

**CITY OF WINTER GARDEN
WESTERN STORAGE, PUMPING & TRANSMISSION FACILITIES**

Addendum No. 2

May 1, 2018

This Addendum forms a part of the Contract Documents and modifies or supplements the original Bidding Documents dated April 2018. It shall be noted that the responses and revisions set forth herein supersede any previous requirements within the original Drawings and Specifications. Revisions are indicated with bubbles and the addendum number. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject Bidder to disqualification.

This Addendum consists of 7 pages, plus attachments.

Questions Received During Bidding

Question 1: Reference drawing I-002 Notes 2 & 3: Please identify the existing SCADA software at the waste water plant & the water plant.

Answer 1: Palmetto WTP is Rockwell and the Crest Ave. WWTP is Wonderware.

Question 2: Reference drawing I-002: Please identify the location of the control room (local operator workstation location) in relation to the office & MCP. Please identify the location of the remote access workstation.

Answer 2: The "Control Room" local operator work station and its ethernet cable have been removed from sheet I-002 by this Addendum No. 2.

Question 3: Reference drawing I-002 & I-201: Please confirm the PLC platform will be Allen Bradley CompactLogix as shown on I-002 and not CompactLogix as found on I-201. It does not appear that a written PLC spec was included in the bid set.

Answer 3: The PLC is to be Allen Bradley ControlLogix as per I-002. Drawing Sheet I-201 has been revised by this Addendum No. 2 to list PLC model as "Allen Bradley ControlLogix". Pages 13400-1 through 13400-46 of specification section 13400 have been revised and reissued as part of this Addendum No. 2. The "Supplements" pages immediately following page 13400-46 of the bid specifications remain unchanged.

Question 4: Reference section 02850 2.04A: Please confirm and clarify the requirement for the gate system to be controlled from Orange County Utilities' Eastern Regional WSF.

Answer 4: Specification Section 02850 has been revised and reissued by this Addendum No. 2.

Question 5: Reference section 02850 2.05C & drawing E-504 detail 28: There appears to be a conflict between the spec & the drawing; please clarify which is to be used and which features are required. Lenel vs Sitesecure, No intercom vs intercom

Answer 5: Specification Section 02850 has been revised and reissued by this Addendum No. 2. Drawing Sheet E-504/Detail 28 has been revised by this Addendum No. 2 to remove four (4) references to "Sitesecure" and to delete the video intercom station. No video intercom station is required.

Question 6: Reference section 02850 2.05J: Please provide the I-Drawings referenced in this section that show the security panel & gate junction boxes, etc.

Answer 6: Specification Section 02850 has been revised and reissued by this Addendum No. 2.

Question 7: Can the bid date please be extended by a week or two? The building will require participation from several smaller subcontractors. With the commercial market as busy as it is most subcontractors cannot fit this into their bid calendar on such short notice.

Answer 7: The bid date has been extended per Addendum No. 1.

Question 8: The Geotechnical Investigation performed for the two tanks provided soil types contained in each boring, but did not provide the Soil Site Classification for each tank structure. Please provide the Soil Site Classification for both tanks and confirm there is not a potential for sinkholes or perched water.

Answer 8: The following response was provided by the geotechnical engineer and is incorporated into the Appendix B - Geotechnical Report which has been revised by this Addendum No. 2: "According to Table 1613.5.2 of the International Building Code (IBC) it is our opinion that the soil profile is most representative of a stiff soil profile, Site Class D."

Question 9: The Geotechnical Investigation provided a soil bearing capacity of 1900 psf for the 1.0-MG tank. Soil bearing capacity required for design of the 1.0-MG tank, including future CMU baffle wall, is a minimum 2500 psf. Please provide confirmation of our required 2500 psf bearing capacity for the 1.0-MG tank.

Answer 9: The following response was provided by the geotechnical engineer and is incorporated into the Appendix B - Geotechnical Report, which has been revised by this Addendum No. 2: "Based on the existing soil conditions and, assuming the tank area is prepared in accordance with the requirements presented, an allowable soil bearing pressure of up to 2,500 pounds per square foot (psf) may be used in the tank foundation design. All bearing wall foundations should be a minimum of 24 inches wide (wider if specifically noted, e.g. for the ringwall) with a minimum soil cover of 18 inches maintained from the bottom of the foundations to the adjacent finished grades. We note that the calculated settlements presented for the 1.0 MG and the 2.0 MG tanks are based on a soil bearing pressure of 1,900 psf and 2,200 psf, respectively, applied uniformly over the tank diameter (i.e. corresponding to an approximate 30-foot water depth)."

Question 10: Specification 13205-7, Section 2.01C, require a 4000 psi compressive strength for the concrete and shotcrete. Specification 03300-21, Section 3.10A, provides a concrete schedule that requires the prestressed concrete to be Class D at 5000 psi. Please delete the Class D at 5000 psi; not applicable. All concrete and shotcrete required for the 1.0-MG and 2.0-MG tanks shall be 4000 psi concrete mixes as specified in Specification 13205.

Answer 10: The requirement for 5,000 psi concrete for prestressed concrete in Section 03300 does not apply to the tank. The concrete for the tank shall be as required by specification Section 13205.

Question 11: Specification 03345-2, Sections A and B, provide surface finishes for the tank floor, wall, and dome. Section B5, Finish S-2, requires a steel trowel finish on the tank floor and Section B6 requires a steel trowel finish on the tank dome. Standard on all tanks: soft broom finish on these surfaces. Steel trowel finishes are not recommended for these applications. Please delete all references to steel trowel finish surfaces for all tanks.

- Answer 11: The requirements for surface finishing and curing in Section 03345 do not apply to the tank. The surface finish for the tank shall be as required by specification Section 13205.
- Question 12: Specification 13205-8, Section 2.01G, requires "a steel tank shell diaphragm shall be cold rolled sheet, minimum 26-gauge, conforming to ASTM A366, for Commercial Quality Cold Rolled Steel, with a Class 2, rolled finish or approved equal". Section 3.01 D1 requires a 26-gauge steel tank shell diaphragm, complying with ASTM A366 for Commercial Quality Cold Rolled Steel, shall be used within and throughout the core wall, providing a positive waterstop. Please update the specifications and replace the language with the following for all tank projects moving forward: "The galvanized steel diaphragm used in the construction of the core wall shall be 26-gauge with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall not be less than G 90 of Table 1 of ASTM A653/A653M." This is an update to standard tank construction that will enhance the finished product.**
- Answer 12: Specification Section 13205 has been revised and reissued by addendum.
- Question 13: Specification 13205-9, Section 2.03B, requires an approved rigid ladder safety device which shall be Saf- T-Climb or equal. Drawing Sheets D-304, D-305, and D-501, Detail 5, shows a stainless steel TS Safety Rail. Please update specifications as "Saf-T-Climb" is no longer available, confirm that the TS rail system is acceptable.**
- Answer 13: Our information indicates Saf-T-Climb is available. The TS rail system is acceptable as an "equal".
- Question 14: Specification 13205-10, Section 2.03 G, requires the aluminum dome handrail shall have three (3) rail type handrail system. Drawing Sheets D-304 and D-305, show a two rail system. Two rail system is standard and provided around the access hatch. Please delete "three (3) rail" and replace with standard "two (2) rail" system.**
- Answer 14: Specification Section 13205 has been revised and reissued by this Addendum No. 2 to require a (2) rail handrail meeting the requirements of the FBC and OSHA.
- Question 15: Specification 13205-10, Section 2.03 J1, is old specification language that requires the manhole opening shall be of round-ended slot approximately 18 inches high and 29 inches long. Drawing Sheet D-501, Detail 7, requires a rectangular manhole opening of 1'-5" x 3'-0". Standard manhole openings are 1'-5" x 4'-4" for all tanks. Please delete all others mentioned.**
- Answer 15: Specification Section 13205 has been revised and reissued by this Addendum No. 2 to require a 17" x 52" manhole opening. Detail 7/Sheet D-501 is revised by this addendum to depict the 17" x 52" manhole opening.
- Question 16: Specification 13205-11, Section 2.04A, states that the interior of the tanks shall not be painted. Specification 09900-8/9, Section 2.02 B1, requires one prime and two finish coats of Tnemec Series N140 at 7 mils per coat on the walls, floor, dome and future CMU block wall. Tnemec Series 63-1500 filler surfacer shall be provided after the prime coat. Please delete "FLOOR" coatings and replace tank coatings specifications referenced above as it is out of date. Please confirm interior coatings are not required for the reclaimed and potable water storage tanks. If so, please confirm that only the potable water storage tank shall be coated underside of dome with Tnemec series 218 and two coats of Tnemec Series N140 (underside of dome and 3' upper wall) if there is an H2S issue.**
- Answer 16: Specification 09900, Subparagraph 1.01.D.14 (page 0990-2) states that the interiors of the tanks are not to be painted. Specification 09900 Subparagraph 1.01.E (page 09900-2) refers to Section 13205 for tank coatings. Exposed piping in the tank shall be coated per Section 09900. No change to the specifications is required.

