved by County Project Manager prior to the execution of the work.

PART 2 – MATERIALS

(NOT USED)

PART 3 – EXECUTION

3.01 MEASUREMENT AND PAYMENT

- A. Make payment on the basis of work actually performed completing each item in the Schedule of Values, such work including, but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, cleanup, temporary facilities, permitting and all other appurtenances to complete the construction and installation of the work to the configuration and extent as shown on the drawings and described in the specifications. Payment for each item includes compensation for cleanup and restorations. Cost of cleanup and surface restorations will be considered as the percentage retained in accordance with the Contract Documents, and complete payment will not be made until cleanup, restorations and as-builts are completed.

- B. Bid Item 1: Jack and Bore

Measurement and payment of the lump sum price shall include full compensation for furnishing all labor, materials, supplies and equipment to complete Jack and Bore work including but not limited to coordination, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper to provide a fully operational pipeline; dewatering, excavation support systems; vibration monitoring; obtaining and complying with all permits required to perform the Work and notifying authorities having jurisdiction (Collier County, FDEP, FDOT, etc.); coordination with the parent parcel owners for work within County easements; maintaining the Work area and site in a clean and acceptable manner; protection of finished and unfinished Work; repair and restoration of Work or existing facilities damaged during construction. Jack and Bore work to be completed during first available dry season (November through April) of construction period, measurement and payment of the lump sum price shall include costs associated with this condition.

- C. Bid Item 2: Force Main and tie-ins

Measurement and payment of the lump sum price shall include full compensation for furnishing all labor, materials, supplies and equipment to complete force main work including but not limited to coordination, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services, and other means of construction necessary or proper to provide a fully operational pipeline; dewatering, vibration monitoring and excavation support systems; obtaining and complying with all permits required to perform the Work and notifying authorities having jurisdiction (Collier County, FDEP, etc.); coordination with the parent parcel owners for work within County easements; maintaining the Work

area and site in a clean and acceptable manner; protection of finished and unfinished Work; repair and restoration of Work or existing facilities damaged during construction.

D. Bid Item 3: Valve Actuators at MPS 302

Measurement and payment of the lump sum price shall include full compensation for furnishing all labor, materials, supplies and equipment to install actuators on existing valves at MPS 302 (including electrical and valve controls) in order to accommodate flow to and from MPS 306 and also flow to the SCWRF; coordination, power, light, heat, fuel, water, tools, appliances, equipment, supplies, bypass pumping and other means of construction necessary or proper to complete proposed improvements; obtaining and complying with all permits required to perform the Work and notifying authorities having jurisdiction (Collier County, FDEP, etc.); maintaining the Work area and site in a clean and acceptable manner; protection of finished and unfinished Work; repair and restoration of Work or existing facilities damaged during construction.

E. Bid Item 4: New MPS 306

Measurement and payment of the lump sum price shall include full compensation for furnishing all labor, materials, supplies and equipment to construct a new MPS 306 facility with complete structural, architectural, civil, mechanical, electrical, I&C, and site work including but not limited to providing new electric and diesel pumps; furnishing and installing piping and valves, bypass pumping, pipe supports, coatings, clearing and grubbing, earthwork, grading, asphalt driveway, concrete slabs, perimeter walls, fence with gates, and tree trimming, wire, fiber, conduit, pull boxes, grounding systems, lightning protection system, transformers, site lighting, disconnects, surge suppression, Variable Frequency Drives, Motor Control Centers, Automatic and Manual Transfer switches, and electrical distribution system, instruments and devices; PLC and HMI supply, installation, programming and programming interface to the County's existing SCADA system; obtaining and complying with all permits required to perform the Work and notifying authorities having jurisdiction (Collier County, FDEP, etc.); maintaining the Work area and site in a clean and acceptable manner; protection of finished and unfinished Work; repair and restoration of Work or existing facilities damaged during construction.

F. Bid Item 5: Decommissioning and Demolition of Existing 306

Measurement and payment of the lump sum price shall include full compensation for furnishing all labor, materials, supplies and equipment for decommissioning and demolition of the existing MPS 306 as shown in the Drawings and specified herein, including but not limited to coordination, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary; obtaining and complying with all permits required to perform the Work and notifying authorities having jurisdiction (Collier County, FDEP, etc.); maintaining the Work area and site in a clean and acceptable manner; protection of finished and unfinished Work; repair and restoration of Work or existing facilities damaged during construction.

G. Bid Item 6: Allowance for FP&L Electrical Service

An allowance has been established for the installation of the new electrical primary service to the pump station. Refer to Specification section 26 05 10 Electrical Work-

General Paragraph J. This allowance item will cover the FP&L fees required to bring the new electrical service from the FP&L power pole to the FP&L transformer. The allowance shall be used for deposits, Contributions-in-Aid-of-Construction (CIACs), and other fees charged by the Florida Power & Light Company in conjunction with the design, planning, permitting or construction of the new electrical service, obtaining and complying with all permits required to perform the Work and notifying authorities having jurisdiction (Collier County, FDEP, etc).

H. Bid Item 7: Allowance for Additional Work as Directed by the Owner

An allowance has been established for additional work as directed by the Owner. The Contractor shall furnish all labor, materials, equipment, and incidentals to complete the additional work requested by the Owner or other changes approved by the Owner. The Owner is not obligated to utilize any of the funds allocated to this pay item. Proposals for allowance work shall be submitted to Engineer for approval prior to initiating work. Final invoices and other supporting documentation shall be submitted for final payment of work.

