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ADDENDUM NO. 4

Date:	**January 5, 2024**
Project Name:	**Coddle Creek WTP Sodium Hypochlorite System Upgrades**
Owner:	**City of Concord, NC**
Owner Bid No.:	**2606**
Garver Project No.	**22W41300**

This addendum shall be a part of the Plans, Contract Documents and Specifications to the same extent as though it were originally included therein, and it shall supersede anything contained in the Plans, Contract Documents, and Specifications with which it might conflict. This addendum, including all attachments, shall become part of the Contract and all provisions of the Contract shall apply thereto, with exception of the items listed under "Other Project Information" at the end of this Addendum No. 4, which are supplements provided for the Contractor's convenience. The time provided for completion of the Contract has not been changed as noted in this addendum. Acknowledgement of receipt of this addendum must be noted in the appropriate section of the Bid Form and included with the Contract Documents.

A. SPECIFICATIONS – Volume #1

1. Replace Section 40 61 13 – PROCESS CONTROL SYSTEM GENERAL PROVISIONS with the attached revised specification section of the same title.
2. Remove Section 40 63 43 – PROGRAMMABLE LOGIC CONTROLLERS. This will be the responsibility of the Automation System Provider as identified in revised Section 40 61 13.
3. Remove Section 40 68 63 – PLC AND HMI PROGRAMMING. This will be the responsibility of the Automation System Provider as identified in revised Section 40 61 13.

B. STANDARD DETAILS - Volume #1

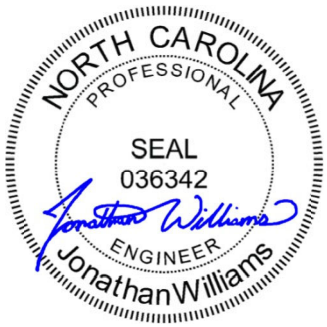
1. No items for Standard Details are included in this addendum.

C. DRAWINGS - Volume #1

1. No items for Drawings are included in this addendum.

D. OTHER PROJECT INFORMATION

1. Note, this Addendum No. 4 shall supersede Addendum No. 3 (issued 1/3/2023) and hereby replaces the revisions outlined in Addendum No. 3.



By: _____

Jonathan Williams, P.E.
Project Manager

Digitally Signed on 01.05.2024

Attachments: Revised Section 40 61 13 – PROCESS CONTROL SYSTEM GENERAL PROVISIONS

END OF ADDENDUM NO. 3

SECTION 40 61 13 – PROCESS CONTROL SYSTEM GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. The work to be included under this section shall consist of furnishing all materials, labor, equipment, tools, supplies, and incidentals necessary for the installation and testing of all process control systems.

B. Related Sections:
1. Section 40 61 96 – Process Control Descriptions
2. ~~**Section 40 63 43 – Programmable Logic Controllers**~~
3. Section 40 67 23 – Control Panels
4. Section 40 70 00 – Instrumentation for Process Systems

1.2 REFERENCES

A. Definitions: Symbols, Definitions, and Abbreviations: All symbols, definitions, and engineering unit abbreviations utilized shall conform to IEEE 100-84, S50.1, and S51.1, where applicable.
1. SCADA – Supervisory Control and Data Acquisition
2. HMI – Human Machine Interface (Graphical Screens, Text Displays)
3. OIT – Operator Interface Terminal
4. PLC – Programmable Logic Controller
5. I/O – Input/Output
6. VFD – Variable Frequency Drive
7. SSRVS – Solid State Reduced Voltage Starter (“Soft Starter”)
8. RTU – Remote Telemetry Unit
9. MTU – Master Telemetry Unit
10. MCC – Motor Control Center
11. Operating Program – Operating system, SCADA, or other core software.
12. Integrated Operating Platform – System of installed, connected, and configured hardware, operating programs, and networking equipment.
13. PLC and HMI Programming – Software configuration of operating programs to implement process control strategies.
14. Control System Specialist – a company specializing in process control hardware and software, including instrumentation, PLCs, networking, installation, and configuration.
15. **Automation System Provider – a company specializing in automation control systems, PLC panel fabrication, and control system integration.**

1.3 QUALITY ASSURANCE

A. The Contractor shall designate in writing the qualified Control System Specialist, including a detailed listing of the firm, resumes and work history of each person working on the project, and project specific references. The qualifications of the Control System Specialist shall be subject to approval of the Owner and the Engineer.

