

**C.C. WILLIAMS WASTEWATER TREATMENT PLANT
DEWATERING AND OTHER IMPROVEMENTS PROJECT**

MOBILE AREA WATER AND SEWER SYSTEM
MOBILE, ALABAMA

To All Planholders and/or Prospective Bidders:

The following changes, additions, and/or deletions are hereby made a part of the Contract Documents for the construction of C. C. Williams WWTP Dewatering and Other Improvements Project dated March 2021 as fully and completely as if the same were fully set forth therein:

A. PART 2—TECHNICAL SPECIFICATIONS

1. Section 07 21 00 Paragraph 2.01B -Add “e. K-13 by International Cellulose Corporation”
2. Section 26 05 33 Paragraph 1.02.A.1-Add “n. Aluminum Conduit”
3. Section 26 23 00 Paragraph 2.02- Add “G: The switchgear shall operate as defined in Section 26 32 13.13, Diesel Engine Generator Set and Control Panel. The switchgear manufacturer shall include hard-wired interlocks on the applicable breakers to inhibit paralleling the generator with any of the available utility sources.”
4. Section 26 23 00 Paragraph 2.03.G.1.b - Replace with “Flame-retardant, arc flash resistant nonmetallic rear barrier. “
5. Section 26 24 16 Paragraph 2.06.A.1 - Replace with “Material: Tin-plated copper, full-sized throughout length. “
6. Section 26 41 00 Paragraph 2.01.A - Add “5 - Robbins Lightning, Inc.”
7. Section 32 31 15 Paragraph 2.02.C.3.b - Replace with the following:
 - b. Motor not to exceed 2hp. The gate and controller for the main entrance gate shall operate on 20A, 480V, three-phase power feed. The gate and controller for the NE Exit gate shall operate on a 20A, 208V, single-phase power feed.
8. Section 40 27 00 Process Valves and Operators:
 - a. Page 6, Paragraph 2.05.A.2.b - Add subparagraph “5” and “6” as follows:
 - 5) American Flow Control.
 - 6) Or equal in accordance with MAWSS standard specifications.

- b. Page 6, Paragraph 2.05.A.2.c, and 2.05.A.2.d - Delete in their entirety.
 - c. Page 7, Paragraph 2.05.A.3.b, Add subparagraph “3” and “4” as follows:
 - 3) American Flow Control
 - 4) Or equal in accordance with MAWSS standard specifications.
 - d. Page 7, Paragraph 2.05.A.4.b - Add subparagraph “3” and “4” as follows:
 - 3) American Flow Control
 - 4) Or equal in accordance with MAWSS standard specifications.
 - e. Page 11, Paragraph 2.05.E.1 - Edit subparagraph “a” to read: “Per MAWSS Standard Specifications as identified as V-200 by MAWSS.”
 - f. Page 11, Paragraph 2.05.E.1 - Add subparagraph “b” to read” DeZurik is an approved equal.”
 - g. Page 15, Paragraph 2.06.B.6 - Add Rotork as an acceptable manufacturer
 - h. Page 17, Paragraph 2.06.C.7 - Add Rotork as an acceptable manufacturer
- 9. Section 40 94 13 - Delete item 3.04.C.f.
 - 10. Section 40 94 13 - Replace Supplement 2 in its entirety with the attached version.
 - 11. Section 40 94 13 - Replace Supplement 3, Component Y124 in its entirety with the attached version.
 - 12. Section 40 96 02- Replace its entirety with the attached version.
 - 13. Section 40 96 00 Supplement 1, Page 7 - Replace Table 4-1 with the table as follows:

Color	State
Green	Off / Stopped / Open
Red	On / Running / Closed / High Level
Violet	Fail/Fault
Yellow	In Transition / Local/Manual / Reverse
White	Remote / Auto / Forward
Magenta	Low Level
To Be Determined	Invalid/Unknown

14. Section 44 42 56.16, Supplement 1 – Delete Verderflex as an approved manufacturer.
15. Section 44 42 60.01, Macerators Page 2, Paragraph 2.01 - Add "Moyno as an approved manufacturer
16. Section 44 46 13.02, Paragraph 2.02 - Add " Schwing Bioset" as an approved manufacturer
17. Section 44 46 13.02, Supplement 1 Screw Conveyor System - Replace its entirety with the attached version.

B. PART 3—DRAWINGS (BOUND SEPARATELY)

1. Drawing 05-C-1003 – Add General notes as follows:
 3. Operations Building demolition includes temporary relocation of control and communications equipment as per specifications and relocation of a sample cooler.
 4. Operations Building demolition includes temporary relocation of a sample cooler into the maintenance building and then its relocation into the dewatering building upon its completion.
2. Drawing 06-E-6003, Section 52 - DELETE the detail reference 2605-400a
3. Drawing 06-E-6003 - ADD the detail reference 2605-420 to the ductbank sections 50-68 and 71-74.
4. Drawing 06-E-6004 - ADD the detail reference 2605-420 to the ductbank sections 23A-39A.
5. Drawing 06-E-6003, Section 52 - DELETE Conduit 2 – [2”C, SPARE].
6. Drawing 06-E-6003, Section 51 - DELETE Conduit 2 – [2”C, SPARE].
7. Drawing 06-E-2005 - ADD Keynote 3 adjacent to the existing PB-13. Keynote 3 shall read as follows:
 - a. “CONTRACTOR SHALL SPLICE FEEDERS TO THE EXISTING HIGH MAST LIGHTS WITHIN EXISTING PB-13. SPLICE SHALL BE WATERTIGHT.
8. Drawing 06-TY-2002 – In the Camera Pole Schedule, revise the number of cameras on Pole No. 04 from 2 to 3.

9. The following drawings are reissued in their entirety. The changes as indicated by these reissued drawings shall be incorporated into other drawings as may be affected by these changes.

01-G-0020	20-S-2003	20-D-3003
06-E-6001	20-S-2004	20-E-2001
06-E-6002	20-S-3002	20-E-6016
08-N-6004	20-D-2002	82-E-2001
08-N-6005	20-D-2003	93-E-2001
20-S-2002	20-D-3002	

10. Drawing 20-A-2004 and 20-E-2002 – The elevator control panel shall be located within the north wall of the elevator shaft 2nd floor.
11. Drawing 20-E-2002 - For the location of the polymer mixing pumps (20-P-51-1 and 20-P-51-2) and the level transmitters 20LE/LIT-50-1, -2), refer to the Drawing 20-D-4001.
12. Drawing 20-E-2003 - The receptacles shown within the Polymer Pump Room shall be shown as Weatherproof (WP).
13. Drawing 20-E-2004 - The receptacles shown within the Polymer Tank Area shall be shown as Weatherproof (WP).
14. Drawing 50-A –2002, 50-P-2001 thru 9002 (and others) - Include within room 50-108 a urinal located on the west wall in the location indicated for the sink. Relocate the sink northward to allow for the urinal. Urinal with accessories shall be as required for Structure 20 Room 20-111 except with flush valve Sloan Model 186-1.0.
15. Drawing 95-E-5003 - ADD the detail 2605-420. See attachment for this detail.
16. Drawing 93-TY-2001 - Add key notes 1 and 6 to the eastern side door # 93C.

All Bidders shall acknowledge receipt and acceptance of this Addendum No. 1 in the Bid Form AND by submitting the Addendum with the bid package. Bid Forms submitted without acknowledgment or without this Addendum will be considered in nonconformance.

Jacobs

David A. Carr
Project Manager

Appended hereto and part of Addendum No. 1:

DRAWINGS:

01-G-0020	20-S-2003	20-D-3003
06-E-6001	20-S-2004	20-E-2001
06-E-6002	20-S-3002	20-E-6016
08-N-6004	20-D-2002	82-E-2001
08-N-6005	20-D-2003	93-E-2001
20-S-2002	20-D-3002	Detail 2605-420

SPECIFICATIONS:

40 94 13 – Supplement 2
40 94 13 - Supplement 3
40 96 02 – OT Networking Software
44 46 13.02 – Supplement 1 Screw Conveyor System

END OF ADDENDUM

SECTION 40 94 13
OPERATIONAL TECHNOLOGY COMPONENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This section gives general requirements for operational technology components (OTC). The following OTC subsections or supplements expand on requirements of this section:
 - 1. Section 40 95 80, Fiber Optic Communication System.
 - 2. Section 40 96 00, Applications Software.
 - 3. Section 40 96 02, Networking Software.
- B. Provide all hardware and software for a completely functioning system meeting the specified requirements.
- C. Configure all hardware and software as shown and specified.
- D. Major Work Items (include but are not limited to): Engineering, furnishing (procuring), installing, programming, configuring, calibrating, adjusting, testing, documenting, starting up, and Owner training for complete and fully functional OTC of the Industrial Control System (ICS). OTC major work includes (but is not limited to) the following: Virtual infrastructure (physical servers, virtual SAN, hypervisors, virtual machines); Backup software and infrastructure (NAS, disaster recovery backups); Alarm notification infrastructure; Network infrastructure and segregation (firewalls, switches, transceivers, physical media; VLANs, subnets, DMZs, network logging and monitoring); Client infrastructure (thick clients, video wall monitors); Remote access infrastructure and DMZ infrastructure.
 - 1. Refer to Project Drawings for an overview of the OTC, and connections. Coordinate software requirements with Section 40 96 00, Application Software.
 - 2. OTC Hardware: Provide all OTC hardware as shown on the Block Diagrams and specified this section. Provide all necessary appurtenances such as cables, drivers, and peripherals for a fully operational ICS.
 - a. Major hardware items include: Rack mounted Servers, network switches, firewalls, routers, transceivers, workstations, video wall components, thin clients, zero clients, network attached storage, mounting hardware, monitors, large screen monitors and Printers.

- b. Minor hardware items needed for a fully operational OTC are not identified nor specified in this document. All Minor hardware items are to be provided for a complete and fully functional OTC as part of this scope.
 - c. All Major and Minor hardware components shall be included.
 - 3. Application Software: Refer to Section 40 96 00, Application Software for additional requirements. Provide application software as specified for specific components, as specified in this section, and as required for a fully operational system. Major software items to be included with Hardware components listed in this section include standard software such as operating systems and office packages.
 - 4. Upgrades to existing facility panels and hardware as indicated in Contract Documents and as required to incorporate complete instrumentation and control system interface. Upgrades include, but are not limited to: power wiring, network cabling, fiber cabling and terminations, adding or removing hardware and cabling at an existing panel, and altering network configuration of existing system.
 - 5. Programming all OTC components.
 - 6. Provision of all fiber optic cabling on the Project unless otherwise noted.
 - 7. Provide all configurations for both hardware and software for proper operation of the ICS and for successful implementation of the Process Control Software.
 - 8. Participate in System Configuration workshops with Owner and Owners representative to discuss and document preferred configuration details for hardware and software.
- E. Coordinate IP addressing of all hardware components with component suppliers, network service providers, the Owner, and the Owners representative, and as shown on the Drawings.
- F. Provide enough capacity and modularity in the OTC for future expansion.

1.02 REFERENCES

- A. The following is a list of standards which may be referenced in this section and other OTC subsections:
- 1. International Conference on Energy Conversion and Application (ICECA).
 - 2. National Electrical Code (NEC).
 - 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. IOTC 1, Industrial Control and Systems General Requirements.