I. Bid Item 8: Pumper Trucks

The Contractor shall provide a pumper truck for standby when making force main connections. The unit of measurement will be on an hourly basis. Contractor shall furnish all labor, materials, equipment and incidentals required for pumper trucks. Contractor shall coordinate and gain approval from Owner prior to providing pumper truck services.

J. Bid Alternate 1 – Delete Programming

The lump sum deduct for Bid Alternate 1 shall constitute full compensation for deleting Programming from the Contract. Measurement and payment of the lump sum deduct shall include full compensation for deleting all labor, materials, supplies and equipment for programming the Pump Station PLC, HMI, and interface to the County's existing DFS SCADA System as described as the PROGRAMMER's responsibility in Section 40 93 00.

END OF SECTION

ATTACHMENT 2

SECTION 40 93 00

INSTRUMENTATION AND CONTROL SYSTEM

SECTION 40 93 00

INSTRUMENTATION AND CONTROL SYSTEM

(Revised Addendum 8)

PART 1 GENERAL

1.1 SCOPE

- A. Furnish and install, complete with all accessories, a programmable logic control based monitoring and control system with its associated instrumentation as described herein and shown on the contract drawings. The system shall serve as a self-contained monitoring and control system for all aspects of pumping station operation. It shall also be capable of integration with the existing off site Collier County Data Flow Systems Central Telemetry Server through a fiber optic Ethernet TCP/IP connection.
- B. This Specification has been developed to establish minimum requirements for a pump controller. This system shall be designed, constructed, tested and documented in strict accordance with the guidelines of this document. All system construction will be the responsibility of the instrumentation and control (I&C) System Supplier. All materials and labor shall be provided for a fully functional system including any items which are required for system operation but are not specifically addressed in this document or on the contract drawings.
- C. This Specification Section also establishes delineation of responsibilities between Contractor, System Supplier, and Programmer.
- D. This specification is intended to be used in conjunction with all drawings supplied and is not intended to be complete without reference diagrams on system configurations, etc. All bidders must conform to all areas of the documentation. It is the intent of this specification that the Contractor, System Supplier, and Programmer have single source responsibility for the complete control and instrumentation package for the project; including but not limited to flow, pressure, level instrumentation and control, Variable Frequency Drives, and interconnecting conduit and control wiring for total system responsibility.
- E. PLC and I/O block diagrams shown on the Contract Drawings are diagrammatic and supplement performance requirements. Provide a complete system working seamlessly with existing and new equipment.
- F. PLC, HMI and SCADA applications Software Programming: Applications software Programming Services of the PLC, HMI, and coordination of integration into the County's DFS (Data Flow Systems) SCADA system shall be performed by the Programmer. The Owner retains the option to delete the Programming Services from the Contract, and provide Owner Furnished Programming services under a separate contract. Refer to Bid

Alternate 1.

- G. Contractor's support shall include the following:
 - 1. Assistance with On-Site checkout of applications software.
 - 2. Installation, testing and commissioning of equipment and instruments.
 - a. The new control platform is Allen-Bradley ControlLogix Programmable Automation Controller (PLC), where all automatic control tasks are implemented

1.2 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall provide a System Supplier for control panel design, fabrication, wiring, controller configuration, and testing.
- B. The Contractor shall use a Programmer for SCADA Control System programming, including PLC program development and HMI graphics development. The Owner retains the option to delete the Programming Services from the Contract, and provide Owner Furnished Programming Services under a separate contract. A bid alternate describes the deletion of the Programming Services.
- C. Provide all devices, components, software and accessory items necessary for the successful implementation and operation of the instrumentation and control systems.
- D. Complete detailed design of system drawings and selection of system components and accessories.
- E. Emergency warranty service response shall be guaranteed to be a maximum of four-hours between the time of emergency notification and arrival of service personnel on site. An emergency service condition shall be considered to exist when any failed system hardware or software prevents or threatens to prevent the pumping station from fulfilling its intended purpose as determined by the owner or engineer.
- F. Non-emergency service requests shall be responded to within 2 business days. Telephone support for operating procedures and non-hardware problems shall be provided on an unlimited basis during the warranty period.
- G. An unconditional warranty shall be provided for all equipment supplied for Two years from date of final acceptance of system by the owner. THIS WARRANTY SHALL INCLUDE ANY DAMAGES CAUSED BY LIGHTNING INDUCED ELECTRICAL SURGES; ONLY DAMAGES CAUSED BY DIRECT LIGHTNING STRIKES TO THE BUILDING STRUCTURE (AS DETERMINED BY THE ENGINEER) SHALL BE EXCLUDED FROM THE WARRANTY. Theft, fire, vandalism and floods shall be excluded from the warranty except for fire damage which originates at equipment which is provided as part of this work.
- H. Sequencing and Scheduling The Contractor shall provide the following services to allow the software developers to carry out programming of PLCs, HMIs, and DFS SCADA System before start-up.
 - 1. Manage the System Supplier's construction, delivery, installation, and configuration of the control system equipment.
 - 2. Coordinate startup and demonstration of the control system

- equipment with the Programmer's application software development.
3. Coordinate the Programmer's work with the System Supplier and County staff in integration of the control system equipment with the DFS SCADA System.