- Question 17:** Specification 13205-11, Section 3.01 B5, requires the floor shall be sloped to drain toward the tank effluent pipe and the finishing tolerance shall be ½-inch in 10 feet, as determined by a 10-foot straightedge placed anywhere on the slab in any direction. Please delete all slope references as the standard 4" membrane floor typically settles at the center or in accordance with the geotechnical information. Crom recommends a flat floor for tanks of this design.
- Answer 17: Specification Section 13205 has been revised and reissued by this Addendum No. 2 to allow the flat tank floor.
- Question 18:** Specification 15062-8, Section 3.01C 1b, requires pipe support spacing for DI pipe at 8 feet on centers and at each fitting and where shown on drawings. Drawing Sheet D-304, Sections A and C, do not show pipe supports. Please confirm that only one pipe bracket support is required for each pipe.
- Answer 18: The influent pipes to the tanks are relatively short and will not need bracket supports. No change to the drawing or specification is required.
- Question 19:** Drawing Sheet S-001, Design Criteria: C, Live Loads (U.N.O), requires the roof to have a 20 psf live load. This requirement is for occupied buildings and does not apply to storage tanks. Per ASCE-7, a 12 psf dome live load is acceptable for storage tanks. Please delete 20 psf and replace with 12 psf.
- Answer 19: A dome live load of 20 psf is required; no changes are required to the dome live load on drawing Sheet S-001.
- Question 20:** Drawing Sheets D-105 and D-107, requires a landing for the interior ladder. There are no other details. Please delete all reference to "landing" as the interior ladder terminates on the tank floor flat area and any landings interior of tanks create a safety hazard.
- Answer 20: Sheets D-105 and D-107 have been revised by this Addendum No. 2 to DELETE the landings for the interior ladders.
- Question 21:** Drawing Sheet D-304 provides a top of dome elevation at 165.67 with a 1/12th dome rise. Based on Crom's dome design, a dome radius of 154.17 feet is required with a 1/12th rise. This provides an elevation of 168.96 feet; 3.29 feet above the top of dome elevation provided. Please confirm which design parameter controls.
- Answer 21: This issue was addressed in Addendum No. 1.
- Question 22:** Drawing Sheet D-305, provides a top of dome elevation at 165.42 with a 1/12th dome rise. Based on Crom's dome design, a dome radius of 115.63 feet is required with a 1/12th rise. This provides an elevation of 166.88 feet; 1.46 feet above the top of dome elevation provided. Please confirm which design parameter controls.
- Answer 22: This issue was addressed in Addendum No. 1.
- Question 23:** Drawing Sheets E-207 and E-208 provide a Lightning Protection Plan. Please delete all reference to Lightning Protection; not recommended. There is a requirement to bond to reinforcing steel. Specification 16060 provides information about grounding and bonding. Specification 16670 provides information about the lightning protection system. Bonding to any concrete encased tank steel is not recommended and shall not be allowed per the tank manufacturer. All bonding shall be done by using air terminals on the top of the tank dome with PVC conduit adhered to the exterior tank wall. Crom does not recommend any

form of lightning protection, based on physical experience of lightning strikes hitting tanks.

Electrical grounding to the reinforcing of a prestressed concrete tank is prohibited by AWWA D110-13, per Section 5.16. Items requiring grounding, such as lightning protection, are required to be a separate system with its own ground connections. Excerpts of the referenced sections are provided below.

- **AWWA D110-13, Sec. 5.16 – Electrical grounding to non-prestressed reinforcing steel or prestressed reinforcement for any equipment or electrical service shall be strictly prohibited.**
- **AWWA D110-13 Sec. 5.17 – Lightning protection, if required, shall be a separate system with its own ground connections**

Answer 23: Drawing Sheets E-207 and E-208 are revised by this Addendum No. 2 to DELETE bonding to the tank reinforcing steel and to ADD bonding to all buried tank influent and effluent piping concrete encasement just outside the tanks' walls.

Question 24: Please confirm Davis-Bacon prevailing wages are not required.

Answer 24: The bid documents do not list those as requirements.

Question 25: Is the American Iron and Steel Act or Buy American requirement in effect for this project? Please confirm.

Answer 25: The bid documents do not list those as requirements.

Question 26: Please confirm DBE/MBE/WBE are not required.

Answer 26: Subcontractor requirements are detailed in Paragraph 10 of Section 00100 - Instructions to Bidders.

Question 27: We would like to request that the bid date be backed up one week to the 10th of May due to a couple other projects that were postponed to bid the same week. We really want to be able to pursue this project for you and the City but these other bids are now getting in the way.

Answer 27: The bid date was extended by Addendum No. 1.

Question 28: What detail do we use for the new fence going in along Amber Sweet Lane?

Answer 28: Match the existing barbed wire fence which is located north of the property line in the ROW that must be removed. Sheets C-103 and C-104 have been revised by this Addendum No. 2 to ADD "3-WIRE BARBED WIRE, MATCH EXISTING" to the proposed new fence callouts on the south side of Amber Sweet Lane.

Question 29: During the site visit, it appeared there may be gopher tortoises present. Will there be an allowance for surveying and possible removal if needed?

Answer 29: Section 00300 – Bid Form has been revised and reissued by this addendum No. 2 to ADD two new bid items to the BID SUMMARY table on page 00300-3: Gopher Tortoise Burrow Survey and Gopher Tortoise Permitting/Relocation. The Contractor shall include in his bid price, services related to an inspection/survey, including determination if the burrows are occupied, and the permitting/relocation of up to 12 gopher tortoises, by an FWC certified agent in accordance with Florida Regulations and requirements of Section 01067.

Question 30: Addendum 1 stated that the contractor will be required to obtain the building permit. Nothing was said about who is responsible for the fees. Attached is the County fee schedule and what we believe will be the cost if the contractors are responsible. Do we need to carry this cost (\$106,625.00) in our bid?

Answer 30: The fee has been waived. There is no application fee for the City Building Department permit.

Question 31: Please refer to Spec. Sect. 01067, Protected Species Permitting. Although there has been a previous Gopher Tortoise Survey conducted and it is the Contractor's responsibility to obtain the required permit prior to construction activities, who will borne the costs for potential Gopher Tortoise relocation? Due to the fact that the survey was conducted over 2 years ago and there may be more or fewer burrows, as well as, unknown costs for each relocation, we suggest that the owner carry an Allowance on the bid form for these potential costs. This would allow all potential bidders to include the same cost.

Answer 31: Section 00300 – Bid Form has been revised and reissued by this Addendum No. 2 to ADD two new line items to the BID SUMMARY table on page 00300-3: Gopher Tortoise Burrow Survey and Gopher Tortoise Relocation/Permitting. The Contractor shall include in his bid price, services related to an inspection/survey, including determination if the burrows are occupied, and the permitting/relocation of up to 12 gopher tortoises, by an FWC certified agent in accordance with Florida Regulations and requirements of Section 01067.

Question 32: Refer to Dwg. C-104. There is a note at Sta. 31+70 that says Begin/End Fence. Dwg. C-101 notes that the perimeter site fence is 8' Chain Link Fence. Dwg. C-502 shows only one type of fence. Is the off site fence along the access roads meant to be the same as the on site fence?

Answer 32: Match the existing barbed wire fence which is located north of the private property line inside the ROW. Sheets C-103 and C-104 have been revised by this Addendum No. 2 to ADD "3-WIRE BARBED WIRE, MATCH EXISTING" to the callouts for the proposed new fence on south side of Amber Sweet Lane.

Question 33: Refer to Dwg. C-503, Typical Roadway, Section B, detail of the 2" Cold Rolled Asphaltic Concrete. Can hot mix asphalt be used in lieu of cold rolled?