B. The minimum qualifications for the Control System Specialist shall include:
1. An established firm in operation as a control and automation company for a minimum of 5 years, with demonstrated water and wastewater industry experience.
2. Staffed with experienced personnel capable of executing the required aspects of the project.

1.4 SCOPE OF WORK

A. The Contractor shall engage the services of a Control System Specialist, who shall furnish all materials, equipment, labor, and services to achieve a fully functional process control system for this project**, except for those materials and services specifically excluded herein to be provided by an Automation System Provider.**

B. The Control System Specialist shall be responsible for providing and installing all instrumentation, **PLC** control panels, ~~**computer equipment**~~, networking equipment, and other control system hardware as specified for a complete process control system installation.

C. **Items specifically excluded from the Control System Specialist's scope of work, and to be provided by the Automation System Provider, includes:**
   1. **Fabrication, provision, and testing of the PLC control panel (04CP1). Installation of the PLC panel shall be provided by the Contractor.**
   2. **Programmable Logic Controller (PLC) programming.**
   3. **Operator Interface Terminal (OIT) and Human Machine Interface (HMI) graphics development and configuration.**

D. **The Automation System Provider providing the PLC panel and programming and integration services for this project, under separate contract with the Owner, is Fortech, Inc. The Control System Specialist shall provide support services to the Automation System Provider as defined herein.**
   1. **Fortech contact information: Jon Forrest, PE, 2124 Wilkinson Blvd, Charlotte, NC 28208, (704)-333-0621**

E. In general, the Control System Specialist shall perform the following tasks:
   ~~1. Provide PLC programming and HMI screen development to implement process control of equipment as described within Section 40 61 96 – Process Control Descriptions.~~
   2. Furnish, install, configure, and calibrate instrumentation as detailed on the drawings and in the specifications.
   3. Fabricate and install all control panels as indicated in the drawings, except for those provided as part of a vendor supplied equipment package. Terminate all field control wiring inside **all** control panels.
      a. Where existing control panels are being replaced with new, field investigate and develop as-builts of the existing instrumentation and control installation to identify and label all I/O and communication wiring entering the existing panels. The contractor shall be responsible for properly identifying and labelling all existing wiring and re-connecting to the new control panel. Perform point-to-point wiring checks and startup testing for re-connected existing components and wiring following the same requirements as new equipment.
   4. Provide all hardware required to properly communicate between all control panels and remote sites, whether or not explicitly identified in the drawings or specifications.
   5. Install networking equipment and communication cables between control devices as indicated in the drawings and specifications. Provide configuration of equipment, including network switches and firewalls, to ensure proper communication between all devices associated with the integrated operating platform.
   6. Provide all instrumentation and control device relocation work associated with the relocation of equipment, including disconnecting all existing wiring and conduit and terminating, calibrating, and replacing service to relocated equipment.
   7. Modification to existing instrumentation and control systems as required to new and existing equipment to maintain process operations.
   8. Provide overall coordination, installation, supervision, and installation of control panels, instrumentation, computer hardware, networking systems, and other miscellaneous control system components as specified.

9. Provide coordination with the Contractor and participate in all meetings as directed by the specifications or Contractor.
10. Execute the testing procedures outlined in this document.

F. Vendor system packages may be provided under other sections of this contract that may interface with the process control system via communications protocol and/or hard-wired I/O. Refer to the associated specification sections and the contract drawings for additional details. The Control System Specialist shall be responsible for coordination, furnishing, installing, and configuring any communication devices or drivers necessary to ensure proper communication with each of the vendor-furnished systems.

G. Vendor system packages may include instrumentation or control panels that shall be installed and configured by the Control System Specialist according to vendor instructions. Upon satisfactory installation, configuration, and calibration, the Control System Specialist shall coordinate with each vendor to inspect finished work. The Control System Specialist shall submit documentation indicating that the vendor has inspected and approved the installation.