4. National Fire Protection Association (NFPA): 820, Standard for Fire Protection in Water Treatment and Collection Facilities.
5. Underwriters Laboratory, Inc. (UL): 508A, Standard for Safety, Industrial Control Panels.
6. International Society of Automation (ISA):
7. ISA 99, Industrial Automation and Control Systems Security.
8. National Institute of Standards (NIST):
9. NIST Special Publications 800 Series.
10. NIST SP 800-82, Guide to Industrial Control Systems Security.
11. International Standards Organization (ISO):
12. Open Systems Interconnection.
13. Institute of Electrical and Electronics Engineers (IEEE):
14. IEEE 802.3, Carrier Sense Multiple Access with Collision Detection (CSMA/CD) (Ethernet).
15. IEEE 802.3z, Gigabit/s Operation.
16. IEEE 802.3ae, 10 Gigabit/s Operation.
17. IEEE 802.3af, DTE Power via MDI.
18. IEEE 802.1p, Traffic Classification/Prioritization.
19. IEEE 802.1q, Virtual LANs.
20. IEEE 802.1x, Comprehensive security framework.
21. IEEE C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
22. Building Industry Consulting Service International (BICSI):
23. Telecommunications Distribution Methods Manual (TDMM).
24. ANSI/TIA/EIA (Telecommunications Pathways and Spaces).
25. International Telecommunications Union (ITU).
26. Electronic Industries Association (EIA).
27. American National Standards Institute (ANSI):
28. ANSI/IEEE C37.90.1, Surge withstand capability.
29. ANSI/IEE C37.90.2, Tolerance of radiated electromagnetic frequency interference.
30. American National Standards Institute/Electronics Industrial Association (ANSI/EIA): ANSI/EIA RS 310 D Rack Mounting Standards for 19-Inch Racks.
31. ANSI TIA/EIA 606-B Cable Labeling Standards.
32. TIA: Telecommunications Industry Association.

1.03 DEFINITIONS

A. Abbreviations:

1. HMI: Human-Machine Interface.
2. HVAC: Heating, Ventilating, and Air Conditioning.
3. I&C: Instrumentation and Control.
4. ICS: Industrial Control System.

5. I/O: Input and Output.
6. NAS: Network Attached Storage.
7. O&M: Operation and Maintenance.
8. OIU: Operator Interface Unit.
9. OT: Operational Technology.
10. OTC Operational Technology Components.
11. P2V: Physical (Machine) To Virtual (Machine) Conversion.
12. PAM: Privileged Access Management.
13. PC: Personal Computer.
14. PAC: Programmable Automation Controller.
15. SCADA: Supervisory Control and Data Acquisition.

B. Enclosure: Control panel, console, cabinet, rack or instrument housing.

C. Instructor Day: Eight hours of actual instruction time.

1.04 SUBMITTALS

A. General:

1. Submit proposed Submittal breakdown consisting of sequencing and packaging of information in accordance with Progress Schedule.
2. Partial Submittals not in accordance with Progress Schedule will not be accepted.
3. Submittal Format:
 - a. Electronic Copies: Required, unless otherwise noted for specific items.
 - 1) Manufacturers' Standard Documents: Adobe Acrobat PDF.
 - 2) Documents created specifically for Project:
 - a) Text and Graphics: Microsoft Word.
 - b) Lists: Microsoft Excel, unless otherwise noted for specific items.
 - c) Block Drawings: MicroStation or AutoCAD.
 - d) Network Diagrams: Microsoft Visio.
4. Identify proposed items, options, installed spares, and other provisions for future work (for example, reserved panel space; unused components, wiring, and terminals).
5. Legends and Abbreviation Lists:
 - a. Definition of symbols and abbreviations used; for example, engineering units, flowstreams, instruments, structures, and other process items used in nameplates, legends, data sheets, point descriptions, HMI displays, alarm/status logs, and reports.
 - b. Use identical abbreviations in OTC subsections.
 - c. Submit updated versions as they occur.

6. Activity Completion:
 - a. Action Submittals: Completed when reviewed and approved.
 - b. Informational Submittals: Completed when reviewed and found to meet conditions of the Contract.

B. Action Submittals:

1. Bill of Materials: List of required equipment.
 - a. Group equipment items by enclosure and field, and within an enclosure, as follows:
 - 1) Components: By component identification code.
 - 2) Other Equipment: By equipment type.
 - b. Data Included:
 - 1) Equipment tag number.
 - 2) Description.
 - 3) Manufacturer, complete model number and all options not defined by model number.
 - 4) Quantity supplied.
 - 5) Component identification code where applicable.
 - 6) For panels, include panel reference number and name plate inscription.
 - c. Formats: Microsoft Excel.
2. OTC block diagram and overview description. Coordinate block diagram with other Subsystems to provide a completely coordinated Wastewater ICS block diagram. Block diagram shall show all equipment connections and equipment tag numbers.
3. OTC network diagram and overview description. Coordinate network diagram with other Subsystems to provide a completely coordinated Wastewater ICS network diagram. Network diagram shall show all equipment, connections, virtual machines, server names, equipment tag numbers, and IP addresses. Both physical and logical diagrams shall be provided.
4. Bill of Materials for OTC Components: Component number, manufacturer, model number, component description, and quantity.
5. Room Layout Drawings: Coordinate with other Subsystems and submit Control Room Layout Drawings showing where all OTC hardware will be installed in existing rooms or panels. Room Layout Drawings shall be completely coordinated with other Subsystems to show the locations of all equipment in the Control Room and not just the OTC hardware locations. Show enclosure locations and sizes, furniture, OTC equipment, and service area requirements.
6. Power Connection Diagram: For OTC equipment show interconnection from power sources through uninterruptible power supplies and power distribution panels, to computer and peripherals.

7. Grounding Diagram: For OTC equipment show grounding philosophy and implementation.
8. Interconnecting Wiring and Cabling Diagrams: For OTC equipment, identify terminal receptacles, cable ID tags, actual cable lengths, and maximum distance limitations between cabinets or components.
9. Component Submittal: For each OTC component:
 - a. General data and description.
 - b. Engineering Specifications and data sheets.
 - c. Scaled drawings and mounting arrangements.
 - d. Equipment weights.
 - e. Power and grounding requirements.
 - f. External electrical interconnection and interface definitions.
10. Standard Software: For each type of standard software to be provided:
 - a. General data sheet and description.
 - b. Exact software package model number and feature list.
 - c. Associated hardware device hosting the software.
11. Shop Drawings for Specifically Manufactured OTC Equipment:
 - a. A complete connection diagram.
 - b. Data sheets on each major item, annotated as necessary to describe specific items furnished.
 - c. Scaled layout and fabrication drawings.
 - 1) Cable access areas and cable routing.
 - 2) Power termination and ground lug location.
 - 3) Data cable termination points.
 - 4) Anchor bolt size and location.
 - d. Installation and mounting detail drawings.
 - e. Equipment weights.
12. Panel Construction Drawings:
 - a. Scale Drawings: Show dimensions and locations of panel-mounted devices, doors, louvers, subpanels, internal and external.
 - b. Panel Legend (Bill of Material): List front of panel devices by tag numbers, nameplate inscriptions, service legends, and annunciator inscriptions.
 - c. Bill of Materials: List devices mounted within panel that are not listed in panel legend. Include tag number, description, manufacturer, and model number.
 - d. Construction Details: NEMA rating, materials, material thickness, structural stiffeners and brackets, lifting lugs, mounting brackets and tabs, door hinges and latches, and welding and other connection callouts and details.
 - e. Construction Notes: Finishes, wire color schemes, wire ratings, wire, terminal block numbering, and labeling scheme.
 - f. Submit electronic copies of Drawings.

13. Panel Wiring Diagrams:
 - a. Cover wiring within a panel including, but not limited to, instrumentation, control, power, and communications, and digital networks.
 - b. Objectives: For use in wiring panels, making panel connections, and future panel trouble shooting.
 - c. Diagram Type:
 - 1) Ladder diagrams where applicable. Include devices that are mounted in or on the panel that require electrical connections. Show unique rung numbers on left side of each rung.
 - 2) Schematic drawings for wiring of circuits that cannot be well represented by ladder diagrams.
14. Panel Power Requirements and Heat Dissipation: For control panels tabulate and summarize:
 - a. Required voltages, currents, and phases(s). Include calculations and list assumptions.
 - b. Maximum heat dissipations Btu per hour. Include calculations and list assumptions.
 - c. Maximum permissible internal temperature based on operating range of internal components.
 - d. Computed maximum internal temperature. Include calculations and list assumptions. Include the impacts of internal heat generation, solar radiation and shielding.
15. Communications and Digital Networks Diagrams:
 - a. Scope: Includes connections to Ethernet network, remote I/O, and fieldbus (for example, Modbus, Profibus, Foundation Fieldbus, Device Net, etc.).
 - b. Format: Network schematic diagrams for each different type of network.
 - c. Show:
 - 1) Interconnected devices, both passive and active.
 - 2) Device names and numbers.
 - 3) Terminal numbers.
 - 4) Communication Media: Type of cable.
 - 5) Connection Type: Type of connector.
 - 6) Node and device address numbers.
 - 7) Wire and cable numbers and colors.
 - d. Ethernet Network Switch Configuration: Complete list of settings, parameters, and configuration details.

C. Informational Submittals:

1. Operations and Maintenance Manuals:
 - a. Operation and Maintenance Data, unless otherwise specified in this section.
 - b. General: Provide the following:
 - 1) Suggested startup/shutdown procedures.
 - 2) Training material.
2. Hardware: Provide the following:
 - a. All hardware cutsheets.
 - b. Detailed logical and physical network diagrams.
 - c. Detailed connectivity spreadsheet.
 - d. Detailed firmware/software version spreadsheet.
 - e. All passwords for every account or device in encrypted format with encryption key and master password.
3. Provide Manufacturer's Certificate of Proper Installation where specified.
4. Evidence of transferability to Owner of all warranties and licenses and support agreements.

D. Testing Related Submittals:

1. Factory Demonstration Test:
 - a. Preliminary Test Procedures: Outline of proposed tests, forms, and checklists.
 - b. Final Test Procedures:
 - 1) Proposed test procedures, forms, and checklists.
 - 2) Capacity, Timing, and Simulation: Describe simulation and monitoring methods used to demonstrate compliance with capacity and timing requirements.
 - c. Test Documentation: Copy of signed off test results.
2. System Acceptance/Performance Test:
 - a. Preliminary Test Procedures: Outline of proposed tests, forms, and checklists.
 - b. Final Test Procedures: Proposed test procedures, forms, and checklists.
 - c. Test Documentation: Copy of signed off test results.
3. Owner Training Plan: In accordance with Section 01 43 33, Manufacturers' Field Services.

E. Quality Control Submittals:

1. Operation and Maintenance Manuals:
 - a. Hardware:
 - 1) Updated version of hardware Shop Drawings submittals.
 - 2) Component Manufacturer's O&M Manuals: Instructions for installation, operation, maintenance, trouble shooting, and calibration.
 - 3) List of spare parts and expendables provided.
 - 4) List of recommended additional spare parts.
 - b. Software Documentation: Updated version of software Shop Drawings submittals.