Answer 33: Please bid as specified.

Question 34: Please confirm that the concrete slab outside of the High Service Pump Building is 6" thick. Also, refer to Dwg. S-301, detail C Threshold Section. What is the proposed reinforcing detail and dowel spacing of the concrete slab adjacent to the building slab?

Answer 34: Drawing Sheet S-501 has been revised and reissued by this Addendum No. 2 to provide additional information on the exterior concrete slabs.

Changes to Specifications

- A. Section 00300 – Bid Form. DELETE Section 00300 – Bid Form, as revised per Addendum 1, in its entirety and REPLACE with attached Section 00300 – Bid Form.
- B. Section 01025– Bid Item Descriptions. DELETE Section 01025 – Bid Item Descriptions in its entirety and REPLACE with attached Section 01025 – Bid Item Descriptions.
- C. Section 02850 - Plant Motorized Gate. DELETE Section 02850 - Plant Motorized Gate in its entirety and REPLACE with attached Section 02850 - Plant Motorized Gate.

- D. Section 13205 – Prestressed Circular Concrete Water Storage Tanks. DELETE Section 13205 – Prestressed Circular Concrete Water Storage Tanks in its entirety and REPLACE with attached Section 13205 – Prestressed Circular Concrete Water Storage Tanks.
- E. Section 13400 - Instrumentation and Control for Process Systems. DELETE Pages 13400-1 through 13400-46 of Section 13400 - Instrumentation and Control for Process Systems and REPLACE pages 13400-1 through 13400-46 with attached pages 13400-1 through 13400-48 of Section 13400 - Instrumentation and Control for Process Systems. The “Supplements” pages 13410-47 through 13410-69 of the original bid specifications remain unchanged.

Changes to Drawings

- A. Drawing Sheet S-501 – Structural Typical Details. DELETE Sheet S-501 in its entirety and REPLACE with attached Sheet S-501.
- B. Drawing Sheet E-504/Detail 28. DELETE all four (4) references to “SITESECURE”. DELETE the “AIPHONE IS-IPDVF VIDEO INTERCOM STATION”.
- C. Drawing Sheet I-201. On the “PROPOSED BACK PLATE LAYOUT” detail, REVISE the name “COMPACTLOGIX” to “CONTROLLOGIX”.
- D. Drawing Sheet I-002 - Network Architecture. DELETE the “CONTROL ROOM” local operator workstation and its associated Ethernet cable.
- E. Drawing Sheet E-207 – 2.0 MG Reclaimed Water Grounding Plan. DELETE the bonding of the grounding system to the tank reinforcement (4 locations) and ADD bonding of the grounding system to the tank influent and effluent piping concrete encasement (3 locations).
- F. Drawing Sheet E-208 – 1.0 MG Potable Electrical and Grounding Plan. On the “POTABLE WATER GROUND STORAGE TANK LIGHTNING PROTECTION AND GROUNDING PLAN” detail, DELETE the bonding of the grounding system to the tank reinforcement (4 locations) and ADD bonding of the grounding system to the tank influent and effluent piping concrete encasement (2 locations).
- G. Drawing Sheet D-105 – 2.0 MG Reclaimed Water Ground Storage Tank Lower Plan. DELETE the “LANDING FOR INTERIOR LADDER” (1 location).
- H. Drawing Sheet D-107 – 1.0 MG Potable Water Ground Storage Tank Plans. On the “LOWER PLAN” detail, DELETE the “LANDING FOR INTERIOR LADDER” (1 location).

END OF ADDENDUM NO. 2

SECTION 00300

BID FORM

SUBMITTED: _____
Date

PROJECT IDENTIFICATION: **CITY OF WINTER GARDEN
WESTERN STORAGE, PUMPING, AND
TRANSMISSION FACILITIES**

NAME OF BIDDER: _____

BUSINESS ADDRESS: _____

Phone No.: _____ Fax No.: _____

E-Mail Address: _____

CONTRACTOR'S FLORIDA LICENSE NO.: _____

THIS BID IS SUBMITTED TO: City of Winter Garden, Florida (hereinafter called Owner) acting through its City Commission.

1. The undersigned Bidder offers and agrees to enter into an Agreement with Owner in the form included in the Bidding Documents, to complete all work for the Contract Price and within the Contract Time, all in accordance with the Contract Documents.
2. Bidder accepts all of the terms and conditions of the Bidding Documents, including without limitation those dealing with the Owner's time for accepting for Bid and the disposition of Bid Bond.
3. In submitting this Bid, Bidder makes all representations required by the Instructions to Bidders and further warrants and represents that:

(a) Bidder has examined copies of all the Bidding Documents and of the following addenda:

No. _____	Dated _____;	No. _____	Dated _____
No. _____	Dated _____;	No. _____	Dated _____
No. _____	Dated _____;	No. _____	Dated _____
No. _____	Dated _____;	No. _____	Dated _____

(Receipt of all which is hereby acknowledged) and also copies of the Advertisement for Bids and the Instructions to Bidders.

(b) Bidder has examined the site and locality where the Work is to be performed and the legal requirements (Federal, State and local laws, ordinances, rules and regulations) and conditions affecting cost, degree of difficulty, progress or performance of the Work and has made such independent investigations as Bidder deems necessary.

Addendum No. 2

- (c) This Bid is genuine and not made in the interest or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm or a corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for himself any advantage over any other Bidder or over Owner.
 - (d) Bidder hereby agrees if this Bid is accepted, to commence work under this contract on or before a date to be specified in the Notice to Proceed and to fully complete all work of the Project within the Contract Time stipulated in the Agreement (Section 00500). Bidder further agrees to pay as liquidated damages the amount stated in the Agreement for each consecutive calendar day completion of the work is delayed.
4. Bidder submits the following unit prices to perform all the Work as required by the Drawings and Specifications for the City of Winter Garden. Bid shall be awarded based on Total Base Bid. Estimated quantities may exceed items listed. Payment based on installed quantities.
 5. All Bid Items shall include all materials, equipment, labor, permit fees, taxes, tests, miscellaneous costs of all types, overhead, and profit for the item to be complete, in place, and ready for operation in the manner contemplated by the Contract Documents.
 6. The following documents are attached to and made a condition of this Bid:
 - (a) **Bid Bond/Bid Security (Section 00410 and surety bond or cashier's check).**
 - (b) **Power of Attorney (for surety bond only).**
 - (c) **Public Entities Crime Form (Section 00470).**
 - (d) **Noncollusion Affidavit (Section 00480).**
 - (e) **Trench Safety Affidavit (Section 00490).**
 - (f) **Corporate authority to execute Bid (for any corporate employee other than president or vice president).**
 - (g) **Questionnaire and Subcontractor Listing (Sections 00301 and 00301-A).**
 - (h) **Evidence of Bidder's Certification and License to perform the work.**
 - (i) **Experience and financial statement demonstrating the Bidder's ability to successfully complete the work.**
 - (j) **References (Section 00302).**
 - (k) **Similar Projects (Section 00303).**
 - (l) **Drug Free Workplace (Section 00310).**
 7. The terms used in this Bid, which are defined in Article 1 of the General Conditions shall have the meanings assigned to them in the General Conditions as amended by the Supplementary Conditions.
 8. **COMPLIANCE WITH FLORIDA TRENCH SAFETY ACT (90-96, LAWS OF FLORIDA)**

Bidder hereby acknowledges that all costs for complying with the Florida Trench Safety Act (90-96, Laws of Florida) are included in the various items of the proposal and in the Total Bid Price. For informational purposes only, the Bidder is required to further identify these costs, to be summarized below:

Addendum No. 2

Trench Safety Measure Description	Units of Measure (LF, SY)	Unit (Quantity)	Unit Cost	Extended Cost
A _____	_____	_____	\$ _____	\$ _____
B _____	_____	_____	\$ _____	\$ _____
C _____	_____	_____	\$ _____	\$ _____
D _____	_____	_____	\$ _____	\$ _____
			TOTAL:	\$ _____

THIS IS NOT A PAY ITEM. The purpose of this form is to disclose information on the costs associated with trench safety measures and to insure that the Bidder has considered these costs and included them in the Bid Price. Contractor will not receive additional payment if actual quantities differ from those estimated above or if the Contractor uses a safety measure different than those listed.

Failure to complete the above may result in the Bid being declared non-responsive.