1.5 SUBMITTALS

A. Product Data:
1. Instrument Installation Details.
2. Certified Calibration Sheets.
3. Complete and detailed instruction manuals on each item furnished including but not limited to all devices and instruments. Information to be contained in the instruction manuals shall include but not be limited to drawings, dimensions, manufacturer's recommendations, ratings, performance charts, power requirements, schematics, maintenance requirements and procedures, calibration recommendations and procedures, repair instructions, complete and recommended spare parts lists and related information.
4. Proposed tagging and attachment materials and methods.

B. Shop Drawings shall be submitted for approval by the Engineer.
1. The Contractor shall submit to the Engineer, for approval, Shop Drawings of the equipment to be installed to meet the Specifications. The Drawings shall be supported by notes or written directions as required to fully define the installation. The submission shall be made as soon as feasible after award of the Contract and, in any event, shall be submitted and approval obtained before installation of the equipment.
2. The information required on the Shop Drawings shall include, but is not necessarily limited to, the following:
    a. Full and complete specifications covering the equipment proposed to be furnished.
    b. Detail Drawings showing plan, network connections and elevation dimensions of the equipment proposed to be furnished.
    c. Guarantees of performance of the equipment proposed to be furnished.
    d. Nearest location of factory maintenance and service facilities that will be available to service the equipment offered.
    e. To scale plans, sections and elevations detailing entire installation. Include mounting hardware, brackets, assemblies, and other devices as required for a complete installation.
3. Control panels:
    a. Panel and sub-panel layout
    b. Point-to-Point Wiring and Interconnection Diagrams
    c. System hardware

C. Contract Closeout Submittals:
1. Project Record Documents
2. Operating and Maintenance Data
3. Warranty

4. Final as-built copies of documented PLC and HMI programs for vendor supplied equipment packages, on electronic media, suitable for future troubleshooting or modifications by others.

D. Instrumentation and control testing documents shall be submitted for approval by the Engineer:
   1. Credentials of technicians doing the inspection and testing.
   2. Written certification as detailed under testing requirements in this specification section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Delivery, storage, and handling shall be in accordance with Manufacturers' recommendation and the requirements of other sections herein.

1.7 PROJECT AND SITE CONDITIONS

A. Environmental Requirements: Instrumentation and control elements may be installed outdoors exposed to sun, rain and excessive humidity and shall be capable of continuous operation without significant reduction of their operating life under the following ambient conditions:

Temperature	-25 °C to 80 °C
Pressure	650 mm Hg to 800 mm Hg
Relative Humidity	20% to 100% condensing
Vibration Frequency:	10 - 2000 Hz.
Vibration Position	1.5 mm peak-to-peak
Vibration Acceleration	10 G.

B. Where the ratings of individual components cannot meet the requirements, provide suitable means of physical protection. Suitable physical protection shall consist of an assembly which meets the requirements listed, while limiting the ambient conditions at the non-conforming component to 90% of the component's rating (Example: A component rated for vibration at only 5 G. acceleration would be required to be combined with vibration isolation to limit the acceleration of the component to 4.5 G. when subjected to ambient acceleration of 10 G. from 10 - 2000 Hz.).

C. Operating Environmental Conditions: All instruments and control devices provided shall be rated for continuous operation in their installed operating environment and shall be capable of continuous operation at the operating conditions without significant reduction of their operating life.

D. All controlling devices shall be NEMA or IEC rated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. All meters, instruments, control units, and other components shall be the most recent field proven models marketed by their respective manufacturers at the time of the submittal of the shop drawings unless otherwise specified to match existing equipment.

B. Analog measurements and control signals shall be electrical and shall vary in direct linear proportion to the variable being measured. All analog signals whether inputs or outputs shall be 4-20mA DC unless otherwise noted. The analog input signals shall maintain loop integrity with the installation of properly sized resistors across the input terminals. Provide surge protection for all analog signal terminations.

C. All of the elements, instruments, accessories, and assemblies shall be installed in accordance with the manufacturer's installation instructions, and as detailed on the Drawings. Shielded instrumentation cables shall be used for all analog signals from the instruments to the programmable logic controller panels. Separate conduits shall be used for instrument power, instrument signals, and fiber optic cables.