F. As-Built Documents:

1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain As-Built documents.
2. Accuracy of As-Built:
 - a. Coordinate changes within As-Built documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
 - b. Purpose of Project As-Built documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
 - c. Make entries within 24 hours after receipt of information that a change in the Work has occurred.
 - d. Prior to submitting each request for progress payment, request Engineer's review and approval of current status of As-Built documents. Failure to properly maintain, update, and submit As-Built documents may result in a deferral by Engineer to recommend whole or any part of Contractor's Application for Payment, either partial or final.

G. Maintenance of As-Built Documents:

1. General:
 - a. Label or stamp each As-Built document with title, "AS-BUILT DOCUMENTS," in neat large printed letters.
 - b. As-Built information concurrently with construction progress and within 24 hours after receipt of information that change has occurred.

2. Preservation:
 - a. Maintain documents in a clean, dry, legible condition and in good order.
 - b. Convert as-built markups to digital format within 10 days of change.
 - c. Do not use As-Built documents for construction purposes.
 - d. Make documents and Samples available at all times for observation by Engineer.
 - e. Making Entries on Drawings:
 - 1) Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
 - 2) Color Coding:
 - a) Green when showing information deleted from Drawings.
 - b) Red when showing information added to Drawings.
 - c) Blue and circled in blue to show notes.
 - 3) Date entries.
 - 4) Call attention to entry by “cloud” drawn around area or areas affected.
 - 5) Legibly mark to As-Built documents actual changes made during construction, including, but not limited to: Locations of existing and new equipment, or Work. Locate existing equipment, and items critical to the interface between existing physical conditions or construction and new construction.
 - 6) Changes made by Addenda and Field Orders, Work Change Directive, Change Order, and Engineer’s written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.

1.05 QUALITY ASSURANCE

- A. Qualifications. PIC System Integrator shall be selected from one of the following MAWSS-approved integrators (listed alphabetically):
 1. Automation Control Service, LLC.
 2. Hargrove and Associates, Inc.
 3. Prism Systems, Inc.
 4. Revere Control Systems, Inc.
- B. OTC Coordination Meetings:
 1. OTC Schedule Coordination Meeting: Purpose: Discuss Engineer’s comments and resolve scheduling issues.

2. Startup and Training Meeting:
 - a. Purpose:
 - 1) Startup and testing planning.
 - 2) Resolve required changes to proposed training plan.
 - 3) Identify specific Owner personnel to attend training.
3. Weekly progress meetings.
4. Provide for a minimum of 4 additional meetings.

C. Project Final Completion:

1. The Project will be considered complete after:
 - a. System has been fully installed, commissioned, tested and accepted by Owner.
 - b. All testing has been completed.
 - c. All testing documentation has been submitted and approved.
 - d. O&M manuals have been submitted and approved.
 - e. All application software is archived and turned over to Owner.
 - f. All salvage and demolition has been completed.
 - g. All operations and maintenance training has been completed.
 - h. All system credentials have been turned over to Owner.
 - i. Final As-built Drawing markups have been submitted to Engineer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. In accordance with Section 01 61 00, Common Product Requirements.
- B. Prior to shipment, include corrosive inhibitive vapor capsules in shipping containers, and related equipment as recommended by capsule manufacturer.
- C. Prior to installation, store items in dry indoor locations. Provide heating in storage areas for items subject to corrosion under damp conditions.
- D. Cover panels and other elements that are exposed to dusty construction environments.

1.07 SEQUENCING AND SCHEDULING

- A. Prerequisite Activities and Lead Times: Do not start following key Project activities until prerequisite activities and lead times listed below have been completed and satisfied:
 1. OTC Kickoff Meeting Prerequisite: Schedule of Values and Progress Schedule submitted and reviewed.
 2. OTC Configuration Workshops.

3. Shop Drawing Reviews by Engineer:
 - a. Prerequisite: Engineer acceptance of Schedule of Values and Progress Schedule.
4. Test Prerequisite: Associated test procedures Submittals completed.
5. OTC Startup and Testing Meeting Prerequisite:
 - a. Factory Demonstration Test Complete.
 - b. Engineer review of preliminary training plan and prior to Functional Test.
6. Training Prerequisite: Associated training plan Submittal completed.
7. Factory Demonstration Test Prerequisite:
 - a. Related Shop Drawings approved.
8. OTC Shipment to Site:
 - a. General Prerequisites:
 - 1) Approval of OT Shop Drawings and preliminary operation and maintenance data.
 - 2) FDT complete.
9. Installation Prerequisite: Equipment received at Site.
10. Functional Test Prerequisite: OTC Startup and Testing Meeting complete.
11. Performance Test Prerequisite: Functional Test completed and facility started up.

1.08 SYSTEM DESCRIPTION

A. Design Requirements:

1. Complete detailed design of OTC and OTC drawings and diagrams
2. Provide consistent hardware and software functions for OTC. For example, provide server configurations that are standardized and common among all servers.
3. OTC design as shown and specified includes:
 - a. Functional requirements, performance requirements, and Component Specifications.
 - b. Network diagrams.
4. Typical drawings for installation details, panel power, and control diagrams.

B. Use a qualified OTC System Integrator for at least the following Work:

1. For OTC Equipment and Ancillaries:
 - a. Completing detail design.
 - b. Submittals.

- c. Equipment, enclosures, and ancillaries.
- d. Instructions, details, and recommendations to, and coordination with Contractor for Certificate of Proper Installation.
- e. Verify readiness for operation.
- f. Verify correctness of final power and signal connections (lugging and connecting).
- g. Adjusting and performance tuning.
- h. Starting up.
- i. Testing and coordination of testing.
- j. Training.
- 2. Verify following Work not by OTC System Integrator is provided:
 - a. Correct electrical power circuits and raceways.
 - b. Correct low voltage and fiber installation and termination.
- 3. Develop and implement a field integration, startup, and testing plan in compliance with OTC, ICS and package systems requirements.

1.09 EXTRA MATERIALS

- A. As specified in OT subsections.
- B. In computing spare parts quantities based on specified percentages, round up to nearest whole number.

1.10 WARRANTIES AND LICENSING

- A. Minimum 3 year warranties for all components unless otherwise specified.
- B. All warranties must be transferable to Owner. Evidence of transferability must be presented with appropriate submittals.
- C. All licenses must be transferable to Owner. Evidence of transferability must be presented with appropriate submittals.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide OTC functions shown on Drawings and required in OTC subsections. Furnish equipment items required in OTC subsections. Furnish materials, equipment, and software, whether indicated or not, necessary to effect required system.

- B. First Named Manufacturer: OTC design is based on first named manufacturers of equipment, materials, and software.
 - 1. If an item is proposed from other than first named manufacturer, obtain approval from Engineer for such changes in accordance with the General Conditions, Article 6.05 Substitutes and “Or Equals”.
 - 2. If proposed item requires, but not limited to, different installation, wiring, raceway, enclosures, intrinsically safe barriers, and accessories, provide such equipment and work.
- C. Like Equipment Items:
 - 1. Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer’s services.
 - 2. Implement same or similar functions in same or similar manner. For example: switch configurations.
 - 3. Use newest equivalent product if newer model/version exist for specified product.

2.02 SYSTEM PERFORMANCE

- A. Provide newest compatible equivalent for all models and version.
- B. Network Architecture and Configuration:
 - 1. The Control Network (VLAN 10):
 - a. General: PAC/Device network.
 - b. Connections:
 - 1) PACs within the LAN for process control.
 - 2) Ethernet enabled control system devices.
 - c. Systems supported include, but are not limited to:
 - 1) Plant PACs.
 - 2) Remote PACs.
 - 2. The Supervisory Network (VLAN 20):
 - a. General: Network consisting of SCADA servers, workstations, and storage devices related to process control applications.
 - b. Connections: Any windows-based device or computer, printers, SMS modem.
 - c. Function elements and services to be supported include, but are not limited to:
 - 1) HMI Servers and Clients.
 - 2) Historian Services.
 - 3) Alarm Notification.

- 4) Maintenance Services.
 - 5) Terminal Services.
 - 6) Hardware such as printers.
 - 3. Management Network (VLAN 100):
 - a. General: Consist of the management interfaces of all servers, network devices and software management interfaces.
 - b. Connections: Connected to all network and server management interfaces.
 - 4. DMZ Network (VLAN 30):
 - a. General: Consists of the network hardware and virtual servers required to be outside of SCADA network for the purposes of traffic segregation.
 - b. Connections.
- C. Provide OTC, including servers and workstations, as specified and shown on Drawings. Required computer nodes are shown on the block diagrams and on the Specification supplements and are summarized below:
- 1. Virtual Servers:
 - a. Used for Wastewater ICS control and monitoring. Virtual servers will host SCADA applications software and provide remote desktop services for SCADA HMI Applications.
 - b. Provide servers with operating systems and anti-virus software.
 - c. SCADA Applications software shall be as specified under Section 40 96 00, Applications Software. Coordinate hardware requirements with Sections 40 96 00, Applications Software and 40 96 02, OT Networking Software, to ensure hardware provided meets the minimum requirements for the software.
 - d. Y203-Y204 Domain Controllers:
 - 1) Redundant Root Domain Controllers used for the purposes of providing a forest root domain for future enterprise wide management of plant level child domains and trust between them.
 - 2) Redundant Child Domain Controllers used for the purposes of providing Active Directory Services and Authentication for CCW WWTP.
 - e. Y205 and Y206 SCADA Servers:
 - 1) VTScada HMI servers will be used to poll PACs data, monitor, and control the Wastewater ICS.
 - 2) Configure servers in redundancy mode using a separate virtual network card on a separate VLANs for the failover link.

- f. Y208 Engineering Server: SCADA development server capable of hosting 2 concurrent development sessions at any given time. PAC programming software shall also reside on this VM. The most recent, loadable PAC programs shall be stored on this VM.
 - g. Y221 VMware SCADA vCenter Management Server: VMware SCADA virtual appliance used for the purposes of managing SCADA virtual servers.
 - h. Y222 OT Management Server: Used for the purposes of network management tasks.
 - i. Y230-Y231 Wonderware Archestra (Legacy Customer HMI - P2V) Server: Used for the purposes of legacy HMI management tasks.
 - 2. Physical Infrastructure: Consists of physical servers, switches, firewalls, network storage device, modems, time source appliance, workstations, tablets, and monitors. See Component Specifications in this section, Supplement 3.
- D. Workstations, Servers, Firewalls, Switches, KVM/KMM, NTP Appliance, Video Wall, Modems and Rack Sequencing:
- 1. One new thin client workstation shall be configured for viewing Wonderware Archestra as a replacement client for the existing thin client workstation. The new thin client workstation will communicate with the existing Wonderware Archestra servers that will be virtualized as part of this project. Provide all cabling and peripherals for connections to monitor, keyboard, and mouse in the Control Room at the Legacy Systems Desk.
 - 2. All other new servers and workstations shall be configured with the VTScada application software as described in Specification Section 40 96 00, Applications Software.
 - 3. Configure the new firewalls, switches, KVM/KMM, NTP Appliance and modems.
 - 4. New servers and workstations shall be used during Factory Demonstration testing.
 - 5. All the new equipment shall be shipped to the jobsite only after successful completion of the Factory Demonstration testing.
 - 6. Install NTP GPS outdoor antenna.
 - 7. Verify phone landline dial tone.
 - 8. New servers shall be installed in the SCADA rack which shall be installed in the Server Room. The core SCADA switches will be connected to the ICS network to communicate with plant PAC's.