BID SUMMARY

Item No.	Description	Estimated Quantity	Unit	Unit Price	Total Price
1	Mobilization/Demobilization	1	LS	\$	\$
2	Insurance Bonds	1	LS	\$	\$
3	Preconstruction Videotape Recordings	1	LS	\$	\$
4	16" DI Potable Water Main & Fittings Off Facility Site	1990	LF	\$	\$
5	16" DI Reclaimed Water Main & Fittings Off Facility Site	570	LF	\$	\$
6	20" DI Reclaimed Water Main & Fittings Off Facility Site	1810	LF	\$	\$
7	4" PVC Sanitary Force Main & Fittings Off Facility Site	1330	LF	\$	\$
8	3" PVC Sanitary Force Main & Fittings Off Facility Site	560	LF	\$	\$
9	16" Gate Valves Off Facility Site	7	EA	\$	\$
10	20" Gate Valves Off Facility Site	2	EA	\$	\$
11	4" Plug Valves Off Facility Site	2	EA	\$	\$
12	Air Release Valves	4	EA	\$	\$
13	Asphalt Pavement Installation Off Facility Site	1	LS	\$	\$
14	Site Work and Stormwater Off Facility Site	1	LS	\$	\$
15	Storage and Pumping Facility	1	LS	\$	\$
16	Gopher Tortoise Burrow Survey	1	LS	\$	\$
17	Gopher Tortoise Relocation/Permitting	12	EA	\$	\$
18	All other work not included in items 1-17.	1	LS	\$	\$
WESTERN STORAGE, PUMPING, AND TRANSMISSION FACILITIES – TOTAL BID					
(SUM OF NUMBERS 1 THROUGH 18)					\$
TOTAL BID IN WORDS:					
DOLLARS AND					/100 CENTS

Addendum No. 2

NAME OF BIDDER: _____

If Bidder is: (ALL SIGNATORIES MUST HAVE THEIR NAME PRINTED OR TYPED
BELOW THEIR SIGNATURE)

SOLE PROPRIETORSHIP

_____(SEAL)
(Individual's Signature)

_____(SEAL)
(Individual's Name)

Doing Business as: _____

Business Address: _____

Phone No.: _____

Fax No.: _____

E-Mail Address: _____

Florida License No.: _____

A PARTNERSHIP

_____(SEAL)
(Partnership Name)

_____(SEAL)
(General Partner's Signature)

_____(SEAL)
(General Partner's Name)

Business Address: _____

Phone No.: _____

Fax No.: _____

E-Mail Address: _____

Florida License No.: _____

Addendum No. 2

NAME OF BIDDER: _____

A CORPORATION

(Corporation Name)

(State of Incorporation)

By _____
(Name of Person Authorized to Sign)

(Title)

(Authorized Signature)

(Corporate Seal)

Attest _____
(Secretary)

Business Address: _____

Phone No.: _____

Fax No.: _____

E-Mail Address: _____

Corporation President: _____

Florida License No.: _____

Addendum No. 2

NAME OF BIDDER: _____

A JOINT VENTURE

By _____ (SEAL)
(Name)

(Address)

By _____ (SEAL)
(Name)

(Address)

Business Address: _____

Phone No.: _____

Fax No.: _____

E-Mail Address: _____

Florida License No.: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above).

8. List the following in connection with the Surety which is providing the Bid Bond.

Surety's Name: _____

Surety's Address: _____

Name and address of Surety's resident agent for service of process in Florida:

Addendum No. 2

SCHEDULE OF MANUFACTURERS/SUPPLIERS

The Contract Documents are based upon the equipment or products available from the manufacturers/suppliers denoted as "A", "B", etc. However, the Bidder must indicate in his Bid which Base Bid manufacturer/supplier he intends to use for each item of equipment listed by circling one (1) of the listed manufacturers/suppliers. Should the Bidder fail to circle a named supplier, he hereby agrees to provide the item listed as "A". After receipt of bids, the Bidder may not substitute for any manufacturer or supplier circled.

If the Bidder desires to propose one (1) or more substitution or "or equal" manufacturers/suppliers, he may write in the name of such substitution or "or equal" in the spaces provided on the pages following the lists, but he must, nevertheless, also circle one of the listed manufacturers/suppliers. All substitutions or "or equal" items must be identified at the time of Bid (see Paragraph 6.05 of the General Conditions as amended by the Supplementary Conditions). Substitutions or "or equal" items will **not** be considered when determining the Apparent Low Bidder. Substitutions or "or equal" items will **not** be evaluated or considered until after the "Effective Date" of the Agreement. The Bidder shall base his Bid on providing one of the listed manufacturers and shall assume for bidding purposes that all substitutions or "or equal" items will not be accepted.

If the proposed substitution or "or equal" manufacturer/supplier is determined "not equivalent" by the Engineer, the Bidder must use the circled manufacturer/supplier. If the Bidder fails to indicate which listed manufacturer/supplier he intends to use or if a substitution or "or equal" is rejected, he must use the supplier listed as "A". Also, if the Bidder circles more than one listed manufacturer/supplier, he must use the first manufacturer/supplier circled (unless a substitution or "or equal" is approved).

Each proposed substitution or "or equal" will be evaluated in accordance with Paragraph 6.05 of the General Conditions following the Effective Date of the Agreement.

In addition to the reimbursement required under Paragraph 6.05 of the General Conditions, the Contractor shall also reimburse the Owner for any engineering costs directly attributable to the change in manufacturers/suppliers, caused by the acceptance of proposed substitutions or "or equal" items, such as; additional field trips for the Engineer, additional redesign costs, and additional review costs, etc. Other costs directly attributable to the change in manufacturers/suppliers caused by the acceptance of proposed substitutions or "or equal" items such as increased electrical requirements, larger buildings, modifications to structures, additional pumps, piping or tankage, etc., shall be borne by the Contractor and not by the Owner. Bidder further agrees that the use of substitute equipment offered will not affect the completion date.

The Owner may request, and the Bidder shall supply any additional information on proposed substitutes or "or equal" items prior to Notice of Award.

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SCHEDULE OF BASE BID MANUFACTURERS/SUPPLIERS

Item No.	Equipment Item or Material	Specification Section No.	Base Bid Manufacturer/Supplier
1.	Horizontal Split Case Pumps	11221	A. Flowserve B. Aurora C. Goulds-ITT
2.	Prestressed Circular Concrete Water Storage Tanks	13205	A. Crom Corp. B. Precon Corp.
3.	Ductile Iron Pipe and Fittings	15062	A. American B. US Pipe C. Clow D. McWane
4.	Gate Valves	15101	A. Mueller B. American C. Clow/M&H/Kennedy
5.	Butterfly Valves	15103	A. Mueller/Pratt/Milliken B. Kennedy/M&H/Clow
6.	Water Regulating Valves	15117	A. Claval B. Bermad
7.	Variable Frequency Drives	16151	A. Yaskawa by Icon Technologies

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SUBSTITUTIONS AND "OR EQUAL"

The undersigned as Bidder agrees that substitutions, or "or equal" items will not be considered until after the "Effective Date of the Agreement" and will be evaluated in accordance with Paragraph 6.05, of the General Conditions as amended by the Supplementary Conditions. If Bidder intends to propose substitutions or "or equal" items after the "Effective Date of the Agreement", it is agreed that these items will be listed on the Substitution List that must be included with the Bid (form provided herein). Only the proposed substitutions or "or equal" items listed on the Substitution List and submitted at the time of Bid will be evaluated by the Engineer in accordance with the General Conditions.

**SUBSTITUTION LIST OF
MANUFACTURERS/SUPPLIERS**

Bidder proposes the following substitutions and "or equal" items of alternate manufacturers/suppliers for the equipment of material categories so identified:

	<u>Equipment Item Material</u>	<u>Drawing No.</u>	<u>Spec. Section</u>	<u>Substitute/"or equal" Manufacturer/Supplier (List One Only)</u>	<u>Proposed Price Deduct</u>
1.	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____
6.	_____	_____	_____	_____	_____
7.	_____	_____	_____	_____	_____
8.	_____	_____	_____	_____	_____
9.	_____	_____	_____	_____	_____

END OF SECTION

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SECTION 01025

BID ITEM DESCRIPTIONS

PART 1 - GENERAL

1.01 GENERAL INFORMATION

- A. Subject to the provisions in the Contract General Conditions, all work and payment for the work is represented by the Total Base Bid amount shown on the Bid Form.