D. All instruments installed outdoors subject to direct sunlight shall include a stainless-steel sunshade.

E. All digital outputs shall be isolated from the field equipment through an interposing relay. The relays shall be mounted inside the cabinet housing the associated programmable logic controller as shown on Drawings.

F. The Contractor shall make the necessary power connections and signal connections from the field devices (i.e., instruments, control valves, etc.) to the programmable logic controllers.

G. The Contractor shall configure and verify proper operation of the Integrated Operating Platform, included but not limited to the following requirements:
   1. The computers, PLCs, OITs, networking hardware, surge protection devices, uninterruptible power supplies, and other incidental equipment shall be configured and installed as shown on the Drawings and as specified herein.
   2. All networked devices shall be configured for proper communication via the topology and protocol shown on the Drawings or specified herein.
   3. Verify that all system devices power up, function, and properly communicate prior to commencing any startup or testing procedures as described herein.

3.2 SYSTEM WIRING COORDINATION

A. The Control System Specialist shall develop complete point-to-point interconnection wiring termination sheets for all control connections to be provided for the project. The sheets shall identify all external interconnecting wiring associated with all new control panels or existing control panels.
   1. Develop point-to-point interconnection wiring termination sheets for performance of the Work and to document terminations.
   2. Use information from shop drawings, record drawings, plan drawings, and field inspections to develop sheets. Contractor shall field investigate the existing installation to determine the connections for equipment that is to remain and reconnected.
   3. The interconnection wiring termination sheets shall include the following information:

a. External wiring for each piece of equipment, panel, instrument, local control stations, and other field devices with an electrical connection.
b. Numbered terminal block identification for each wire termination.
c. Identification of the assigned wire numbers for all interconnections.
d. Conduit tags, terminal numbers, and pull box identifications through which wiring is routed between end points.
e. Identification equipment documents from which the wire numbering and termination information was obtained.

4. Conduct point-to-point wiring checks to determine that wiring and terminations are installed in compliance with the point-to-point interconnection diagrams. The Control System Specialist shall document all wiring checks and sign-off on completed wiring termination sheets. Submit signed documentation to Owner and Engineer.

3.3 TESTING AND INSTALLATION REQUIREMENTS

A. Testing and Installation Requirements: The Contractor shall be required to coordinate the following services during construction related to the testing and installation of the process control system. The complete system testing shall include all PLCs, computer systems, SCADA software and hardware, network devices, interconnecting cables, and other peripheral devices required for a complete and functional system. The testing of the system shall occur in stages as defined below. The Contractor shall develop and submit proposed testing procedures and documentation for each test. Testing documentation shall include signature lines for representatives of the Control Systems Specialist, Engineer, and Owner. Signatures shall be provided for each portion of the test, including a final sign-off indicating satisfactory completion of the entire test. Any deviations from the test procedure or corrections made during test must be recorded on the documentation and initialed by individual making the record. Testing documentation submittals must be approved by the Engineer prior to the scheduling of any actual tests.

~~B. Factory Readiness Test~~

~~1. A Factory Readiness Test shall be performed for each control panel fabricated and provided by the Control System Specialist. The test will be witnessed by, at minimum, representatives of both the Engineer and Owner. Additional witnesses may be present at the Engineer or Owner's discretion. The Control System Specialist shall provide notice to the Engineer a minimum of thirty (30) days in advance of the test.~~

~~2. The purpose of the Factory Readiness Test is to verify that all hardware and wiring within the control panel has been properly constructed and ready for shipment to the project site, and to test the automatic and manual process control strategies through PLC and HMI programming.~~

~~3. The Control System Specialist shall assemble all hardware components within the specified enclosure, including the instruments, PLCs, network components and other required items. This assembly shall be complete and considered suitable for field installation.~~

~~4. For the Factory Readiness Test, the Control System Specialist shall demonstrate that the control panel is suitable for field installation by powering up each item and testing for proper network connections. In addition, the Control System Specialist shall test each PLC input and output for proper operation from each field connection point within the control panel. The Control System Specialist shall be responsible for all measurement and testing components required to complete the Factory Readiness Test.~~

~~5. The Control System Specialist shall be responsible for connecting test instruments to each PLC and verifying proper operation of each input and output. All wire and terminal numbers shall be checked for conformance with the submittal drawings during this Readiness Test.~~