1.3 SYSTEM SUPPLIERS

- A. The supply and installation of instruments, PLC control panels and control system hardware, including testing, calibration, commissioning shall be performed as a complete system by an approved instrumentation and control subcontractor (System Supplier).
- B. The System Supplier shall provide the Pump Controller Enclosure and Pump Controller System as described in Part 2 of this Section.
- C. The System Supplier shall provide all panel construction and factory testing in a UL 508A approved panel construction facility.
- D. The System Supplier providing this system shall be an instrumentation and control systems contractor who is experienced in and regularly engaged in engineering, installation and service of systems of similar size and complexity within the water treatment industry.
- E. All on site control and instrumentation work is to be performed under the direct supervision of a qualified and experienced supervisor employed by the System Supplier.
- F. The System Supplier shall be required to demonstrate recent past experience in the engineering, design, manufacture, and commissioning of instrumentation and control equipment of comparable size to that being proposed. The System Supplier shall be required to have in-house capability to engineer, design, fabricate, and test all equipment and systems, and to demonstrate a capability of commissioning the equipment in the field.
- G. The System Supplier shall demonstrate five years' experience, all within the last ten years, in the development, integration and commissioning of control systems for the water and wastewater industry. The System Supplier shall show experience in training of customer staff in the use and long term support of installed systems
- H. The System Supplier shall be responsible for coordinating with the equipment vendor under other Sections of these Specifications and under this contract to install the vendor supplied loose instruments and devices that require field installation. The System Supplier shall provide all necessary mounting hardware, piping, wiring etc. for proper operation of the vendor supplied field instruments and devices.
- I. All equipment shall be designed and installed in full conformity with the Contract Drawings, Specifications, engineering data, instructions and recommendations of the manufacturer.
- J. Furnish all materials, equipment, and software (including package software and excluding custom applications software programming), whether indicated in the Contract Documents or not, necessary to effect required instrumentation and control system, subsystem and loop performance.
- K. The System Supplier shall identify the specific staff members, including system engineers, and maintenance engineers that shall be responsible for the control system works specified herein.
- L. Approved System Suppliers are:
 1. C2i (Control Instruments, Inc.), 5253 Oakdale Road, Smyrna, GA, 30082

2. (404) 351-1085.
 2. Revere Control Systems, 3810 Drane Field Road, Suite 16, Lakeland, FL, 33811 (863) 226-0219.
 3. Commerce Controls, Inc., 41069 Vincenti Court, Novi, MI, (248) 476-1442.
 4. Curry Controls Company, 4245 S. Pipkin Road, Lakeland, FL 33811, (863) 646-5781.
 5. Or approved equal.
- M. The System Supplier shall install, startup, and demonstrate functionality of all SCADA Control System hardware and standard (non-application specific) software. All I/O wiring shall be completed and tested to demonstrate interface with the PLC. The System Supplier shall configure the PLC and I/O subsystem to the extent necessary to demonstrate this functionality.
- N. The System Supplier shall provide, install, and configure all network equipment, in close cooperation with County IT staff. Functionality of all network equipment shall be demonstrated by successful “pinging” from a networked device.
- O. Field Devices
1. The System Supplier shall calibrate, test and commission all field instrumentation, PLC panels, HMIs, and control system hardware including all lightning and surge protection, and all peripheral devices necessary based on the Contract Specifications and Drawings.
 2. Provide all field device tags and panel labels.
 3. Sign off the check list on each device installation using Instrument Check and Sign-Off Sheets and other applicable forms. Provide detailed calibration sheet/report on each instrument to the Engineer for approval.
 4. Provide configuration and programming for all microprocessor based equipment including single loop or multi-loop controller, analyzer, networked instrumentation, HART-capable devices, and other intelligent instruments.
 5. Provide all interconnecting cabling between controllers.
 6. Test and commission all instruments and control system equipment.

1.4 PROGRAMMER

- A. Provide the services of a qualified programmer. The Owner retains the option to delete the Programming Services from the Contract, and provide Owner Furnished Programming services under a separate contract as noted in Bid Alternate 1.
- B. The Programmer shall demonstrate competence in providing controls system integration and programming on this type of facility. Provide the services of one of the following PLC/HMI programmers for this project:

CH2M	Brian Stark (386.383.4467)	5801 Pelican Bay Blvd. Suite 505 Naples, FL 34108
	Bill Gramer (239.596.1715)	
Carollo	Joe Hanlon (727.460.2550)	401 North Cattlemen Road Suite 306 Sarasota, FL 34232
	Robert Cushing (941.504.2874)	
Tetra	Mick Jones (734.417.4430)	9970 Bavaria Road Fort Myers, FL 33913

Tech		
	Danny Nelson (239.438.2108)	

- C. The Programmer shall provide a complete sequence of operation narrative describing the control strategy in response to external signals and the signals which will be provided to the process control system during operation of the Master Pump Station. All interlocks and limits which are internal to the operation of the controls shall be included in this description. General requirements for SCADA System operation are included in Part 2 of this Section.

- D. The Programmer shall provide all HMI display programming based on the control narratives. The display shall provide status of the pump station, control of pumps, resetting of faults, and configuration of parameters. The following parameters shall be displayed on the main screen: Pressure, Setpoints for alarms and pump start/stop, Pumps running/stopped, Pump available, Pump fault. The screen will also have buttons to allow the user to access Faults, and Settings. The following parameters shall be available via a user key press from the main screen: Status of all I/O. All parameter settings shall be password protected.

- E. The main screen shall include a Fault button which takes the user to a Fault screen and allows them to check all current and unacknowledged alarms. The fault screen will detail the fault (e.g. VFD fault, seal fault, motor overtemp, over-current, etc.) along with date/time each fault occurred and cleared. A reset option for a fault will be presented to the user when faults can be acknowledged and reset.