1.02 PAYMENT

- A. Work under this contract will be paid for on a unit price basis as outlined on the Bid Form. The amount of payment will be as defined in the Agreement between Owner and Contractor and the General Conditions.
- B. The prices shown on the Bid Form establish a total price cost for completing the Work in its entirety. Furnish all materials, equipment, transportation, tools, labor, services and supplies, plus any miscellaneous items and services that may not be specifically identified in the Contract Drawings and Specifications but that can be inferred from the Contract Drawings and Specifications and are necessary to produce a completed Work that is usable in a manner for which it was intended. If any items for a complete work are omitted or not shown, the Contractor shall furnish and install them without additional cost to the OWNER. No separate payment will be made for another Payment Item required to complete the work of a lump sum item.
- C. Refer to the General Conditions for Applications for Payment.
- D. Retainage shall apply to all Contractor payments prior to final acceptance as provided for in the General Conditions.

1.03 MEASUREMENT FOR PAYMENT

- A. Measurement for Lump Sum bid items shall be based on the percent of actual completion as determined by the Contractor and agreed upon by the ENGINEER.
- B. Measurement of quantities shall be the actual "as-built" quantity pertinent to payment items. Quantities on the Bid Form are estimated and may be increased or decreased without limit.

1.04 PAYMENT ITEMS

- A. Separate payment will be made for the Unit Price and Lump Sum Items listed on the Bid Form. Related work not specifically listed or identified, but evidently

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necessary for satisfactory completion of the Item, shall be considered to be included.

B. No separate payment will be made for the following Work and its cost shall be included in appropriate Payment Items:

1. Maintenance and replacement of plantings and sodding.
2. Record drawings.
3. Field office(s) and storage facilities.
4. Clean up.
5. Testing materials and apparatus.
6. Appurtenant work.
7. Contractor fees associated with the performance of the Work.
8. Piggings.
9. Night work.
10. Temporary jumper connection between existing and proposed pipelines.

C. The following will clarify the work included for bid items in the Pay Item Sheet:

1. Mobilization and Demobilization (Bid Item No. 1):
 - a. Measurement of various items for Mobilization and Demobilization will not be made for payment and all items shall be included in the lump sum price.
 - b. Payment for Mobilization and Demobilization will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for the preparatory work and operations in mobilizing for beginning work on the Project and demobilizing for ending work on the Project. The establishment of field offices, buildings, safety equipment, first aid supplies, sanitary and other facilities, as required by these Specifications, State and local laws and any other preconstruction expense necessary for the state of the Work; the cost of field engineering, disposal of cleared and grubbed material and debris, permits and fees, construction schedules, project signs, shop drawings, temporary facilities, lay down storage area, construction aids, erosion control, work associated with Contractor support during testing, reviews and inspection, re-inspection and any rework resulting from same, cleaning, project records documents, operating and maintenance data. The Contractor shall submit invoices substantiating the cost of mobilization with each pay request. Ten percent of the cost for mobilization and demobilization will be withheld until acceptance and final payment. Contractor is responsible for securing a site for

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storage of materials and equipment and all other construction needs and providing security for this site and its contents.

2. Insurance and Bonds (Bid Item No. 2):
 - a. Measurement for various items covered under General Requirements, and Bonds will not be made for payment, and all items shall be included in the lump sum price.
 - b. Payment for General Requirements, and Bonds shall include all Insurance requirements costs, the costs of all bonds, and all administrative costs associated with acquiring and maintaining the necessary coverage as described in the Contract Documents. This item will be paid upon each payment request made by the Contractor. The Contractor shall attach with the payment request invoices to substantiate that appropriate insurance and bonds have been obtained by the Contractor.
3. Preconstruction Videotape Recordings (Bid Item No. 3):
 - a. Measurement of various items for Preconstruction Videotape Recordings will not be made for payment, and all items shall be included in the lump sum price.
 - b. Payment for Preconstruction Videotape Recordings will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for work as called for in the Specifications.
4. 16" DI Potable Water Main & Fittings Off Facility Site (Bid Item No. 4):
 - a. Measurement for 16" DI Potable Water Mains and Fittings Off Facility Site, except as otherwise specified, will be based on the laying length of the pipe in linear feet actually placed as measured along the centerline of the completed pipe, including length of fittings and specials measured along the centerlines, between the limits shown on the Drawings and restraint of pipe as required by Contract Documents. This bid item includes all labor, materials, and equipment necessary to physically locate all utilities in the immediate area of the pipeline using non-destructive digging equipment, 3D Ground Penetrating Radar (GPR), supplies, and personnel experienced in subsurface utility engineering (SUE), to determine precise horizontal and vertical positions of existing utilities.
 - b. Payment for pipe will be made at the Contract unit price per linear foot for the size and type installed. Contractor to provide all pipe, fittings, joint restraints, and associated items and install, which price and payment shall be full compensation for materials, transportation and storage at the project site, installation in

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locations indicated on the Construction Drawings, all clearing, grubbing, silt fencing, dewatering, excavation, removal and disposal of any unsuitable material and replacement with suitable approved fill material, pipe bedding, backfill and compaction, testing, pipe identification tape, insulated conducting wire, site restoration, sod and watering, support of power poles and guys, mail box removal and replacement, sign removal and replacement, tree removal and trimming, connections to existing mains, vegetation/landscaping removal and replacement, removal and replacement of fences, and all equipment and all other work necessary to complete the installation as specified. All cost to clean, repair piping and appurtenances will be included under the payment for linear feet of pipe installed.

5. 16" DI Reclaimed Water Main & Fittings Off Facility Site (Bid Item No. 5):
 - a. Measurement for 16" DI Potable Water Mains and Fittings Off Facility Site, except as otherwise specified, will be based on the laying length of the pipe in linear feet actually placed as measured along the centerline of the completed pipe, including length of fittings and specials measured along the centerlines, between the limits shown on the Drawings and restraint of pipe as required by Contract Documents. This bid item includes all labor, materials, and equipment necessary to physically locate all utilities in the immediate area of the pipeline using non-destructive digging equipment, 3D Ground Penetrating Radar (GPR), supplies, and personnel experienced in subsurface utility engineering (SUE), to determine precise horizontal and vertical positions of existing utilities.
 - b. Payment for 16" DI Reclaimed Water Main & Fittings Off Facility Site will be made at the Contract unit price per linear foot for the size and type installed, which price and payment shall be full compensation for piping, fittings, joint restraints, and other associated items installed in locations indicated on the Construction Drawings, all silt fence, clearing, grubbing, dewatering, excavation, removal and disposal of any unsuitable material and replacement with suitable approved fill material, pipe bedding, pipe identification tape, insulated conducting wire, backfill and compaction, testing, tree removal and trimming, site restoration, sod and watering, supporting of power poles, and all equipment and all other work necessary to complete the installation as specified. All cost to clean, repair new piping and appurtenances will be included under the payment for linear feet of pipe installed.

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6. 20" DI Reclaimed Water Main & Fittings Off Facility Site (Bid Item No. 6):
 - a. Measurement for 20" DI Reclaimed Water Main & Fittings located outside the parcel limits of the facility site, except as otherwise specified, will be based on the laying length of the pipe in linear feet actually placed as measured along the centerline of the completed pipe, including length of fittings and specials measured along the centerlines, between the limits shown on the Drawings and restraint of pipe as required by contract documents.
 - b. Payment for 20" DI Reclaimed Water Main & Fittings Off Facility Site will be made at the Contract unit price per linear foot for the size and type installed, which price and payment shall be full compensation for piping, fittings, joint restraints, and other associated items installed in locations indicated on the Construction Drawings, all silt fence, clearing, grubbing, dewatering, excavation, removal and disposal of any unsuitable material and replacement with suitable approved fill material, pipe bedding, pipe identification tape, insulated conducting wire, backfill and compaction, testing, tree removal and trimming, site restoration, sod and watering, supporting of power poles, and all equipment and all other work necessary to complete the installation as specified. All cost to clean, repair new piping and appurtenances will be included under the payment for linear feet of pipe installed.