~~6. Each analog I/O point shall be checked for proper operation from each field connection point in the control enclosure. The Control System Specialist shall~~

~~simulate inputs and outputs in order to fully confirm the proper operation of each analog I/O.~~

~~7. The Control System Specialist may load a test program in the PLCs in order to facilitate the Factory Readiness Test.~~

~~8. Upon satisfactory completion of the control panel hardware and wiring portion of the test, load the PLC and HMI programming to begin functional testing of control strategies.~~

~~9. Each analog and discrete I/O signal will be checked through the PLC to the HMI screens to verify proper mapping of tags.~~

~~10. Functionality of the system will be checked to ensure conformance with process control strategies.~~

~~11. Process conditions and field equipment feedback will be simulated or forced in order to prove proper PLC response and logic functionality.~~

~~12. If during the Factory Readiness Test the Engineer, or Owner finds that process control is not achievable due to errors in the control panel wiring or construction, the functional testing shall stop, and the Control System Specialist shall correct the work and repeat the Factory Readiness Test at no additional cost to the Owner.~~

~~13. The Control System Specialist shall submit completed testing documentation as record to the Engineer upon satisfactory completion of the Factory Readiness Test prior to shipment of the control panels to the project site.~~

C. Site Readiness Test

1. A Site Readiness Test shall be performed after the installation of all control system components including PLC control panels, communications, control wiring, device configurations, instrument calibrations, motor controllers, and variable frequency controllers in accordance with the Contract Documents. The test will be witnessed by, at minimum, representatives of both the Engineer and Owner. Additional witnesses may be present at the Engineer or Owner's discretion. The Control System Specialist shall provide notice to the Engineer a minimum of thirty (30) days in advance of the test.
2. The purpose of this test is for the Control System Specialist to verify the following:
   a. All instruments have been properly configured and calibrated.
   b. All field control wiring has been properly installed and terminated.
   c. All PLC control panel hardware is operating and communicating properly.
   d. The installation is ready **for the Automation System Provider** to load PLC and HMI programming and begin functional process control testing.
3. Site Readiness Test shall include energization and testing for correct hardware integration of all system components, including PLC remote I/O assemblies, and reliable communications between components with correct protocols.
4. Provide point-to-point wiring checks for continuity between field devices to final PLC I/O terminations.
5. To the greatest extent possible, the Control System Specialist shall check I/O under process conditions to the end elements. For example, I/O for valve limit switches shall be checked by operating the valve to fully open and closed positions, rather than using jumpers or other means to simulate valve operation. Any testing performed that could upset or affect any live process shall be coordinated with the Owner.
6. Provide verification and documentation of normally closed or normally open contacts for discrete I/O signals.
7. Discrete inputs shall be tested by operating the end device to force a signal change. Observe results on all indicators such as PLC register, panel light, etc.
8. Discrete output signals shall be tested by forcing a value in the PLC register. Observe that the connected equipment properly responds.
9. Analog inputs shall be verified at 0 percent, 25 percent, 50 percent, 75 percent, and 100% of span. Observe results on all indicators such as PLC register, digital panel meters, etc.
10. Analog outputs shall be tested by entering values in the PLC register to force the outputs at 0 percent, 25 percent, 50 percent, 75%, and 100% of span. Observe that the connected equipment properly responds.

11. Personnel performing the test shall have International Society of Automation (ISA) Certified Control Systems Technicians (CCST) or equivalent credentials as approved by the Engineer or Owner.
12. The Control System Specialist shall submit completed testing documentation as record to the Engineer upon satisfactory completion of the Site Readiness Test.