9. The new workstations shall be installed in the Control Room operator console.
 10. Video Wall SCADA monitors shall be mounted in the control room in a 2x2 format. Monitors to be connected via HDMI cables. SCADA wall monitors shall be controlled by a keyboard and a mouse at the control room console via USB cabling. Video Wall Workstation shall be set up to automatically connect to the VTScada server with four concurrent VTScada sessions (one on each monitor) spanning the 2x2 grid.
 11. Video Wall Security monitors shall be provided and mounted by OTC in the control room in a stacked format. Monitors to be connected via HDMI cables. In addition, the OTC shall provide a desktop monitor for the Security workstation; desktop monitor shall be installed on the operator console. The workstation, keyboard, and mouse will be provided by the Security contractor.
 12. Coordinate with MAWSS for the backup of all servers and workstations to network attached storage (NAS) which is located at Park Forest headquarters. Adhere to MAWSS backup standard procedures and demonstrate backup functionality.
 13. Perform SCADA alerts testing via email.
 14. Perform remote VPN device configuration.
 15. Coordinate with MAWSS to implement the privileged access management (PAM) solution which is managed by MAWSS at Park Forest headquarters. Integrate PAM solution into VTScada application remote access and demonstrate functionality. Train authorized users to use the PAM solution for remote access.
 16. Coordinate with MAWSS to perform password vault administrator password management testing using the MAWSS solution as implemented at Park Forest headquarters.
 17. Coordinate with MAWSS to confirm functionality of an email relay, AntiVirus and Windows Updates using MAWSS configured services implemented at Park Forest headquarters.
 18. The application software on the new servers shall be demonstrated in the field as described in Part 3 of this Specification section.
 - a. Contractor shall manage scan status of tags during migration to prevent nuisance alarms.
- E. Refer to 40 94 13 Supplement 1 - OT Network Component List for listing of OTC Hardware.

2.03 SERVICE CONDITIONS

- A. Standard Service Conditions: The following defines certain types of environments. OTC subsections refer to these definitions by name to specify the service conditions for individual equipment units. Design equipment for continuous operation in these environments:
1. Computer Room, Air Conditioned:
 - a. Temperature: 60 degrees F to 80 degrees F.
 - b. Relative Humidity: 40 percent to 60 percent.
 - c. NEC Classification: Nonhazardous.
 2. Inside, Air Conditioned:
 - a. Temperature:
 - 1) Normal: 60 degrees F to 80 degrees F.
 - 2) With Up to 4-Hour HVAC System Interruptions: 40 degrees F to 105 degrees F.
 - b. Relative Humidity:
 - 1) Normal: 10 percent (winter) to 70 percent (summer).
 - 2) With Up to 4-Hour HVAC System Interruption: 10 percent to 100 percent.
 - c. NEC Classification: Nonhazardous.
 3. Inside:
 - a. Temperature: 20 degrees F to 104 degrees F.
 - b. Relative Humidity: 10 percent to 100 percent.
 - c. NEC Classification: Nonhazardous.

2.04 ELECTRICAL REQUIREMENTS

- A. Electrical Raceways: As specified in Division 26, Electrical.
- B. Wiring External to OTC Equipment:
1. Special Control and Communications Cable: Provided by OTC System Integrator as noted in Component Specifications and OT subsections.
 2. Other Wiring and Cable: As specified in Division 26, Electrical.
- C. OTC Enclosure Internal Wiring:
1. Restrain by velcro or ducts or plastic wireways.
 2. Hinge Wiring: Secure at each end so bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.
 3. Arrange wiring neatly, cut to proper length, and remove surplus wire.
 4. Provide abrasion protection for wire bundles that pass through holes or across edges of sheet metal.

5. Connections to Screw Type Terminals:
 - a. Locking-fork-tongue or ring-tongue lugs.
 - b. Use manufacturer's recommended tool with required sized anvil to make crimp lug terminations.
 - c. Wires terminated in a crimp lug, maximum of one.
 - d. Lugs installed on a screw terminal, maximum of two.
6. Connections to Compression Clamp Type Terminals:
 - a. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.
 - b. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.
7. Splicing and tapping of wires, not allowed.
8. Separate dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
9. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.
10. Plastic Wire Duct Fill: Do not exceed manufacturer's recommendations.
11. Conductor Color Coding: In accordance with UL508A.
12. Conductors Carrying Foreign Voltages within a Panel:
 - a. Route foreign voltage conductors into panel and land on a circuit blade disconnect type terminal block.
 - b. Use wire with pink insulation to identify foreign voltage circuits within panel from terminal block on. Do not use wires with pink insulation for any other purpose.
13. Harness Wiring:
 - a. 120V ac: No. 14 AWG, MTW.
 - b. 24V dc: No. 16 AWG, MTW where individual conductors are used and Type TC shielded tray cable where shielded wire is used.
14. Panelwork:
 - a. No exposed connections.
 - b. Allow adjustments to equipment to be made without exposing these terminals.
 - c. For power and control wiring operating above 80V ac or dc use covered channels or EMT raceways separate from low voltage signal circuits.
15. Plastic Wire Ducts Color:
 - a. 120V ac: White.
 - b. 24V dc: Gray.
 - c. Communications Cables and Fiber Optic Jumpers: Orange.
16. Provide a communications plastic wire duct for communications cables and fiber optic cables between the communications devices in control panel and communications raceways. Design plastic wire duct design to take into account the minimum bending radius of the communications cable.

17. Make plastic wire ducts the same depth.
18. Provide a minimum of 1-1/2 inches between plastic wire ducts and terminal blocks.

D. Power Failure Detection and AUTO Restart:

1. Prevents errors due to power failure or short-term power fluctuations that occur when UPS is not operating.
2. Power Failure: Voltage variations in excess of plus or minus 10 percent of normal for a duration of 0.5 second or longer. Causes OTC equipment to automatically shut down as required to prevent introducing errors on disk.
3. Short-term Power Fluctuations: Voltage variations in excess of plus or minus 10 percent of normal for durations of 0.5 second to 1 millisecond. CS shuts down as above or is buffered to prevent fluctuations from causing errors.
4. OTC executes Restart program and return to normal operation when power is restored. Battery backed-up real-time clock used by CS during automatic restart to set time and date.
5. Connect UPS SNMP alarm and event messaging to SCADA System, add I/O to SCADA System and graphical overview for each treatment plant as required for Owner to monitor UPS health.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Material and Equipment Installation: Follow manufacturers' installation instructions, unless otherwise indicated or directed by Engineer.
- B. Wiring connected to OTC components and assemblies, including power wiring in accordance with requirements in Division 26, Electrical.
- C. Electrical Raceways: As specified in Division 26, Electrical.
- D. Field Finishing: Refer to Section 09 90 00, Painting and Coating.
- E. Onsite Supervision:
 1. Require OT site representative to observe OT equipment installation to extent required in order to provide Certificates of Proper Installation.
 2. Require OT site representative to supervise and coordinate onsite OT activities.
 3. Require OT site representative to be onsite while onsite work covered by this section and OT subsystems is in progress.

3.02 TESTING

A. General:

1. Coordinate OT testing with Owner and affected Subcontractors.
2. Notify Engineer of Performance Test schedule 4 weeks prior to start of test.
3. Engineer may actively participate in tests.
4. Engineer reserves right to test or retest specified functions.
5. Engineer's decision will be final regarding acceptability and completeness of testing.
6. Test hardware to demonstrate that the setup and configuration satisfies requirements for a secure and functional network and server infrastructure on which SCADA VMs and applications software can be hosted.
7. Test Format: Cause and Effect:
 - a. Person conducting test initiates input (cause).
 - b. Specific test requirement is satisfied if correct result (effect), occurs.
8. Required Test Documentation: Test procedures, forms, and checklists signed by Engineer and Contractor.
9. Have space after each test item description for sign off by appropriate party after satisfactory completion.
10. Procedures, Forms, and Checklists:
 - a. Except for Unwitnessed Factory Test, conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
 - b. Describe each test item to be performed.
 - c. Have space after each test item description for sign off by appropriate party after satisfactory completion.
11. Conducting Tests:
 - a. Provide special testing materials and equipment.
 - b. Wherever possible, perform tests using actual process variables, equipment, and data.
 - c. If not practical to test with real process variables, equipment, and data provide suitable means of simulation.
 - d. Define simulation techniques in test procedures.
 - e. Test Format: Cause and effect.
 - 1) Person conducting test initiates an input (cause).
 - 2) Specific test requirement is satisfied if correct result (effect), occurs.

B. Unwitnessed Factory Test:

1. Scope: Inspect and test OTC to ensure it is operational, ready for FDT.
2. Location: OTC System Integrator's facility.
3. Integrated Test:
 - a. Interconnect and test OTC.
 - b. Exercise and test functions.
 - c. Provide stand-alone testing of smaller panels.
 - d. Simulate inputs and outputs for primary elements, final control elements, and panels excluded from test.
 - e. New servers, workstations and thin clients shall be used in testing.

C. Factory Acceptance Tests (FAT):

1. Notify Engineer of test schedule 4 weeks prior to start of test.
2. Scope:
 - a. This will be an extensive and exhaustive test of the entire SCADA system.
 - b. System. Including but not limited to the following items:
 - 1) Ensure that each and every VM is configured and communicating correctly with the other VMs.
 - 2) Contractor will need a test PAC of each type used by the Owner.
 - 3) Ensure SNMP points from Server and network hardware function properly.
 - 4) Operation of communications between PACs and servers; including, failure-mode testing (i.e. failovers, power failures, network failures).
 - 5) Operation of communications between servers and operator workstations; including, failure-mode testing.
 - 6) Up to one day of Unstructured Testing: Owner/Engineer will initiate "What-If" scenarios for the control system or its components to witness how the SCADA System responds.
 - a) Provide staff and equipment necessary to perform test as specified.
 - b) Location: Control System Integrator's facility.
 - c) Nonloop-Specific Functions: Test all nonloop-specific functions including but not limited to:
 - (1) Capacity: Demonstrate that SCADA Systems have required spare capacity for expansion. Include tests for both storage capacity and processing capacity.
 - (2) Failure mode and backup procedures including power failure, AUTO restart, and disk backup and reload.

- (3) Dual Computer Operation: Processor transfer modes, peripheral switching, and communications switching.
 - (4) Message logging and alarm handling.
 - (5) Communication with field interface units.
 - (6) Data acquisition.
 - (7) Human Machine Interface: Database and display configuration and use of all types of displays.
 - (8) Data collection and data retrieval.
 - (9) Report Generation: Creation of a typical report and production of specified reports.
 - (10) Control configuration processor.
 - (11) System Software: Operating system, programming languages, and utility functions.
- c. Test entire OTC to demonstrate it is operational.
- d. Test all OTC supplied panels.
- 3. Location: OTC System Integrator's facility.
- 4. Operation of communications between PAC and computers.
- 5. Failed Tests:
 - a. Repeat and witnessed by Engineer.
 - b. With approval of Engineer, certain tests may be conducted by OT System Integrator and witnessed by Engineer as part of Functional Test.
- 6. Make following documentation available to Engineer at test site both before and during FDT:
 - a. Drawings, Specifications, Addenda, and Change Orders.
 - b. Master copy of FDT procedures.
 - c. List of equipment to be tested including make, model, and serial number.
 - d. Approved hardware Shop Drawings for equipment being tested.
 - e. Approved preliminary software documentation Submittal.
- 7. Daily Schedule for FDT:
 - a. Begin each day with meeting to review day's test schedule.
 - b. End each day with each meeting to review day's test results and to review or revise next day's test schedule.