7. 4" PVC Sanitary Force Main & Fittings Off Facility Site (Bid Item No. 7):
 - a. Measurement for 4" Sanitary Force Main & Fittings Off Facility Site, except as otherwise specified, will be based on the laying length of the pipe in linear feet actually placed as measured along the centerline of the completed pipe, including length of fittings and specials measured along the centerlines, between the limits shown on the Drawings and restraint of pipe as required by contract documents.
 - b. Payment for 4" Sanitary Force Main & Fittings Off Facility Site will be made at the Contract unit price per linear foot for the size and type installed, which price and payment shall be full compensation for piping, fittings, joint restraints, and other associated items installed in locations indicated on the Construction Drawings, all silt fence, clearing, grubbing, dewatering, excavation, removal and disposal of any unsuitable material and replacement with suitable approved fill material, pipe bedding, pipe identification tape, insulated conducting wire, backfill and compaction, testing, tree removal and trimming, site

Addendum No. 2

restoration, sod and watering, supporting of power poles, and all equipment and all other work necessary to complete the installation as specified. All cost to clean, repair new piping and appurtenances will be included under the payment for linear feet of pipe installed.

8. 3" PVC Sanitary Force Main & Fittings Off Facility Site (Bid Item No. 8):
 - a. Measurement for 3" Sanitary Force Main & Fittings located outside the parcel limits of the facility site, except as otherwise specified, will be based on the laying length of the pipe in linear feet actually placed as measured along the centerline of the completed pipe, including length of fittings and specials measured along the centerlines, between the limits shown on the Drawings and restraint of pipe as required by contract documents.
 - b. Payment for 3" Sanitary Force Main & Fittings Off Facility Site will be made at the Contract unit price per linear foot for the size and type installed, which price and payment shall be full compensation for piping, fittings, valves, joint restraints, and other associated items installed in locations indicated on the Construction Drawings, all silt fence, clearing, grubbing, dewatering, excavation, removal and disposal of any unsuitable material and replacement with suitable approved fill material, pipe bedding, pipe identification tape, insulated conducting wire, backfill and compaction, testing, tree removal and trimming, site restoration, sod and watering, supporting of power poles, and all equipment and all other work necessary to complete the installation as specified. All cost to clean, repair new piping and appurtenances will be included under the payment for linear feet of pipe installed.
9. 16" Butterfly Valves Off Facility Site (Bid Item No. 9):
 - a. Measurement for 16" Butterfly Valves Off Facility Site, except as otherwise specified, will be based on the number of actual valves installed and accepted.
 - b. Payment for 16" Butterfly Valves Off Facility Site will be made at the Contract unit price per the item, which price and payment shall be full compensation for furnishing, installing and testing the valve, complete with mechanical restraints, nut with extension, valve box, pad, disk and cover.
10. 20" Butterfly Valves Off Facility Site (Bid Item No. 10):

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- a. Measurement for 20” Butterfly Valves Off Facility Site, except as otherwise specified, will be based on the number of actual valves installed and accepted.
 - b. Payment for 20” Butterfly Valves Off Facility Site will be made at the Contract unit price per the item, which price and payment shall be full compensation for furnishing, installing and testing the valve, complete with mechanical restraints, nut with extension, valve box, pad, disk and cover.
11. 4” Plug Valves Off Facility Site (Bid Item No. 11):
- a. Measurement for 4” Plug Valves Off Facility Site, except as otherwise specified, will be based on the number of actual valves installed and accepted.
 - b. Payment for 4” Plug Valves Off Facility Site will be made at the Contract unit price per the item, which price and payment shall be full compensation for furnishing, installing and testing the valve, complete with mechanical restraints, nut with extension, valve box, pad, disk and cover.
12. Air Release Valves (Bid Item No. 12):
- a. Measurement for Air Release Valves, except as otherwise specified, will be based on the number of air release valves to be paid for will be determined by the actual units installed and accepted.
 - b. Payment for Air Release Valves will be made at the Contract unit price per the item, which price and payment shall be full compensation for furnishing, installing and testing the valve, complete with tapping saddle, valves, supports, vent, vault, enclosure, hatches, and restoration.
13. Asphalt Pavement Installation Off Facility Site (Bid Item No. 13):
- a. Measurement for various items covered under Asphalt Pavement Installation Off Facility Site will not be made for payment, and all items shall be included in the lump sum price.
 - b. Payment for Asphalt Pavement Installation Off Facility Site shall be full compensation for furnishing, installation, testing and compaction results, all labor, equipment, and materials necessary for installation of asphalt pavement, shown on the plans including required excavation and fill under paved areas, roadway base materials, or other applicable operation in order to install asphalt

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pavements. No additional compensation will be allowed for additional pavement required to bring proposed pavement up to finished grade.

14. Site Work and Stormwater Off Facility Site (Bid Item No. 14):
 - a. Measurement for various items covered under Site Work and Stormwater Off Facility Site will not be made for payment, and all items shall be included in the lump sum price.
 - b. Payment for Site Work and Stormwater Off Facility Site shall be full compensation for furnishing, installation, all labor, equipment, and materials necessary for installation of all grading, tree removal, sod installation and watering, stormwater culverts and structures, mail box removal and replacement, wood post fence, chain link fence, and signs as shown on the plans or other applicable operation.

15. Storage and Pumping Facility (Pay Item 15):
 - a. Measurement for various items covered under Storage and Pumping Facility will not be made for payment, and all items shall be included in the lump sum price.
 - b. Payment for this item will be made at the lump sum price for the item, which price and payment shall be full compensation for all labor, materials, and equipment to perform all work within the limits of the facility parcel property line required for installing new high service pump station, two (2) ground storage tanks, yard piping, including concrete foundation, masonry structure, roof system, pumps, equipment, monorail and hoist, piping, fittings, valves, and new ground storage tanks including, dewatering, excavation, foundation preparation and compaction, manways, handrail, ladders, and tank piping. This bid item also includes yard piping shown within the limits of the facility parcel property line on Drawing D-101 including associated open cut trenching, excavation, backfilling, compaction, piping, fittings, valves, flow meters, etc. This item includes demolition and removal of trees and debris, site work, grading, stormwater systems, and landscaping as shown on Drawings C-100, C-101, C-106, and L-101 including erosion control, filling, compaction, grading, sodding and watering, and hauling and disposal of excess fill material.. This item includes painting and coatings, HVAC, plumbing, and fire suppression systems, chemical feed systems, electrical power, lighting, and grounding, emergency power systems including fuel storage and supply systems, and instrumentation controls,

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telemetry systems, and PLC programming. This item will be paid upon each payment request made by the Contractor.

16. Gopher Tortoise Burrow Survey (Bid Item No. 16):
 - a. Measurement for items covered under Gopher Tortoise Burrow Survey will not be made for payment, and all items shall be included in the lump sum price.
 - b. Payment for Gopher Tortoise Burrow Survey shall be full compensation for all labor, equipment, and materials necessary for identification and location of all gopher tortoise burrows in that will be within 25 feet of any construction activity associated with the project, determination if the burrows occupied, and production of the report detailing the results of the survey.
17. Gopher Tortoise Permitting and Relocation (Bid Item No. 17):
 - a. Measurement for items covered under Gopher Tortoise Permitting and Relocation will be based on the number of actual gopher tortoises captured and relocated offsite by an Authorized Gopher Tortoise Agent that is registered with the Florida Wildlife Commission (FWC) to an a FWC-certified Recipient Site.
 - b. Payment for Gopher Tortoise Permitting and Relocation will be made at the Contract unit price per the tortoise relocated, which price and payment shall be full compensation for obtaining the permit from FWC, and capturing and relocating tortoises offsite to an FWC-certified recipient site. This item also includes any testing of tortoises for Upper Respiratory Tract Disease that may possibly be required at the discretion of the recipient site landowner.

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PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

Addendum No. 2

SECTION 02850

PLANT MOTORIZED GATE

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers design, furnishing, and installation of a motorized entrance gate which includes, but is not limited to, security control panels, power supplies, gate and gate operators, gate control panels and MCP Plant Control System (PCS) interface.
- B. The motorized gate shall be compatible with MCP OWNER existing Plant Control System (PCS) interface. The System Supplier shall be responsible to provide all equipment specified herein, and shall subcontract the gate and gate control system to an OWNER approved, certified installer. Gate operator system shall be provided with Electronic Card Access System (ECAS) with all the accessories as stated in this specification and as shown on instrumentation drawings complete in place.
- C. All associated equipment, devices, cabling (fiber-optic and copper), system configuration, and controls necessary for proper operation shall be included.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The System Supplier shall furnish all installation drawings, tools, equipment, conduit, wiring, materials, and supplies and shall perform all labor to complete the work as specified, and in compliance with all applicable codes, standards, and regulations.
- B. System Supplier shall coordinate with CONTRACTOR and any sub-contractors (including electrical) to provide all additional conduit and wiring required for a complete operable system beyond the use of conduit marked for security use as shown on drawings.
- C. The System Supplier shall review the specifications and supply equipment that meets the functional requirements indicated, and shall furnish and install additional or differing components if required.