- F. The user interface should allow password protected intuitive configuration of the system, including as a minimum:
 - 1. Set-points, including alarm and pump setpoints.
 - 2. Pressure alarms setpoints
 - 3. Start, stop and alarm delays
 - 4. Alternation/ fixed sequence of pumps
 - 5. Assign pre-defined (or user-defined) faults, e.g. thermal overload, contactor fail, to any digital input
 - 6. Zero and span analog inputs

- G. Closely coordinate graphics appearance, functionality, and development with County staff. County will develop DFS graphics, HMI graphics to match DFS graphics to the greatest extent possible. Base graphics design on latest Master Pump Station graphics currently in use in Collier County, as applicable

- H. The Programmer shall provide all Telemetry Control/Monitoring/Alarm Signals as shown on the network block diagram and PLC I/O list in the appendix. Provide virtual data available through the network connections.

Provide virtual, setpoints, alarm settings, time delay settings, operator configurable settings, etc. communicated between the PLC and the Central Station SCADA system.

1.5 SUBMITTALS

Shop Drawings shall be submitted in accordance with General Conditions, Section 013300, and the following:

1. A cover sheet consisting of a Bill of Material, purchase order number, manufacturer's job number, Owner's name, location, application and shipping address.
2. Mechanical layouts detailing the overall external dimensions of all enclosures. Include all pertinent information such as location of door handles, windows, lifting lugs and enclosure mounted items such as pump controller chassis and I/O modules (show cable connections on modules), relays, cooling fans, etc.
3. Details for mounting of the processor, I/O racks, relays, motor starters, disconnect switch, fuse blocks, wireways, etc. All materials shall be labeled to provide easy cross-reference to the Bill of Material listing.
5. Electrical drawings detailing all hardwiring, done by the supplier, to devices such as relays, pump controller modules, disconnect switches, fuse blocks, etc. Provide individual wire numbers and relay contact cross-reference designations.
6. A description of all input and output modules by name, rack, module and terminal location.
7. The last sheet(s) in the set shall describe all terminal block designations and individual terminal numbers.
8. Shop Drawings: Complete master wiring diagrams, elementary schematics and control schematics shall be submitted for approval before proceeding with manufacture. Suitable outline drawings shall be furnished as part of this submittal. Standard or typical pre-printed sheets or drawings simply marked to indicate applicability to this contract will not be acceptable. Shop drawings shall be on standard 24" X 36" or 11" X 17" media; drawn with a computer aided design package. The computer aided design package shall be AUTOCAD. Engineering plan backgrounds of the facility shown on the contract documents will be available to the contractor on request. Submittals shall include reproducible plots of the drawings on CD-ROM electronic copies.
9. A complete drawing indicating each point of interface with the process control system and the type of signal provided or accepted at each point. This drawing shall depict the actual interface terminal block including all circuit designations.

10. A drawing showing the layout of the control panels indicating every device with complete identification.
11. Provide instrument loop diagrams in accordance with ISA-5.4. Identify range of all analog devices. Identify all termination cabinet and panel terminal numbers. Show all loops in their entirety including control wiring within the MCC and between all field devices including those devices furnished under other Divisions. Clearly identify which selector switch contacts are closed in each selector switch position. Identify normally open or normally closed status for all relay and switch contacts. Assign each wire a unique wire number. Show all power sources, grounding, isolation and lightning protection. Show both analog and discrete signals on a single loop diagram. Show where the analog signal ground shield shall be cut and taped. Submit loop diagrams on 11 inch by 17 inch sheets. The loop diagrams shall be bound in a 3-ring 11 inch by 17 inch binder. The loop diagrams shall be sequential by facility and loop number. The title shall include the facility and loop number. Submittals which are not properly ordered will not be reviewed.
12. Provide graphic display diagrams indicating proposed display appearance and functionality.
13. Qualifications of Programmers not specifically listed in Paragraph 1.4B shall be provided with initial shop drawing submittal from Contractor.

PART 2 - PRODUCTS

2.01 PUMP SYSTEM CONTROLLER OPERATION

- A. SCADA System and PLC Programming
 1. PLC application software programming will be completed by the Programmer. Coordinate closely with the Engineer when carrying out all work to demonstrate overall system integrity.
 2. Programmer shall provide testing and commissioning services including those associated with installing and testing application software. Provide qualified staff on-site during PLC and SCADA software testing. Include any additional time necessary to meet the testing and commissioning requirements.
 3. System Supplier shall provide Panel FATs to demonstrate the operational functionality of all PLC panels and SCADA hardware and communications.
- B. The programmable logic controller (PLC) system shall perform all logic operations necessary to sequence and alternate the pumps to accomplish suction pressure control and to ensure equal run times on all pumps. The PLC shall interface with the VFD's through discrete, analog module, and Ethernet interfaces.
- C. The drives will be hardwired control and monitored through an Ethernet connection. Provide start/stop, speed setpoint, speed feedback, drive fault

and not-in-auto hard wired control. All other parameters will be available through an Ethernet/IP connection.

- D. Provide emergency diesel pump monitoring and control. Provide for Modbus RS485 Serial connection to diesel pump control panel. Provide at a minimum, 6 hardwired discrete input one hardwired analog input, and one hardwired analog output. Provide for monitoring and control of parameters listed in PLC-I/O list in appendix.

The control signals to and from the pump control panels shall be as shown in the PLC I/O list in the specifications. Also refer to Section 40 93 00 A for pump control strategy.