D. Performance Test During and After Facility Startup:

- 1. FDT-Repeat:
 - a. Repeat FDT onsite with installed OTC equipment and software.
 - b. As listed in OTC subsections, certain portions of FDT may not require retesting.
 - c. Use FDT test procedures as basis for this test.

2. Once a facility's Functional Test has been completed and that facility has been started up, perform jointly with Owner's Consultant a Performance Test on associated OTC equipment to demonstrate that it is operating as required by Contract Documents. Demonstrate each required function.
3. Make updated versions of documentation required for Performance Test available to Engineer at Site, both before and during tests.
4. Make O&M data available to Engineer at Site both before and during testing.
5. Follow daily schedule required for FDT.
6. Determination of Ready for Operation: When Functional Test has been completed.

E. System Acceptance Test:

1. After FAT has been completed and SCADA System equipment has been installed at its respective Treatment Plant, a witnessed Site Acceptance Test on associated SCADA System equipment shall be performed to demonstrate each required function on a point-by-point, screen-by-screen, and site-by-site basis to demonstrate that the new VTScada SCADA System is performing the same functions as the existing system.
2. Tests are the same as required for FAT except that entire installed SCADA System is tested using actual process variables and functions demonstrated.
3. Perform local and manual tests for each point before proceeding to remote and automatic modes.
4. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.
5. Make updated versions of documentation required for Site Acceptance Test available to Engineer at Site, both before and during tests.
6. Make O&M data available to Engineer at Site both before and during testing.
7. Follow daily schedule required for SAT.

3.03 MANUFACTURER'S SERVICES

- A. Manufacturer's Representative: As required by each OTC subsection.
- B. See Section 01 43 33, Manufacturers' Field Services.

3.04 TRAINING

- A. General:
 - 1. Perform OTC system training to meet specific needs of Owner's personnel.
 - 2. Include training sessions, classroom and field, for managers, engineers, operators, and maintenance personnel.
 - 3. Provide instruction on two working shift(s) as needed to accommodate the Owner's personnel schedule.
 - 4. Provide a video recording of all training sessions in a format acceptable to the Owner.
 - a. Owner reserves the right to reuse video of training sessions.
- B. Operations and Maintenance Training:
 - 1. General:
 - a. Refer to specific requirements specified in OTC Subsections.
 - b. Include review of O&M data and survey of spares, expendables, and test equipment.
 - c. Use equipment similar to that provided.
 - d. Unless otherwise specified in OTC subsections, provide training suitable for instrument technicians with at least a 2-year associate engineering or technical degree, or equivalent education and experience in electronic OTC, instrumentation, or digital systems.
- C. OT Network and Hardware Training:
 - 1. Length: 2 day.
 - 2. Location: Owner's facility.
 - 3. Presenters: The seminar presenters should include the integrator responsible for configuring the system and representatives from OT application and networking software providers.
 - 4. Objective: Provide an overview for non-operations and maintenance personnel for understanding the OT networking applications software, hardware, and configurations including:
 - a. Configuration Management.
 - b. Firewall Programming and Policies.
 - c. Switch Configuration.

- d. Dell:
 - 1) Dell Training.
 - 2) Configuration.
- e. Time Tools GPS NTP.
- ~~f. Park Forest Headquarters OT Components (managed by MAWSS IT):~~
 - ~~1) Active Directory (AD) settings, policies, organizational units, users, permissions.~~
 - ~~2) PAM, Bomgar.~~
 - ~~3) Anti-Virus Management.~~
 - ~~4) FortiManager network management.~~
 - ~~5) FortiAuthenticator identity access management.~~
 - ~~6) VMWare vCenter, vShpere, configuration.~~
 - ~~7) NAS, Veeam backup software.~~
- 5. Attended by management, engineering, IT, and other non-operations and non-maintenance personnel.
- 6. Primary Topics:
 - a. Management-oriented explanation of data management displays and printouts.
 - b. Walk-through of installed systems.
 - c. User access instructions.
 - d. Procedures for configuring each hardware type.
 - e. Things to avoid and dangers of changing parameters.
 - f. Best practice and best use.

3.05 CLEANING

- A. Upon completion of Work, remove materials, scraps, and debris from interior and exterior of equipment.

3.06 SUPPLEMENTS

- A. Supplements listed below, follows “End of Section,” are part of this Specification.
 - 1. Supplement 1, OT Network Component List.
 - 2. Supplement 2, OT Network Software List.
 - 3. Supplement 3, OT Component Specifications.

END OF SECTION

SUPPLEMENT 1, OT NETWORK COMPONENT LIST

DELIVERY AND INSPECTION

- A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site.
- B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.
- C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.
- D. Remove damaged products from Site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

HANDLING, STORAGE, AND PROTECTION

- A. Handle and store products in accordance with manufacturer's written instructions and in a manner to prevent damage.
- B. Manufacturer's instructions for material requiring special handling, storage, or protection shall be provided prior to delivery of material.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.
- D. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.
- E. After installation, provide coverings to protect products from damage due to construction operations. Remove coverings when no longer needed.
- F. Hazardous Materials: Prevent contamination of personnel, storage area, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

MAWSS WATER SCADA UPGRADE SOFTWARE COMPONENT DETAIL SHEET - CCW				
Item	Item Description	QTY	Manufacturer	Note
1	Windows Server 2019 Datacenter	1	Microsoft	SCADA Windows Server 2019 Datacenter (1 CPU per node (10 cores) x 3 Nodes) = Total Cores 30
2	Microsoft Server 2019 Client Access Licenses	25	Microsoft	Coordinate with MAWSS IT for Park Forest requirements.
3	Microsoft Office 2019 Standard	2	Microsoft	Microsoft Office 2019 Standard. Installed on the Operator Workstations.
4	VMWARE vSphere Essentials Plus	1	VMware	VMWARE vSphere Essentials PlusDMZ Nutanix With 3 Years Support
Other Software				
Item	Item Description	QTY	Manufacturer	Note
1	Adobe Reader	2	Adobe	free version - thick clients and RDP servers
2	Network Time Sync	15	TIMESYNCTOOL	http://www.timesynctool.com/
3	VMWare Workstation Professional	1	VMware	VMWare Workstation Professional 16

Standard Hardware Specifications

Y124, Rack mounted Multimedia Patch Panel

Document History and Status

Revision	Date	Author	Reason for Change
0	07/14/2020	John Shaffer/Jacobs	DRAFT
1	2/2/2021	John Shaffer/ Jacobs	Added Alternates
2	3/25/2021	Gregg Gray / Jacobs	Removed Alternates

- 1) 12 Port Multimedia Patch Panel
- 2) Keystone/Multimedia USB 2.0, USB3.0 HDMI
- 3) 1U Rack-Mount
- 4) Manufacturer: Tripplite
- 5) Panel Model: N062-012-KJ
- 6) Coupler Model P164-000-KP-BK HDMI (Qty.as required)
- 7) Coupler Model U060-000-KP-BK USB 2.0(Qty as required)

SECTION 40 96 02
OT NETWORKING SOFTWARE

PART 1 GENERAL

1.01 WORK INCLUDED

- A. General: Work includes design, furnishing, testing, documenting, training and starting up the security, network management, and application software for the functioning ICS Security Zone and DMZ Security Zone Virtual Machines as shown on the Drawings.
- B. Major applications software work items include:
 - 1. Work sequence and schedule.
 - 2. Software workshops.
 - 3. Software and configuration submittals.
 - 4. Applications software development.
 - 5. Software testing.
 - 6. Software installation.
 - 7. O&M development.
 - 8. Owner training.
 - 9. Startup.

1.02 DEFINITIONS

- A. Abbreviations:
 - 1. AV: Antivirus.
 - 2. CPU: Central Processing Unit.
 - 3. CVE: Common Vulnerabilities and Exposures.
 - 4. DMZ: Demilitarized Zone.
 - 5. GPO: Group Policy Object.
 - 6. GPS: Global Positioning System.
 - 7. HDD: Hard Disk Drive.
 - 8. HMI: Human-Machine Interface.
 - 9. I&C: Instrumentation and Control.
 - 10. I/O: Inputs and Outputs.
 - 11. ICS: Industrial Control System.
 - 12. IDS: Intrusion Detection System.
 - 13. IGS: Industrial Gateway Server.
 - 14. IPS: Intrusion Prevention System.
 - 15. IP: Internet Protocol.
 - 16. IT: Information Technology.
 - 17. I&C: Instrumentation and Controls.

18. LAN: Local Area Network.
19. LDAPS: Lightweight Directory Access Protocol over SSL/TLS.
20. MAS: Multiple Address System.
21. MFA: Multi-Factor Authentication.
22. NAS: Network Attached Storage.
23. NIC: Network Interface Card.
24. NIST: National Institute of Standards and Technology.
25. NTP: Network Time Protocol.
26. O&M: Operation and Maintenance.
27. OIT: Operator Interface Terminal.
28. ORT: Operational Readiness Test.
29. OT: Operational Technology.
30. OU: Organizational Unit.
31. P&ID: Process and Instrument Diagram.
32. PC: Personal Computer.
33. PIC: Process Instrumentation and Control.
34. PAC: Programmable Automation Controller.
35. PMCS: Process Monitoring and Control Software.
36. PoE: Power Over Ethernet.
37. PAT: Performance Testing.
38. PLC: Programmable Logic Controller.
39. PMCS: Process Monitoring and Control Software.
40. PNP: Plug and Play (PnP).
41. PRA: Privileged Remote Access.
42. PW: Password.
43. RADIUS: Remote Authentication Dial-In User Service.
44. RAID: Redundant Array of Independent Disks.
45. RDS: Remote Desktop Services.
46. SAM: Security Accounts Manager.
47. SAN: Storage Area Network.
48. SCADA: Supervisory Control and Data Acquisition System.
49. SDT: Software Demonstration Test.
50. SLA: Service Level Agreement.
51. SMB: Server Message Block.
52. SNMP: Simple Network Management Protocol.
53. SQL: Structured Query Language.
54. USB: Universal Serial Bus.
55. VLAN: Virtual Local Area Network.
56. VM: Virtual Machine.
57. VPN: Virtual Private Network.
58. WMI: Windows Management Instrumentation.

B. Instructor Day: 8 hours of actual instruction time.

C. Software:

1. Programming of computers, switches, firewalls, and machines using all types of programming language.
2. Configuring of digital devices using all types of configuring process.
3. Programs or configuration data stored in read only memory, programmable read only memory, read/write memory, disk, tape, or other storage device.

D. Types of Software:

1. Standard Software: Software packages that are independent of project on which they are used. Standard software includes system software and process monitoring and control software.
 - a. System Software: Application independent software developed by Microsoft. Includes, but is not limited to, Microsoft's Windows operating system; file management utilities; text editors; debugging aids; and diagnostics.
 - b. Process Monitoring and Control Software (PMCS): Software packages independent of specific process control project on which they are used. Includes, but is not limited to, providing capability for, data acquisition, monitoring, alarming, man-machine interface, data collection, data retrieval, trending, report generation, control, and diagnostics.
2. OT Networking Software: Software packages intended to provide Information Technology (IT) type functions for industrial control systems. These include antivirus, network monitoring, virtual machine management, active directory, and backup management.
3. Application Software:
 - a. Software to provide functions unique to this Project and that are not provided by standard software alone.
 - b. Configuring databases, tables, displays, reports, parameter lists ladder logic, and control strategies required to implement functions unique to this Project.