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2.02 SUPPLIER

A. Supplier's Qualifications

1. The design, equipment, installation, and installation supervision furnished under this section shall be provided by a manufacturer or supplier who has been engaged in the business of supplying these types of equipment for at least 5 years.

B. Governing Standards

1. All wiring and components shall meet the applicable requirements of the NEC.

C. Nameplates

1. Major components of equipment shall be identified with a permanently affixed nameplate bearing the manufacturer's name and address, and type or style and catalog number of the item. Name plates shall be as specified in the Equipment, Valve, and Piping Identification section.

D. Tags

1. Keys and locks, where required, shall be furnished with tags bearing stamped identification number. Cable and conduit runs, wiring circuits, and all spare parts supplied to maintain the equipment shall be furnished with tags. Tags shall be as specified in the Equipment, Valve, and Piping Identification section.

E. Power Requirements

1. Primary power supply to all components will be 208 volt, 60 Hz, single phase. The System Supplier shall be responsible for meeting all additional power supply requirements and shall furnish any transformers or other power supply equipment needed.

2.03 SUBMITTALS

- A. Complete wiring diagrams; assembly and installation drawings; detailed specifications; and data covering the materials used and the parts, devices, and other accessories forming a part of the equipment furnished shall be submitted in accordance with the submittals section. The equipment submittals shall include the following:

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1. A complete description of all components, including certification of listing by UL.
2. Complete sequence of operation for all functions of the equipment.
3. Complete wiring diagram for all components and interfaces to equipment supplied under other sections or by the Owner.
4. Location drawings for all components.
5. A listing of the manufacturer's representatives responsible for installation and servicing.
6. Conduit and cabling to all equipment locations.

2.04 ELECTRIC MOTORIZED GATE

A. The facility gate system shall be furnished as a complete package by the System Supplier consisting of a vehicular motorized slide gate as shown on the drawings and as specified herein. The gate system shall include the slide gate, automatic gate operator, and all required structural and safety equipment. Facility ingress shall be by through the MCP by remote SCADA from an operator at the City's Palmetto WTP or the City's Crest Ave. WWTP. Plant Control System (PCS) initiated by the ~~SCADA operator at the Eastern Regional WSE~~ or by the ECAS system at the Site entrance. Facility egress shall be by road imbedded proximity vehicle detector. The gate controller and gate operation shall be integrated with the facility MCP Plant Control System (PCS).

- B. Slide Gate. The slide gate shall meet the following mechanical specifications:
1. The slide gate shall be the Traditional Georgian Cantilever type.
 2. Gates shall have 2"x 4" rectangular frame with a 2" vertical upright every four feet; 3/16" stainless steel aircraft table "X" bracing throughout.
 3. Gates shall have two (2) 2"x 1-1/2" stringers set in frame with 1" pickets set 3-1/8" o.c with a between space of 2-1/8".
 4. The slide gate construction shall be a non-ornamental, aluminum design. Gate shall conform to UL 325 standards. Field verify actual gate size.
 5. Gate will be coated with approximately 4-6 mil coat of TCI TG polyester

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powder coating. Verify color with OWNER.

6. Provide crawl bar to eliminate crawl space under gate frame.

C. Slide Gate Operator.

1. Gate operation shall be by means of a metal rail passing between a pair of solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 4000 pounds. Gate panel velocity shall not be less than 2.0 feet per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly. The “soft stop” feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction). The “soft start” feature shall allow the pump to start at zero pressure, then progressively increase the pressure, over a period not less than two seconds, to 1,000 PSI. The gate operator shall be interfaced to the PCS MCP for remote operation and override.

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D. Operator Code Requirements. The gate operator shall meet the following regulatory requirements.

1. Operators shall be built to UL325 standards.
2. Current safety standards require the use of multiple external sensors to be capable of reversing the gate in either direction upon sensing an obstruction.
3. Current safety standards require gate operators to be designed and labeled for specific usage classes. HySecurity Model 222 EX gate operators are to be used on Class III and Class IV installations only.

E. Functionality. The gate operator shall include the following specifications components and functionality.

1. Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.
2. Limit switches: Fully adjustable, toggle types, with plug connection to control panel for gate open and gate closed.

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3. One (1) vehicle proximity detection loop for safety and/or free egress operation.
4. Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories. Enclosure shall be NEMA Type 4X stainless steel.
5. Hydraulic hose: Shall be 1/4" synthetic, rated to 2750 psi.
6. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.
7. Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.
8. Hydraulic fluid: High performance type with a viscosity index greater than 375.
9. A zero to 2000-PSI pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.
10. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.
11. Pump motor: Shall be a single phase, 60Hz, 208 VAC, 2 HP, 56C, TEFC, continuous duty motor, with a service factor of 1.15, or greater. All components shall have overload protection and NEMA Type 4X local disconnect/enclosure.
12. Heater with thermostat control for cold or damp climates.
13. Gate controller: HySecurity Smart Touch Controller Board with 128K memory or approved equal containing:
 - a. Inherent entrapment sensor;
 - b. Built in "warn before operate" system;
 - c. Built in timer to close;
 - d. Liquid crystal display for reporting of functions;
 - e. 19 programmable output relay options;

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- f. Anti-tailgate mode;
 - g. Built-in power surge/lightning strike protection;
 - h. RS232 port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems.
14. Required external sensors installed such that the gate is capable of reversing in either direction upon sensing an obstruction.
- a. Radio controlled Miller safety edge or approved equal
 - b. UL approved EMX IRB photo safety beam with NEMA Type 4X enclosure or approved equal
 - c. Siren operated sensor for fire department emergency ingress. Fire department to specify sensor frequency.
15. The gate operator shall be HySecurity Model 222EX Heavy Duty Industrial Slide Gate Operator or approved equal.
- F. Warranty: The gate and gate operator warranty is as follows:
- 1. System Supplier one (1) year warranty on all labor and materials.
 - 2. Manufacturer's warranty on gate operator for five (5) years
 - 3. Manufacturer's warranty on gate drive wheels for two (2) years
 - 4. Manufacturer's warranty on all labor for one (1) year.
 - 5. Manufacturer's warranty to commence upon OWNER'S approval of satisfactory installation and startup.

2.05 SLIDE GATE CONTROLS AND ELECTRONIC CARD ACCESS SYSTEM (ECAS)

- A. An electric operated gate with Electronic Card Access System (ECAS) will be provided.
- B. The card access shall utilize City's existing ECAS pass cards and shall not require new access cards. Card entry system shall be provided at the main gate. ECAS and gate controller shall be connected into the new security control system that is provided by the I&C supplier as per I-drawings.

Addendum No. 2

- C. Linear AKR1 Keypad/ Receiver with Vandal Resistant Antenna (Or Accepted Equal). Controls shall be compatible with the Lenel system.
- D. Outdoor enclosure.
- E. FDC Aluminum Mounting Pedestal (Or Accepted Equal) for keypad (NWRP only).
- F. Three each - Vehicle loops sawn and sealed in existing asphalt pavement for safety and/or free exit operation.
- G. Radio controlled Miller safety edge (Or Accepted Equal).
- H. UL approved EMX IRB Photo Safety Beam set (Or Accepted Equal) and Aluminum Housing.
- I. Siren Operated Sensor for Emergency Access.

J. Gate supplier shall sub-contract to the I&C supplier (~~Curry Controls~~) for providing the gate security control panels, gate junction boxes, etc. ~~and as shown on I-drawings. All the equipment required for security control panel, gate junction boxes, etc. are listed in the I-drawings.~~ Gate supplier shall coordinate with the instrumentation sub-contractor for a complete and workings security gate system. Gate supplier shall coordinate with Electrical Contractor for all the interconnection conduit/cable requirements before bidding and notify the Engineer if any deviation is proposed from the design drawings. Gate supplier shall still be solely responsible for the operation of a complete gate package system.

2

2.06 OPERATION, MAINTENANCE AND INSTRUCTION MANUALS

- A. Operation, Maintenance and Instruction Manuals for the equipment and systems shall be furnished in accordance with Section 01720 – Project Record Documents and Section 01730 – Operating and Maintenance Data.