2.2 PUMP CONTROLLER ENCLOSURE

- A. The pump system controller shall be housed in a floor mounted free standing NEMA type 12 enclosure. The cabinet shall be arranged to separate the incoming field terminal interface blocks and surge suppression from the PLC I/O signals in the cabinet. See drawing for arrangement details.
- B. Fused terminal blocks shall be provided for all field inputs and outputs. Blocks shall be permanently marked to indicate the appropriate I/O address of each circuit on the pump controller. Surge suppressors shall be provided for all analog and digital inputs and outputs.
- C. The assembled system shall include circuit breakers, fuse blocks and other electrical components as required by the application and in accordance with the standard requirements of the National Electric Code as well as all State and Local electrical code requirements.
- D. All I/O racks, processor racks and power supplies shall be grounded in accordance with the manufacturer's specifications.
- E. All push-buttons, switches and other operator devices shall be UL listed and/or CSA approved and sufficiently large and durable to provide dependable, long life operation.
- F. All cables, plugs, connectors and receptacles shall be designed to withstand an industrial environment.

2.3 PUMP CONTROLLER SYSTEM

- A. Provide an Allen Bradley Control Logix 1756 PLC controller with Panelview HMI operator interface system. Provide PLC system with dual Ethernet modules as shown on the drawings. Provide all analog input modules capable of Hart communications (1756-IF16H HART). Ethernet modules will be connected via Cat-6 (5e) UTP to the Control System Stratix Switch and the SCADA Fiber media converter as shown on the Network Architecture diagrams.
- B. Provide an Allen Bradley Stratix 8000 managed 100 base-T/FL Ethernet switch in the PLC control panel. Provide mixed media Ethernet switch

with minimum 10-port RJ45 10/100Base-TX auto-sensing and 2-port 100Base-FX fiber ports. Provide Allen Bradley Stratix-8000 Switch model# 1783-MS10T and 1783- MX08T expansion module. Provide two Allen Bradley 1606-XLP30E redundant power supplies and alarm module.

- C. Provide a user interface for operations and configuration. Provide an Allen Bradley 15" PanelView Plus 7 Performance Model Terminal.
- D. Provide 4 spare I/O slots with 1 digital input card, 1 digital output card; 1 analog input card and 1 analog output card in addition to the future I/O shown in the I/O table

2.4 Fiber Based Telemetry System

- A. Provide a Modbus Ethernet-TCP/IP communications system from the pump control system/RTU to the central station SCADA system to monitor and control the pump station. Provide for Ethernet communications with the Central Telemetry SCADA system through a single mode fiber connection to the fiber optic backbone as shown on the drawings. Coordinate with the fiber optic contractor for connection to the fiber backbone and facilities for the IP addresses required.

2.5 POWER SUPPLY SYSTEM

- A. The power supplied to the PLC and HMI, shall be protected by an Uninterruptible Power Supply (UPS). UPS shall prevent spikes, sags, surges, noise, and harmonics from adversely affecting equipment. UPS input and output shall be galvanically isolated from one another. Input and output power shall be 120 VAC, 60 Hz.
- B. UPS shall contain internal backup batteries sufficient to allow all connected equipment to run continuously for no less than 30 minutes at full load. Provide load calculations which show these requirements to be met.
- C. UPS shall be a true online UPS with zero switch time, using a continuous no-break connection to ensure no momentary power interruptions.
- D. Batteries shall be a sealed lead acid or gelled electrolyte type which require no special ventilation provisions.
- E. UPS shall be APC Smart-UPS XL, or approved equal.

2.6 PROCESS METERS – Process Meter to talk Ethernet or HART if available.

- A. Process Meters: Provide digital programmable process meters designed for a 4- 20MA current loop display and isolated retransmission of displayed output. Process Meter to talk Ethernet or HART if available. Provide minimum 0.5" high, 4-1/2 digit LED display to

indicate amplitude of current in the current loop and calibrated to engineering process units. In general, a loop current of 4ma corresponds to a display indication of 0 percent and a loop current of 20ma corresponds to a display indication of 100 percent. The meter shall be provided with programmable internal scaling adjustment. Provide units with NEMA-4X faceplate rating constructed of silicone coated Lexan and gasketed for NEMA 4 requirements; circuit boards coated for moisture resistance.

2.7 Relays

- A. Control circuit switching shall be accomplished with relays. These relays, for interfacing and control applications, shall be the compact general purpose plug-in type having low coil inrush and holding current characteristics. A neon status-indicating light shall be provided with each relay. Contact arrangements shall be as noted or shown, and shall be rated for not less than 10 amperes at 120V ac or 28V dc. Coil voltage shall be as noted or shown. Non-latching relays shall have a single coil. Latching relays shall have two coils, unlatching being accomplished by energizing one coil, and latching being accomplished by energizing the other coil. Relays shall have plain plastic dust covers, test buttons, and mounting sockets with screw terminals and holddown springs. Relays shall be UL recognized. Relays shall be Potter and Brumfield, Struthers-Dunn, or equal.
- B. Time delay functions where required separate from the microprocessors shall be accomplished with time delay relays. Units shall be adjustable time delay relays with the number of contacts and contact arrangements as shown. A neon status-indicating light shall be provided with each relay. Contacts shall be rated for 10 amperes at 120V ac. Integral knob with calibrated scale shall be provided for adjustment of time delay. Initial setting shall be as shown with time delay range approximately three times the initial setting. Time delay rangeability shall be at least 10:1. Operating voltage shall be 120V ac, plus 10 percent, -15 percent at 60-Hz. Operating temperature shall be -20 degrees F to 165 degrees F. Repeat timing accuracy shall be plus or minus 10 percent over the operating range. Units shall be Amerace Corp., Control Products Division, Agastat Series 7000, Cutler-Hammer Series D87, or equal.
- C. All relays shall have a screw terminal interface with the wiring. Terminals shall have a permanent, legible identification. Relays shall be mounted such that the terminal identifications are clearly visible and the terminals are readily accessible.