1.03 WORK SEQUENCE AND SCHEDULE

- A. General: All work provided under this section shall be in accordance with a Milestone Breakdown and System Delivery Plan.
- B. System Delivery Plan (SDP):
 1. The intent of the SDP is to:
 - a. Coordinate and communicate applications and OT Networking software design and testing activities.

- b. Coordinate interactions with the Owner regarding software configuration, workshops, submittal reviews, contractor(s) progress, test witnessing, training, etc.
 - c. Communicate and clarify required work sequences and major milestones.
- 2. Minimum Content:
 - a. Work sequence and schedule.
 - b. OT Networking software workshops.
 - c. OT Networking software submittals.
 - d. OT Networking software development.
 - e. Software testing.
 - f. Software installation.
 - g. O&M development.
 - h. Owner training.
 - i. Startup.

1.04 SOFTWARE DESIGN WORKSHOPS

- A. Location: Owner's facility during the course of the Project.
- B. Objective: To provide a vehicle for the Owner to oversee the applications and networking software development.
- C. Documentation: Software Supplier to summarize resolutions reached in each workshop, including cost and schedule impacts and distribute copies to Owner and Engineer.
- D. Order and minimum topics to be covered in each Software Design Workshop.
 - 1. Networking Software Design Kickoff Workshop that establishes project processes, including:
 - a. Contractor, integrator, and Owner coordination and communication.
 - b. Required coordination workshops and workshop agendas
 - c. Submittal process.
 - d. Owner input and involvement in OT network software configuration.
 - e. Minimum functional requirements of OT networking software.
 - 2. Networking Software Configuration Workshop:
 - a. Software and Configuration:
 - 1) VM Configuration.
 - 2) Accounts and Account Management.
 - 3) Backup Management
 - 4) Overall security configurations.

- 5) OT Management:
 - a) Identify ongoing support/system management roles and responsibilities.
 - b) Develop support/system management matrix
- 6) Discuss and document choices.

1.05 SUBMITTALS

A. Action Submittals:

1. Manufacturers standard literature for all application and network software types and version being provided for each physical and virtual device.
2. Virtual Machine Mapping Diagram: Provide a drawing showing all virtual machine communication and mapping between virtual machines.
3. IP address assignments, VLAN mappings, VM network interface card settings.
4. Preliminary firewall policies.
5. Remote access flow diagram.
6. Authentication flow diagram.
7. Security Standards Submittal:
 - a. Review and develop security standards in a participative workshop with the Owner and Engineer.
 - b. Documented and submitted as security software standards.

B. Informational Submittals:

1. Networking Software Schedule of Values and Progress Schedule:
 - a. Submit within 30 days after first Preconstruction Conference.
 - b. Upon acceptance by Engineer, shall form basis and schedule of Submittal reviews, test witnessing, and partial payments.
 - c. Prior to this acceptance, Engineer will not review Submittals, witness tests, or consider requests for partial payment.
2. Owner Training Plan: In accordance with Section 01 43 33, Manufacturers' Field Services.
3. Testing Related Submittals:
 - a. Test Forms:
 - 1) Proposed test procedures, forms, and check lists:
 - a) Software Demonstration Tests (SDT).
 - b) Operational Readiness Test (ORT).
 - c) Performance Acceptance Test (PAT).

- b. Test Procedures: Conduct tests using Engineer accepted test procedures, forms, and checklists. Conduct testing of OT system prior to testing SCADA related applications software.
 - c. Test Documentation: Copy of signed of test procedures when tests are completed.
- 4. Operations and Maintenance Manuals:
 - a. In accordance with Section 01 78 23, Operation and Maintenance Data, unless otherwise specified in this section.
 - 1) User's manuals for OT networking and application software packages.
 - 2) Networking and OT Applications software source files.

PART 2 PRODUCTS

2.01 COORDINATION WITH OWNER

- A. Coordinate with Owner on required configuration of CC Williams OT network. System shall be compatible with OT network installed at Park Forest Headquarters and shall incorporate configuration standards developed as part of Park Forest network development.
- B. The following configurations and OT network software packages are expected to be developed by Owner for Park Forest OT Network. These configuration and packages are expected to be developed prior to development of CC Williams OT Network. Configurations and packages developed at Park Forest shall be assumed to be Owner's standards and incorporated and utilized in the development of the CC Williams OT Network where possible.
 - 1. VM and VLAN configuration and management.
 - 2. ICS Domain Controller and active directories.
 - 3. Privileged Access Management.
 - 4. Network Monitoring.

2.02 VM APPLICATION SOFTWARE DESIGN CRITERIA

- A. VMware:
 - 1. ESXi 6.7 (or latest stable version) must be installed on all virtual hosts.
 - 2. vCenter must be installed and used (where required) to manage multiple hosts.

3. All VM's shall be configured per the following parameters:

	Domain Controllers	VTSCADA	Backup Servers	Member Servers
CPUs	2 vCPUs	4 vCPUs	2 vCPUs	2 vCPUs
Memory	8 GB	16 GB	8 GB	8 GB
HDD 1	100 GB	100 GB	100 GB	100 GB
HDD 2	100 GB	1 TB	1 TB	100 GB
NICs	1 x 1 Gbps	1 x 1 Gbps	1 x 1 Gbps	1 x 1 Gbps

- B. All Virtual Hosts must use a RAID array capable of handling a single drive failure as a minimum.
- C. Windows:
1. All VM's must use a 64-bit version of Windows Server 2019 Datacenter Operating System.
 2. A Read-Only Domain Controller is required on the DMZ and integrated with systems and/or services also within the DMZ.
 3. Integrator shall coordinate with Owner on Forest Root Domain and Park Forest active directory configuration for inclusion in development of CC Williams active directory.
 4. Active Directory will be used centralize user accounts, security groups and group policy objects. Active Directory Organization Unit (OU) structure shall follow (but is not limited to):

Root Domain (eg. wwtp.local)				
Organizational Unit (OU)	Sub Folder	Sub Folder	Account(s)	Description
Vendors	<Vendor 1>	I&C	<as required>	OU for I&C Staff User Accounts
		OT	<as required>	Operational Technology (OT) User Accounts
	<Vendor 2>	I&C	<as required>	As above
		OT	<as required>	As above
Utility	OT		<as required>	OT User accounts of members employed by the Utility

Root Domain (eg. wwtp.local)				
Organizational Unit (OU)	Sub Folder	Sub Folder	Account(s)	Description
	Developers		<as required>	Developer accounts
	Managers		<as required>	Manager accounts
	Supervisors		<as required>	Supervisor accounts
Service Accounts			<domain>/HMIservice	Must be an admin on every HMI system
			SQLDataRetrieval	Optional SQL Domain Accounts instead of mixed mode. Otherwise use Mixed Mode with SA account and strong PW. Mixed mode is recommended.
			SQLSysAdmin	
Security Groups	HMI Administrators			Add users to the following security groups.Type: Domain Local/Security
	HMI Developers			Type: Domain Local/Security
	Global HMI Administrators			Type: Global/Security
	Global HMI Developers			Type: Global/Security

5. Group Policy Objects must be configured and applied to all systems, including (but not limited to):

a. An Audit Policy shall be created and applied to all servers and workstations. The policy shall include:

- ‘Audit Credential Validation’ is set to ‘Success and Failure’

- Audit 'Application Group Management' is set to 'Success and Failure'
- Audit 'Computer Account Management' is set to 'Success and Failure'
- Audit 'Other Account Management Events' is set to 'Success and Failure'
- Audit 'Security Group Management' is set to 'Success and Failure'
- Audit 'User Account Management' is set to 'Success and Failure'
- Audit 'PNP Activity' is set to 'Success'
- Audit 'Process Creation' is set to 'Success'
- Audit 'Account Lockout' is set to 'Success and Failure'
- Audit 'Group Membership' is set to 'Success'
- Audit 'Logoff' is set to 'Success'
- Audit 'Logon' is set to 'Success and Failure'
- Audit 'Other Logon/Logoff Events' is set to 'Success and Failure'
- Audit 'Special Logon' is set to 'Success'
- Audit 'Removable Storage' is set to 'Success and Failure'
- Audit 'Audit Policy Change' is set to 'Success and Failure'
- Audit 'Authentication Policy Change' is set to 'Success'
- Audit 'Authorization Policy Change' is set to 'Success'
- Audit 'Sensitive Privilege Use' is set to 'Success and Failure'
- Audit 'IPsec Driver' is set to 'Success and Failure'
- Audit 'Other System Events' is set to 'Success and Failure'

- Audit 'Security State Change' is set to 'Success'
 - Audit 'Security System Extension' is set to 'Success and Failure'
 - Audit 'System Integrity' is set to 'Success and Failure'
- b. A complex password policy shall be created and applied to all servers and workstations following these requirements:
- All passwords must be a minimum of 12 characters in length.
 - All passwords must be alphanumeric, using a combination of capital letters and special characters.
 - Passwords must be rotated every 90 days.
 - Password history restrictions for the past 10.
- c. A new Server device hardening policy shall be created and applied to all workstations. The policy shall include the following:
- "Network security: Do not store LAN Manager hash value on next password change"
 - "No auto-restart with logged on users for scheduled automatic updates installations"
 - "All removable storage classes: Deny all access"
 - "Network Access: Do not allow anonymous enumeration of SAM accounts and shares" – DISABLED
 - "Accounts: Guest Account Status" – DISABLED
- d. A new Workstation device hardening policy shall be created and applied to all workstations. The policy shall include the following:
- "Prohibit access to Control Panel and PC settings"
 - "Network security: Do not store LAN Manager hash value on next password change"
 - "Prevent access to the command prompt"

- “No auto-restart with logged on users for scheduled automatic updates installations”
 - “All removable storage classes: Deny all accesses”
 - “Prohibit User Install”
 - “Accounts: Guest Account Status” – DISABLED
 - “Network Access: Do not allow anonymous enumeration of SAM accounts and shares” – DISABLED
 - “Interactive Login: Machine Inactivity Limit” – set to 900 seconds.
- e. A new Cyber Security hardening policy shall be created and applied to all servers and workstations. The policy shall include the following:
- SMBv1
 - USB ports
 - Execute access on removable disks
 - Changes to proxy settings
- f. Application Whitelisting shall be enforced on all servers and workstations connected to the SCADA network per recommendations from the NIST 800-167 standard.
- g. Whitelisting shall be enforced using two (as a minimum) AppLocker GPO’s for domain bound Servers and Workstations.
- h. Once baseline servers, engineering and operator workstations are created rules shall be generated automatically utilizing the contents of the C drive (the primary HDD) to create AppLocker GPO’s which shall include (but are not limited to) the following:
- Executable Rules
 - Windows Installer Rules
 - Script Rules

- i. AppLocker GPO's shall permit by exception (all required SCADA software and related applications installed on a domain bound workstation and or server system by an authorized technician) and deny all other forms of software from installation and or execution.
- 6. Operator and/or Engineering Workstations, Thin/Thick Clients must:
 - a. Use the Windows 10 Professional Operating System
 - b. Be connected to the SCADA Domain.
 - c. Have Group Policies applied including application whitelisting.
- D. Microsoft Office Professional may be installed on Engineering Workstations only – NOT thin/thick clients or operator stations.
- E. Adobe Reader may be installed on Engineering Workstations only – NOT thin/thick clients or operator stations.
- F. Time:
 - 1. (Including but not limited to): All Servers, Workstations, Controllers, HMI, OITs must have clocks set to the correct localized time zone and synchronize with a primary local (preferably GPS) time source including a secondary source using NTP or equivalent protocols.
- G. An E-mail Relay (at Park Forest) will be used to forward critical alerts to key personnel. Coordinate with Owner on relay server configuration.