D. Functional System Test
1. Upon the Engineer's approval of the Site Readiness Test, **the Automation System Provider will** load the PLC and HMI programming to begin functional testing of control strategies.
2. The test will be witnessed by, at minimum, representatives of both the Engineer and Owner. Additional witnesses may be present at the Engineer or Owner's discretion. Although the Control System Specialist must provide notice to the Engineer a minimum of thirty (30) days in advance of the test, the Functional System Test may be performed consecutively with the Site Readiness Test if approved by the Engineer and Owner ahead of time.
3. The purpose of the functional system testing is to implement and test the automatic and manual process control strategies through PLC and HMI programming. **This testing will be primarily performed by the Automation System Provider, with support from the Control System Specialist as needed.**
4. The Control System Specialist shall be available to assist with equipment operations, as necessary.
5. For this test, all equipment shall be installed, calibrated, and functioning as required in the contract documents.
6. Each analog and discrete I/O signal will be checked through the PLC to the HMI screens to verify proper mapping of tags.
7. Functionality of the system will be checked to ensure conformance with process control strategies.
8. PLC control loops will be tuned to achieve stable process control.
9. If during the Functional System Test the **Automation System Provider,** Engineer, or Owner finds that process control is not achievable due to errors in the installation, the functional testing shall stop, and the Control System Specialist shall correct the installation and repeat the Site Readiness Test at no additional cost to the Owner.

E. Final Acceptance Test:
1. After the system has been started up and running in automatic control to the greatest extent possible as determined by the Engineer/Owner, the Control System Specialist shall conduct a Final Acceptance test of the completed installation. The test shall start after satisfactory completion of all previous tests, the Engineer has received marked record (as-built) drawings from the Contractor, and when directed by the Owner/Engineer.
2. During this test, the Owner and Engineer shall have full use of the system. The duration of the test shall be 10 days.
3. Control System Specialist personnel shall be readily available to address issues onsite during the acceptance test.
4. The system shall operate with 100% reliability during the test period. Failure shall be defined as the inability to control or indicate status of specified inputs or outputs or any specified function of the control systems as described herein caused by defective hardware or software furnished in this project. Failure of hardware or software shall require repair or remedy of the defect to the satisfaction of the Engineer/Owner within 2 days. If the problem cannot be repaired in this time, the test shall be aborted and restarted after the problem is corrected and when directed by the Owner/Engineer. Restarting and satisfactory completion of the test shall be conducted at no additional cost to the Owner.
5. Throughout the duration of the test, no modifications shall be made to the system without prior approval from the Engineer or Owner.

3.4 TRAINING, STARTUP ASSISTANCE, & WARRANTY

A. Training: The Contractor shall provide training for the purpose of familiarizing Owner's personnel with the process control system. All training shall be as scheduled by the Owner. The training shall be scheduled a minimum of thirty (30) days in advance of when it is to be given. Proposed training materials, including a detailed training agenda itemizing relative emphasis on various topics of each course, shall be submitted to the Owner and Engineer at least fourteen (14) days in advance of when the training is to begin. The course content shall include, but not be limited to, a description of system philosophy, all major hardware components utilized in the system and hardware maintenance practices.

B. Startup Assistance
   1. The Contractor shall be responsible for furnishing a qualified technical representative who shall supervise the installation of equipment and/or install equipment, and who shall test, adjust, field calibrate, and fully commission all flow metering equipment, instrumentation equipment, control equipment, and accessories specified herein and required as integral components of the complete systems. The commissioning will be deemed to be complete only after all systems are found to be performing satisfactorily following the final balancing of plant operation. The guarantee period, during which all defective materials shall be replaced, and all faulty workmanship will be corrected at no cost to the Owner, shall begin with the date on which the commissioning is judged to be complete.

C. Service:
   1. Manufacturers shall provide as part of the equipment cost sufficient days of service by a factory-trained service engineer specifically trained on the type of equipment herein specified to assist the Contractor during installation and start-up. The service time shall be sufficient to place the units in satisfactory service and instruct the Owner's personnel in proper operation and maintenance of the equipment.
   2. A minimum of three (3) days service Engineer time shall be provided.

D. Maintenance Instruction:
   1. Operating and maintenance instructions, along with a separate parts list, shall be furnished in three (3) copies to the Owner. Operating instructions shall also incorporate a functional description of the system, including the system schematics which reflect "as-built" modifications. Maintenance requirements particular to the system shall be clearly defined, along with calibration and test procedures.

E. Warranty:
   1. All equipment and workmanship furnished under this contract shall be guaranteed to be free of defects in materials and workmanship for a period of one (1) year from and after the date of final acceptance of the work by the Owner, and any such defects which appear within the stipulated guaranty period shall be repaired, replaced, or made good without charge. This guarantee shall include the capacity and integrated performance of the component's parts.

END OF SECTION