2.8 Electrical Surge & Transient Protection

- A. General: All instrument and control equipment mounted outside of protective structures (field-mounted equipment) shall be equipped with suitable surge-arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges and nearby electrical devices. Surge suppression equipment shall meet or exceed the requirements as specified herein.

Surge suppressors shall be as manufactured by EDCO, Inc., of Ocala, Florida.

B. Suppressor Locations: Surge suppression equipment described herein and indicated on the contract drawings shall be installed in the following locations: At the point of connection between each equipment item and its power supply conductors (direct wired equipment).

C. Power Supply Suppressor Assemblies: Provide suppressors suitable for connection to 120-volt, single-phase power supply. Suppressors shall be EDCO "HSP-121 SERIES", or equal, and shall meet or exceed the following requirements:

1. Suppressors for direct wired equipment shall be provided with two 3- terminal barrier terminal strips capable of accepting no. 12 AWG solid or stranded copper wire. One terminal strip shall be located on each end of the suppressor unit.
2. Suppressors shall be epoxy encapsulated within a phenolic nonflammable enclosure with provision for mounting to interior of equipment racks, cabinets or to the exterior of free standing equipment. Epoxy encapsulation shall be flame retardant.
3. Suppressors shall be constructed as multistage devices. The first stage shall be a high energy metal oxide varistor element. The second stage shall consist of fast acting high power bipolar silicon avalanche devices. First and second stages shall be interconnected through a series air core inductor of sufficient current carrying capacity to permit a continuous operating current of 15 amperes.
4. Suppressors shall meet or exceed the following performance criteria based on a test surge waveshape of 8 times 20 microseconds.
Maximum Operating Voltage:
130V ac Minimum Breakdown
Voltage: 150V ac Maximum
Operating Current: 15 amps
Response Time: 5 nanoseconds
Peak First Stage Clamping Voltage: 20,000
amps Maximum First Stage Clamping Voltage:
350 Volts Maximum Second Stage clamping
Voltage: 210 Volts Pulse Life Before Failure:
2,000 occurrences

D. Analog Signal Cable Suppressor Assemblies: Suppressors shall be EDCO SRA or DRS Series, or equal. Provide EDCO type SS64 surge suppressors at all loop powered instrument locations. Suppressors shall be epoxy encapsulated within a phenolic enclosure and stainless steel for SS64 units. Suppressor Assembly shall be flame retardant. Suppressor assemblies shall be four lead devices and shall include a threaded mounting/grounding stud. Suppressors shall meet or exceed the following performance criteria based on a test surge waveshape of 8

times 20 microseconds:

1. Components: Hybrid circuit consisting of a 3 electrode gas tube and silicone avalanche devices to clamp each line to ground. High energy gas tube and silicone avalanche devices shall be separated by a series impedance.
 2. Recovery: Automatic
 3. Peak Surge Current: 10,000 amps
 4. Pulse Life Before Failure: 100 occurrences
 5. Response Time: 5 nanoseconds
 6. Minimum Voltage Clamp Rating: 40 volts
 7. Series Impedance: 24 ohms total
 8. Temperature Range: -40 degrees C to +85 degrees C
 9. Operating Voltage: Less than 30V dc
 10. Operating Current: 4 to 20 Ma dc
 11. Resistance Line to Ground: Greater than 1 megohm
- E. Hybrid power and analog signal suppressor assemblies. Suppressors shall be EDCO SLAC units or approved equal.
- F. Surge suppressor input (unprotected) and output (protected) wiring shall be kept segregated at the point of connection to the surge unit and external to the unit. Do not route unprotected cable adjacent to protected cable.

2.9 SPARE PARTS

NONE.

PART 3 – EXECUTION

3.1 General Testing Requirements

- A. All system start-up and test activities shall follow detailed test procedures, check lists, etc., submitted and previously approved by the Engineer. The Engineer shall be notified at least 21 days in advance of factory system tests and reserves the right to have his and/or the Owner's representatives in attendance.
- B. Duration of on-site testing, start-up, and commissioning activities is expected to be up to eight weeks. On-site presence and assistance by the Contractor, System Supplier, Programmer, and other subcontractors may be required at any time during this period.
- C. The Contractor shall provide the services of experienced factory trained technicians, tools and equipment to field calibrate, test, inspect, and adjust all equipment in accordance with manufacturer's specifications and instructions.
- D. The Contractor shall maintain master log books for each phase of installation, startup and testing activities specified herein. Log book shall include signal, loop or control strategy tag number, equipment

identification, description and space for sign-off dates, Contractor signature and Engineer signature. Example test documentation specific to each phase of testing shall be approved prior to initiation of that testing, as specified here.

- E. All test data shall be recorded on test forms, previously approved by the Engineer. When each test has been successfully completed, a copy of all test results shall be furnished to the Engineer together with a statement that all specified test requirements have been met and that the system is operating in accordance with the Contract Documents.
- F. Involve County staff in field testing and startup activities.

3.2 Unwitnessed Factory Acceptance Test (FAT) shall be completed by System Supplier

- A. Scope: Inspect and test system to ensure it is operational, ready for delivery.
- B. Location: System Supplier's factory.
- C. Integrated Test
 1. Interconnect and test system, except for primary elements.
 2. Include PLCs, HMIs, and network hardware.
 3. Configure all devices to the extent necessary to demonstrate integrated functionality.
 4. Exercise and test all functions.
 5. Simulate inputs and outputs for primary elements, final control elements, both discrete and analog.
 6. Submit internal, signed QA/QC reports to the Engineer for approval.