2.03 SECURITY APPLICATION SOFTWARE DESIGN CRITERIA

- A. Contractor to provide specified firewalls for inclusion into CC Williams OT Network. Owner will configure firewalls based on Owner's standard firewall configuration.
- B. Integrator shall coordinate with Owner on security configurations necessary for the development of CC Williams OT network. This may include:
 - 1. Fortigate Firewall configurations.
 - 2. FortiManager.
 - 3. FortiAnalyzer.
 - 4. FortiAuthenticator.

- C. Cylance AV shall be installed on all servers and workstations (Thin/Thick Clients, Operator & Engineering Desktops/Laptops). Endpoint protection client shall:
 - 1. Pull updates from a central server located in the Park Forest DMZ and not directly via the internet.
 - 2. Automatically download and install the updated signature immediately upon release by the vendor.
 - 3. Scan for updates every 60 minutes.
 - 4. Perform a daily scan of the system and report to the central infrastructure monitoring platform in real-time (eg. PRTG, Solarwinds) for warnings and detection of known malware.
- D. Beyond Trust Privilege Remote Access (PRA) Appliance :
 - 1. Will be installed by Owner within the Park Forest DMZ network of the SCADA environment.
 - 2. Integrator shall coordinate with Owner as necessary to:
 - a. Configure Integrator use of PRA application during configuration and testing of CC Williams OT network.
 - b. Permit access to CC Williams OT Network servers, workstations, and applications.

2.04 BACKUP AND CHANGE MANAGEMENT SOFTWARE DESIGN CRITERIA

- A. Owner will install and configure a backup management software application at Park Forest as necessary to back up PAC and HMI programs running on production equipment in the field. Integrator shall coordinate with Owner to ensure backup of CC Williams applications and devices.
 - 1. Provide necessary SQL Server software and PAC/HMI developer software and licensing as required to enable automated backups.
 - 2. Install the Program Export Event Module to export configs of all devices attached to the system to a secure local File Server and backed up by Veeam.

PART 3 EXECUTION

3.01 TESTING

- A. Testing steps below are by no means an exhaustive list, the Integrator must devise testing scenarios referencing items in server 3.01 with input from the Owner.
- B. The Integrator must submit test sheets to the Owner for review and approval prior to testing.

C. The Integrator must submit test sheets to the Owner upon each completed test for review and signoff.

D. General:

1. **Setup / Testing Environment:**

- a. Test laptop must be connected to core network Management VLAN.
- b. Ensure all Virtual Hosts are connected and operational.
- c. Ensure all core networking equipment (switches, firewalls) are powered on

2. **Test Virtual Host Drive Failure** – virtual hosts RAID cluster should be designed in such a way that disk failures have little effect on the cluster beyond the temporary loss of the capacity and I/O resources of that disk. When a disk is determined to have failed, the host will continue servicing I/O transparently using the mirrored data copies. The expected result from a drive failure is no change in available logical space or drop in I/O.

3. **Test Network Failure** - All Virtual Hosts offer redundant network ports for network connections via the core switches to allow for full network redundancy. These ports should be in an active / passive bond for failover. If access to the primary port is lost to either core switch network, the secondary port will activate with little to no disruption to the cluster node. Once the primary port becomes available again the network will fail back to that port. By sending “Ping” packets to any internal VM, the tester should see that there are little to no packet drops when the cable is pulled from the primary port. This is repeated for all nodes in the cluster.

4. **Workstation and Network Share communications** - Verify that the workstation/users can access network shares.

5. **Test Backup System:**

- a. Demonstrate scheduled system backups of all systems are running as required and completing successfully.
- b. Demonstrate automated backup to Thick workstation and run VM with VMware Workstation Pro.
- c. Demonstrate backup replication from NAS to Cloud system (or equivalent) for offsite storage.

- d. Run restoration jobs for critical systems to ensure the integrity of the backup image and functionality of the system, which may include (but is not limited to): Domain Controllers, SCADA HMI, Historian and Application Servers.
6. **Test Infrastructure Monitoring Platform and Configuration Management:**
- a. Check that every critical asset/device with a networking interface on the SCADA network is registered with the infrastructure monitoring software.
 - b. Generate a networking event and demonstrate its capture and subsequent log/record with the system.
 - c. Generate an alarm event and display notification of alarm
 - d. Test notification emails are received by incident responders.
 - e. Demonstrate a configuration change and subsequent alarm notification sent by the Infrastructure Monitoring Platform to incident responders.
7. **Test Software and Signature Updates** – Ensure all critical systems, including (but not limited to); Windows Servers, Windows Workstations, Firewalls and Endpoint Protection are receiving software and signature updates from systems/services located in the DMZ only.
8. **Test Remote Access:**
- a. Terminate a VPN connection with the Fortigate using a Forticlient from the test laptop via an external internet connection and ensure MFA is functioning as required.
 - b. Open the Beyond Trust client and connect to a pre-configured jump client with an authorized user account.
 - c. Attempt to connect to a jump client with a user account that is not authorized to confirm user permissions are correct.
 - d. Once connected to a jump host, open Windows Explorer and a Web Browser and Create and save a text file on the desktop. Review the Beyond Trust admin portal and go through the logs to ensure the system is capturing user activities based on username with the correct date and time stamps.

3.02 OWNER TRAINING

A. General:

1. Provide an integrated training program for Owner's personnel.
2. Perform training to meet specific needs of Owner's personnel.
3. Include training sessions, classroom and field, for managers, engineers, operators, and maintenance personnel.
4. Provide instruction on all working shift(s) as needed to accommodate the Owner's personnel schedule.
5. Owner reserves the right to make and reuse video recordings of all training sessions.

B. OT Network and VM Management Seminar:

1. Length: 2 days.
2. Location: Owner's facility.
3. Presenters: The seminar presenters should include the integrator responsible for configuring the system and representatives from OT application and networking software providers.
4. Objective: Provide an overview for non-operations and maintenance personnel for understanding the OT networking applications software including:
 - a. VMware.
 - b. Domain Configuration.
 - c. Update Procedures.
 - d. Configuration Management.
5. Attended by management, engineering, IT, and other non-operations and non-maintenance personnel.
6. Primary Topics:
 - a. Management-oriented explanation of data management displays and printouts.
 - b. Walk-through of installed systems.
 - c. User access instructions.
 - d. Procedures for using each software type.
 - e. Things to avoid and dangers of changing parameters.
 - f. Best practice and best use.