3.3 Software Factory Acceptance Test (Software FAT) shall be completed by the Programmer.

- A. Test software programs to verify operation in conformance with process design, instrumentation, and control equipment installation.

3.4 Installation

- A. The work included in this section consists of furnishing, installing and placing in operation the instruments and appurtenances, including all conduit, wiring and circuitry, necessary to provide the Owner with a fully operable system properly calibrated and installed.
- B. Include the services of a factory trained, certified service engineer of the equipment manufacturer to inspect the complete equipment installation to assure that it is installed in accordance with the manufacturer's recommendations, make all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment furnished.
- C. Provide continuous protection of the installed instrumentation equipment from the elements, moisture, construction damage, dust, debris, paint spatter or other conditions which will adversely affect the unit operation until such time as the equipment is scheduled for start-up testing.
- D. Install and mount equipment in accordance with the Contract Documents, manufacturer's instructions and installation detailed shop

drawings. Mount equipment so that they are rigidly supported, level and plumb, and in such a manner as to provide accessibility; protection from damage; isolation from heat, shock and vibration ; and freedom from interference with other equipment, piping, and electrical work. Do not install field enclosures, cabinets, and panels until heavy construction work adjacent to the equipment has been completed to the extent that there shall be no damage to the equipment.

- E. Locate devices, including accessories, where they shall be accessible from grade, except as shown otherwise.
 - F. Coordinate the installation of the electrical service to components related to the system to assure a compatible and functionally correct system. All accessories shall be coordinated and installation supervised by the Contractor.
- 3.5 Loop Checks shall be completed by System Supplier and Contractor/electrician.
- A. Prior to control system startup and testing, each monitoring and control loop shall be tested by the Contractor on an individual basis from the primary element to the final element, including the PLC I/O module and PLC data table, for continuity and for proper operation and calibration.
 - B. Signals from transducers, sensors, and transmitters shall be utilized to verify control responses. Simulated input data signals may be used subject to prior written approval by the Engineer. All modes of control shall be exercised and checked for proper operation.
 - C. The accuracy of all analog inputs shall be verified using field inputs or by manually applying input signals at the final controller, and then reading and recording the resulting analog input data at the PLC.
 - D. Final control elements and ancillary equipment shall be tested to verify that proper and stable control is achieved using local area control panels, motor control center circuits, and local field mounted control circuits. All hardwired control circuit interlocks and alarms shall be operational. The control to final control elements and ancillary equipment shall be tested using both manual and local automatic (where provided) control circuits.
 - E. Each loop tested shall be witnessed, dated and signed off by both the Contractor and the Engineer/owner upon satisfactory completion.
- 3.6 Calibration
- A. Calibrate each instrument in the factory before shipping and furnish with the calibration data and the certification of calibration.
 - B. The service technician shall calibrate all instruments and components of the instrumentation system with field adjustable ranges and/or settings after installation in conformance with the manufacturer's instructions, the Contract Documents and the reviewed shop drawings. Set each instrument and components for the specific conditions and intended application as specified for this installation. Replace defective instruments and components which cannot achieve correct calibration of stated accuracy, either individually or collectively within the system.

- C. Certify in writing to the Owner that all calibrations have been completed and the instrumentation system is ready to be operated. Provide instrumentation calibration sheets in the O&M manuals for future reference for both factory and field calibration tests. Calibration certification documents shall be available on site at the time of substantial completion. Certification documents shall include the signature of the service technician performing the calibration.

3.7 Start-Up Supervision

- A. Following installation, mounting of all equipment, successful completion of loop testing, and completion of instrumentation calibration, prepare for and conduct start-up of each subsystem.
- B. The System Supplier shall provide a qualified service technician to inspect all final connections and check the system prior to start-up of the systems. The service technician shall coordinate with the owner's representative for functional check-out of the complete system.
- C. The Programmer shall provide a system software engineer on site during startup of the Master Pump Station to make adjustments to the Control Computer/ Operator Interface and tune the system as deemed necessary by the engineer.
- D. The System Supplier's personnel shall be available for support of equipment operating and maintenance activities for the duration of the facility start-up period.
- E. At least two qualified control systems technician shall be provided by the Contractor when loop checkout is being performed and at least one for all other control system startup and test activities
- F. The System Supplier's startup personnel shall be present and coordinate with all other startup and testing activities especially the pump, odor control, standby power system and variable frequency drive startups.

3.8 Field Testing

- A. All system start-up and test activities shall follow detailed test procedures, test report, check lists, etc., submitted and previously approved by the Engineer.
- B. Control system start-up and testing shall be performed to ensure that all Master Pump Station processes shall be systematically and safely placed under digital control in the following order:
 - 1. Primary elements such as transmitters and switch devices shall be calibrated and tested as specified.
 - 2. Each final control element shall be individually tested by Contractor. System supplier and Contractor/electrician

3. Each instrument and control loop shall be tested by System Supplier and electrician, with assistance from the Programmer.
 4. Each subprocess shall be started and tested in Local control.
 5. Each subprocess shall be tested in Manual control from the PLC and HMI.
- C. Verify that each instrument, meter, and gage has been properly installed, connected, grounded and calibrated. Perform three-point calibration on continuous elements and systems. Provide calibration records.
 - D. Verify that the inputs/outputs functions of each instrument conform to the requirements of the application.
 - E. Assist with exercising each system as defined by each loop description through operational tests to demonstrate that it performs as intended on a continuing basis and to demonstrate the integrity of the system.
 - F. After the field testing has been demonstrated, a date for system start up involving the Owner's operating personnel will be scheduled as agreed to by the Owner. Notify Engineer fourteen (14) days prior to initial start-up of each item of equipment