3.03 O&M MANUALS

A. General: Provide the following:

1. Failure Scenarios:
 - a. Recovery from failures.
 - 1) Recovery Procedure.
 - 2) Contact if recovery procedure fails.

2. Suggested shutdown and startup procedures.
3. Training material.

B. Software: Provide the following:

1. Run Book:
 - a. Licensing Information.
 - b. Configuration Parameters.
 - c. All Credentials.
 - d. Support Contacts.

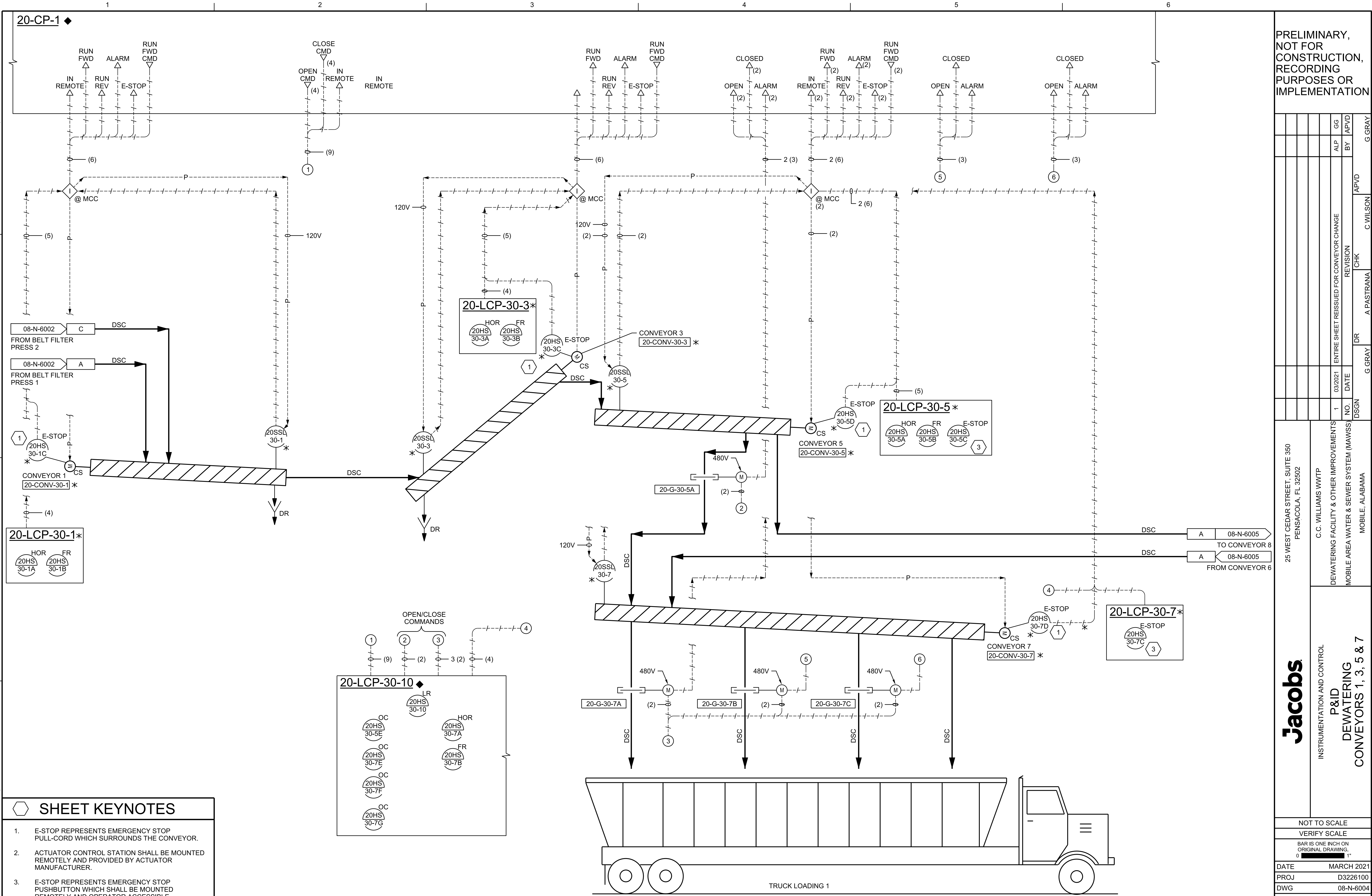
3.04 SUPPLEMENTS

A. The supplement listed below, following “End of Section,” is a part of this Specification:

1. Virtual Servers List – CC Williams.

END OF SECTION

CONVEYOR DATA SHEET				
	20-CONV-30-(1 and 2)	20-CONV-30-(3 and 4)	20-CONV-30-(5 and 6)	20-CONV-30-(7 and 8)
PERFORMANCE				
Material Conveyed	Sludge	Sludge	Sludge	Sludge
Density (typ) - lbs/ft3	70	70	70	70
Volume – ft3/hr	408	408	408	816
Spiral Speed (max) – rpm	20	20	20	20
Trough fill rate @ Design - %	40	40	40	40
SYSTEM DESIGN				
Length – ft	Per drawings	Per drawings	Per drawings	Per drawings
Incline – degrees	2	34	2	2
Inlet quantity	2	1	1	2
Outlet quantity	1	1	2	4
Discharge Type (axial or vertical)	Axial	Vertical	Vertical	Vertical
Conveyor size, U or OK trough	U420	U420	U420	U500
Trough ID (min) – inches	14	14	14	18
Trough thickness (min) – gauge	11	11	11	11
Lid thickness (min) – gauge	12	12	12	12
Spiral material	HTMAS	HTMAS	HTMAS	HTMAS
Liner (base) material	UHMW-PE	UHMW-PE	UHMW-PE	UHMW-PE
Liner thickness (min) – inches	5/8	5/8	5/8	5/8
Location of drives (push/pull)	Push	Pull	Pull	Pull
Motor Power – Hp (max)	5	7.5	7.5	10

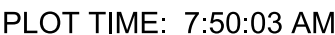







	BID DOCUMENTS
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1/8"=1'-0"	
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING	
0	
DATE	MAR 2011
PROJ	D301
DWG	20-1
SHEET	

BID DOCUMENTS

DATE	BY	FOR	REMARKS
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1. SLAB CONSTRUCTION (UON):
 - 10" MIN SLAB ON GRADE
 - REINFORCED W/ #5@12" OC EW TOP AND BOTT.
 - OVER VAPOR RETARDER AND 6" LAYER OF COMPACTED GRANULAR FILL.
2. 10" CMU WITH #5@24" OC CENTERED. SEE 5/20-S-5002 TYPE 'A' FOR WALL INFO. WALL TO BE REMOVED DURING CLASS A CONVERSION.
3. CMU WALL CONNECTION TO PRECAST CONCRETE WALL, SEE 0422-011.
4. 10" PRECAST WALL BY PRECAST MANUFACTURER, TYP.
5. SLAB CONSTRUCTION:
 - 6" SLAB ON GRADE WITH #5@12" CANTERED EW
 - OVER VAPOR RETARDER AND 6" LAYER OF COMPACTED GRANULAR FILL.
6. AL PLATFORM W/ ANGLE POSTS. SEE DETAIL 0551-201, SIM. TOG EL 22.00. PLATFORM SHALL NOT BE ATTACHED TO PRECAST PANEL.
7. MINIMUM CLEARANCE BETWEEN GUARDRAILS/HANDRAILS.
8. KNOCK-OUT PANEL IN PRECAST WALL BY PRECAST SUPPLIER FOR FUTURE OVERHEAD COILING DOOR. COORDINATE OPNG SIZE AND LOCATION WITH ARCH DWGS AND APPROVED DOOR SUBMITTAL. KNOCK-OUT PANEL TO BE REMOVED DURING CLASS A CONVERSION.
9. FLOOR DRAIN. SEE DET 0330-082.
10. CONC EQPT PAD. SEE DET 0330-056, TYPE 'A'.
11. PROVIDE #4x3'-0" LG RE-ENTRANT CORNER BAR AT ALL RE-ENTRANT CORNERS. LOCATE 2" CLR FROM TOP OF SLAB. BARS SHALL NOT CROSS SLAB JOINTS.
12. TEMPORARY STUD WALLS TO BE REMOVED DURING CLASS A CONVERSION. SEE ARCH DWGS FOR WALL INFO.
13. CONVEYOR SUPPORTS. COORDINATE SUPPORT LOCATIONS WITH BELT FILL PRESS FOUNDATIONS AND SLAB JOINT LOCATIONS. SUPPORT ANCHORS SHALL MAINTAIN MINIMUM 6" EDGE DISTANCE FROM ALL JOINTS.

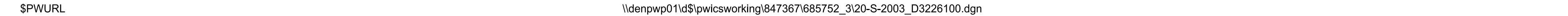
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25 WEST CEDAR STREET, SUITE 350
PENSACOLA, FL 32502

C.C. WILLIAMS WWTP
DEWATERING FACILITY & OTHER IMPROVEMENTS
MOBILE AREA WATER & SEWER SYSTEM (MAWSS)

MOBILE, ALABAMA

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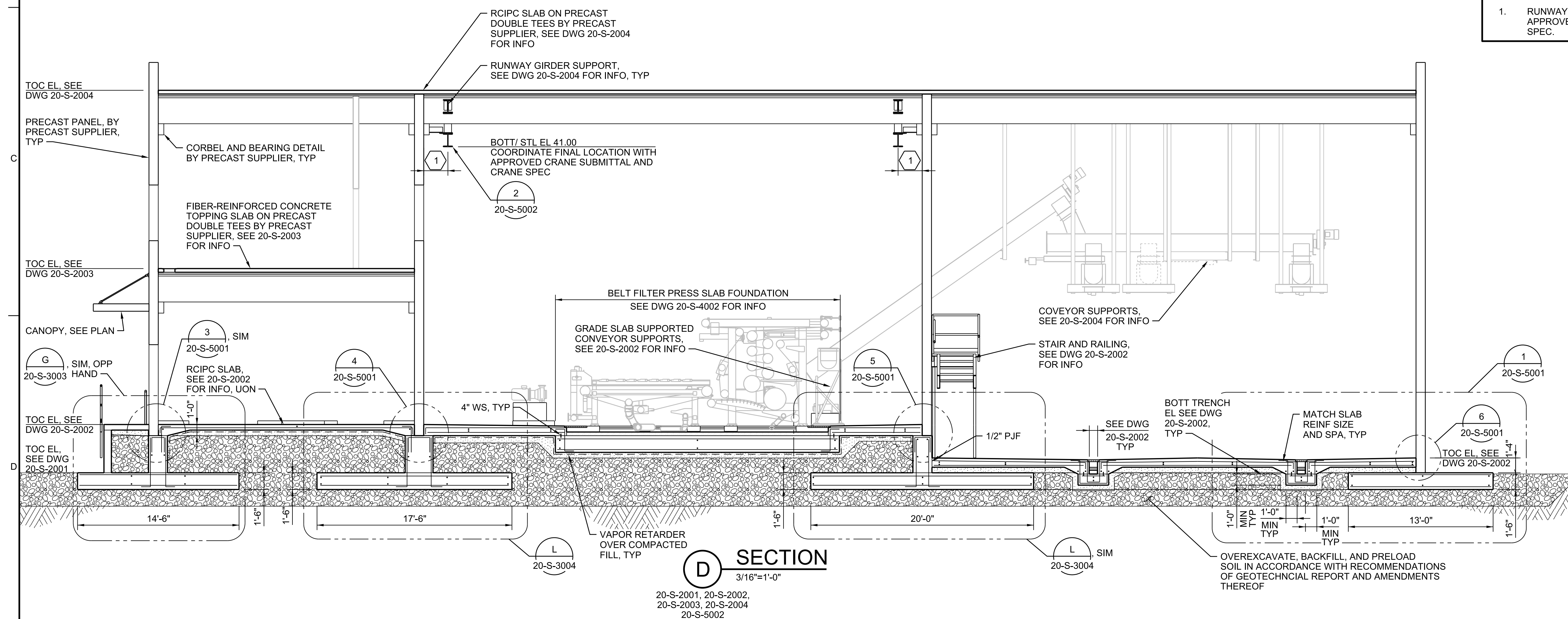
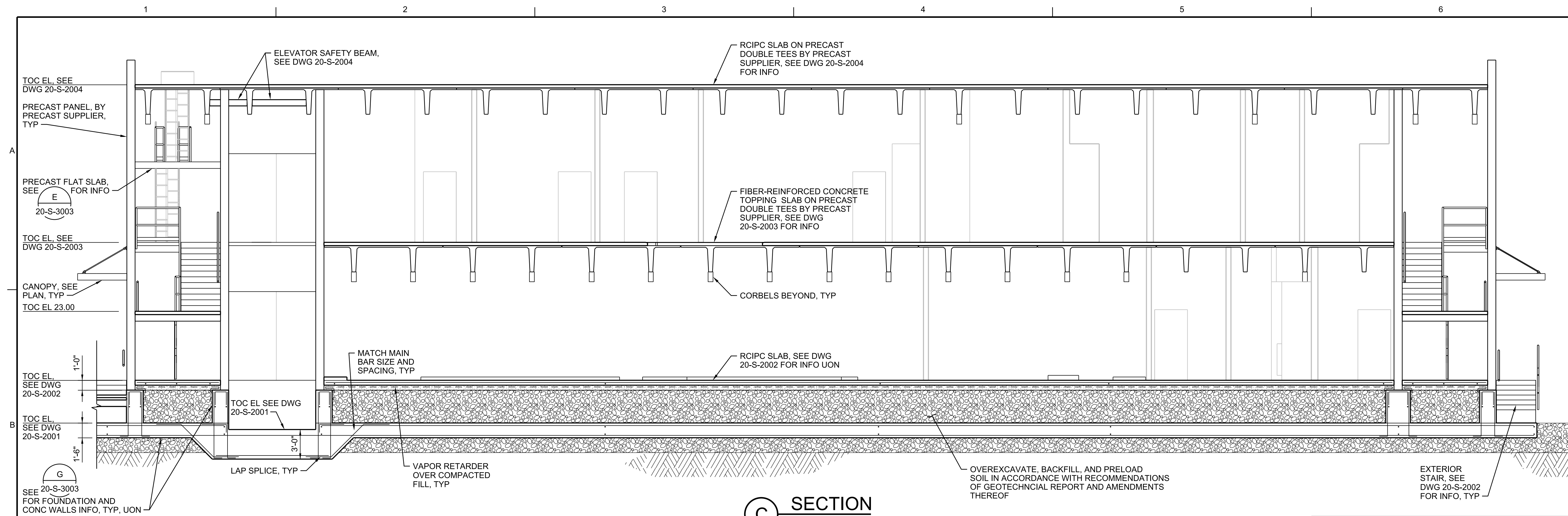
D3226100.dgn PLOT DATE: 3/29/2021

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RECORDING
PURPOSES OR
IMPLEMENTATION

[illegible]

25 WEST CEDAR STREET, SUITE 350
PENSACOLA, FL 32502

Jacobs.

DEWATERING AND
CONTROL BUILDING
SECTIONS

3/16"=1'-0"	
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING.	
0	1"
DATE	MARCH 2021
PROJ	D3226100
DWG	20-S-3002
SHEET	87

DATE	MARCH 2021
PROJ	D3226100
DWG	20-S-3002
SHEET	87

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