3.1 Start-Up and Commissioning

- A. Following successful start-up and testing of all processes, control loops, instrumentation, and equipment, conduct an integrated startup of the Master Pump Station and Control System.
- B. Begin by operating the station in Remote Manual mode. Sequentially convert equipment and control loops to Automatic mode for test and verification of intended operation.
- C. Start-Up and Commissioning shall be completed by the Programmer with assistance from the System Supplier and Contractor.
- D. Perform Contractor's initial start-up and functional test prior to demonstration for Owner and Engineer.
- E. Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during entire start-up process.
- F. Provide control diagrams that show actual control components and wiring.
- G. Provide ISA 5.4 loop drawings that include all revision during construction.

- H. Coordinate sequence for initial start-up of various items of equipment.
- I. Start up and test the instrumentation equipment with the entire system operational.

3.2 Site Acceptance Test (SAT)

- A. When initial site inspections and commissioning of the instrumentation and the control system is satisfactorily complete, schedule with the Owner, Engineer, System Supplier, and Programmer to demonstrate the entire system is ready for final demonstration and acceptance.
- B. Demonstrate the proper operation of all field physical input and output signals of the PLC, and HMI systems under actual operating conditions to the satisfaction of the Engineer. This includes proper operations and communications between PLCs, and all peripheral devices. Supply all labor, instruments and materials to perform the testing.
- C. SAT test plan shall be developed and submitted to the Engineer for approval no later than ten (10) working days prior to the schedule start of SAT. Include:
 - 1. Roles and responsibilities of SAT team participants.
 - 2. SAT schedule.
 - 3. Any safety or process-related considerations.
 - 4. Procedure for performing tests.
- D. Scope
 - 1. Demonstrate that equipment, standard software, and application software has been properly installed and is fully functional.
 - 2. Perform functional and performance tests under supervision of responsible System Supplier, Programmer, and Contractor personnel. Representatives of Owner and Engineer shall witness functional test
 - 3. Verify all data communications required for remote Pump Station DFS SCADA operation.
- E. Perform functional and performance tests on each piece of equipment and operational section. Demonstrate that equipment operates and complies with specified performance requirements. Demonstrate that control panel functions, including failures and alarms, operate and comply with specified performance requirements.
- F. Functionally test failures and alarm conditions; or if approved by engineer simulate by jumping failure input terminals. Provide signal generators that simulate control conditions if it is not feasible to create actual conditions. Testing activities shall include the simulation of both normal and abnormal operating conditions.
- G. Use Operation and Maintenance manuals, loop descriptions, submittals, graphic screens, etc. to demonstrate operation of equipment. Use actual as-built control diagrams in demonstration of functions
- H. No later than five working days after the completion of SAT, a SAT test report shall be submitted to the Owner. At minimum the SAT test report shall include:
 - 1. Description of any deviation from the SAT test plan.
 - 2. Summarize test results.
 - 3. Explain any deficiencies and plans for corrective action.
- I. Deliver all testing software, panel keys etc. to the Engineer.
- J. Deficiencies
 - 1. SAT Deficiencies shall be corrected and successfully retested prior to applying for Final Acceptance.

3.3 SCADA Network Security

- A. System Supplier and Programmer shall comply with the County's SCADA Network Security for the scope of work under this Contract. Contractor, System Supplier and Programmer shall support SCADA Network Security implementation activities.
- B. System Supplier, Programmer, and Contractor shall contact County's SCADA Group for the details on County's SCADA Network Security Standards, and shall comply with all requirements.

3.4 WARRANTY

- A. All work products mentioned herein must be warranted by the supplier for a period of Two (2) years from the date of system turnover; final acceptance.

3.5 TRAINING

Training shall be provided as described below by System Supplier and Programmer:

- A. Phase 1 Training
 1. The first phase of training shall include: one (1) day operator training, and two (2) days Controls system maintenance training including software maintenance training.
 2. Phase 1 Training shall not occur until after completion of successful startup/commissioning, and Substantial Completion. Provide training while equipment is fully operational.
 3. Training shall not occur until after review and approval of system O&M manuals. Use accepted Operation and Maintenance manuals as the basis of instruction.
- B. Phase 2 Training
 1. The second phase of training shall include one (1) day for review of Phase 1 Training, including basic operator training, Controls system maintenance, and software maintenance.
 2. Days two and three of Phase 2 training shall include control system operational details, instrumentation and control equipment maintenance instruction, and training on additional details as requested by the owner's personnel.
 3. Phase 2 training shall occur a minimum of four (4) weeks following Substantial Completion and completion of Phase 1 training, and prior to Final Completion. Coordinate Phase 2 training dates with the Owner.
- C. Training shall not occur until after completion of successful functional testing and performance testing. Provide training while equipment is fully operational
- D. Training shall not occur until after review and approval of system O&M manuals. Use accepted Operation and Maintenance manuals as the basis of instruction.
- E. Submit to Engineer not less than 14 days prior to each training session an outline of the training program and the qualifications of

the trainer(s).

- D. Training services are exclusive of travel time to and from the facility. The times specified shall not be construed as to relieve the manufacturer of any additional visits to provide sufficient service to insure equipment is in satisfactory and continuous operation.

END OF SECTION