2.07 MANUFACTURERS' FIELD SERVICES AND TRAINING

- A. Equipment manufacturers or suppliers shall provide the services of a factory-trained manufacturer's representative or agent and maintenance personnel as required to participate in installation, check-out, and testing of equipment and systems, and in the training of Owner plant operating personnel as required by Section 01650 – Startup and Demonstration and this section. The representative shall have complete knowledge of proper installation, operation, and maintenance of the equipment and systems supplied.

Addendum No. 2

- B. The manufacturer's representative or agent shall visit the site or classroom designated by the Owner, for the minimum person-days listed below, travel time excluded.
 - 1. Full time as required. The System Supplier shall provide on-site supervision of installation.
 - 2. 3 days. Inspection, checking, and adjustment of equipment, including submittal of Manufacturer's Certificate of Proper Installation in accordance with 01650 – Startup and Demonstration.
 - 3. 2 days. Participate in Functional Tests, Start-Up Tests, and Demonstration Tests and in preparation of required certifications in accordance with 01650 – Startup and Demonstration.
 - 4. 2 days. Participation in Manufacturer's Training Services of Owner's Personnel.

PART 3 - EXECUTION.

3.01 GENERAL

- A. All work shall be installed in accordance with the manufacturer's diagrams and recommendations except where otherwise indicated.
- B. After completion of the installation, the System Supplier shall clean the inside and the outside of the security equipment and shall remove any dirt and debris from the site.

3.02 CABLE

- A. Cable shall be installed in accordance with Section 16050. The conductors shall be installed in conduits or junction boxes separate from conductors of other systems. Conduit fill shall meet applicable NEC requirements.
- B. Raceways
 - 1. Conduit shall be installed in accordance with section 16050. Exposed conduit systems shall be rigid steel. Concealed conduit systems shall be PVC schedule 40.

3.03 FIELD QUALITY CONTROL, CHECKOUT AND TESTING

Addendum No. 2

- A. The Contractor shall perform field quality control, checkout, and testing, and shall submit required documentation in accordance with Section 01650 – Startup and Demonstration, and any special field testing requirements as may be listed below or elsewhere in this section of these project specifications. Shop testing, if required, is addressed elsewhere in this section.
- B. Prior to starting any on-site testing the Contractor shall submit a testing protocol to the PM in accordance with the requirements of Section 01650. The protocol shall address preparation, calibration, testing procedures, measurement, and documentation for the required Functional, Start-Up, and Demonstration tests.

END OF SECTION

Addendum No. 2

SECTION 13205

PRESTRESSED CIRCULAR CONCRETE WATER STORAGE TANKS (AWWA D-110 TYPE II)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Provide for the design and construction of one (1) 1.0 million gallon (MG) and one (1) 2.0 million gallon (MG) low profile domed top, circular prestressed concrete storage tanks for storage of potable water and reclaimed water, respectively, conforming to the dimensions and locations shown on the Drawings. The Tank Construction Company shall furnish all engineering services required for the preparation of design calculations and detailed design drawings, and furnish all materials, labor and equipment for the construction of the prestressed tanks as shown on the Drawings and as specified herein.
2. The prestressed concrete tanks shall be of composite steel-shotcrete, wire-wound, prestressed construction constructed in accordance with AWWA D-110 Type II. The wire-wound prestressed composite walls shall include a shotcrete core wall in which a steel shell diaphragm of a height equal to the full wall height has been encased. All prestressing shall be done with high tensile wire permanently bonded to the tank walls. The tank floors shall be of concrete construction containing no less than 0.6 percent of reinforcing steel. The tanks shall be designed to prevent buoyancy under conditions of maximum groundwater elevation as presented in the geotechnical engineer's report (Appendix B). The tanks are not within 100 year flood zone.
3. Foundations of the storage tank is to be prepared in accordance with the geotechnical engineer's recommendations in the geotechnical report (Appendix B).

B. Related Work Described Elsewhere:

1. Shop Drawings, Working Drawings, and Samples: Section 01340.
2. Warranties and Bonds: General Conditions.

Addendum No. 2

3. Earthwork: Section 02200.
4. Concrete: Division 3.
5. Metals: Division 5.
6. Painting: Section 09900.

C. General Design

1. The GST shall be furnished complete and shall, at a minimum, include: all inlets and stand pipes; outlets; overflows; drain pipes; ladders, hatches, and railings; roof ventilators; perimeter concrete ventilators; manways; liquid level indicators; and tank levels and transmitters.
2. The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.
3. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.
4. All prestressing shall be done with high tensile steel wire in which a substantial allowance shall be made for loss of prestress due to shrinkage and plastic flow in the shotcrete and to relaxation in the steel wire and diaphragm.
5. Size and Configuration of Tanks: The dimensions of the prestressed circular concrete tanks including the floor slopes, sumps, diameters and vertical wall heights shall be as indicated on the Drawings. The tank dome shall be a low profile design with the dome height not exceeding a height greater than 1/12th of the tank diameter.
6. Design of the prestressed circular concrete tank shall accommodate the total settlement and differential settlement as detailed in the geotechnical engineering report.
7. The 1.0 MG potable water tank shall be designed and constructed to support a future 2,600 gpm fiberglass dome-mounted tray aerator and a future interior concrete masonry baffle wall of vertical dimension equal to the tank sidewall height. Provide a thickened floor slab under the location of the future baffle wall as shown on the drawings.

Addendum No. 2

1.02 QUALITY ASSURANCE

- A. Design Standards: Unless otherwise indicated, all materials, workmanship and practices shall meet all requirements of the following standards, latest revisions.
1. Florida Building Code.
 2. ACI 301: Specifications for Structural Concrete for Buildings.
 3. ACI 318: Building Code Requirements for Reinforced Concrete.
 4. ACI 506R-85: Guide to Shotcrete.
 5. ACI 344R-70: Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures.
 6. AWWA D110: Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures.
- B. Qualifications and Experience of Tank Construction Company: The Tank Construction Company shall have the following qualifications and experience:
1. The Tank Construction Company shall specialize in the design and construction of wire-wound circular prestressed composite steel-concrete tanks. The Tank Construction Company shall give satisfactory evidence that it has the skill, reliability and financial stability to design, build and guarantee the tank in accordance with the quality required by these Specifications. The Tank Construction Company shall have at least ten (10) years experience in this specialty and shall have built completely in its own name in the past five years no less than ten (10) AWWA D-110 Type II prestressed composite tanks of comparable size, which meet these Specifications and are now demonstrating satisfactory service. If all experience requirements cannot be met, an additional bond will be required. This bond shall be in effect for four (4) years after expiration of the standard one (1) year performance bond and shall warrant the tank to be free of defects in materials and workmanship.
 2. The Tank Construction Company staff shall include a full-time Professional Engineer registered in the State of Florida having no less than ten (10) years experience in the design and field construction of circular prestressed composite tanks who will be the responsible engineer in charge of the work to be done. All Working Drawings and design calculations shall carry the seal of such Registered Professional Engineer.

Addendum No. 2

3. Acceptable Tank Manufacturer: The tank shall be as manufactured by the Crom Corporation, Precon Corporation, or an approved equal as required below.

Any other company wishing to be considered shall submit a record of its experience in the design and construction of AWWA D-110 Type II tanks, which is the type of tank proposed for this project, including a list of the ten (10) AWWA Type II tanks of the proposed size or larger now in service. Qualification data shall be submitted to the Engineer prior to 15 days before the date set for the receipt of bids. Any Tank Construction Company considered acceptable, will be notified prior to the bid date by the Engineer. Companies not pre-qualified prior to the bid shall not be considered.

- C. Design Criteria: To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall:

1. The top 2 feet of core wall shall have not less than 1% circumferential reinforcing.
2. The bottom 3 feet of core wall shall have not less than 1% circumferential reinforcing.
3. Inside Face:
 - a. 26-gauge steel shell diaphragm continuous the full wall height, without horizontal splices.
 - b. Additional vertical and horizontal reinforcing steel bars as required by design computations.
4. Outside Face:
 - a. Vertical reinforcing steel: Minimum of #4 bars at 12-inch center to center.
 - b. Additional vertical and horizontal reinforcing steel bars as required by design computations.
5. Allowable Tensile Stress f_s 18,000 psi
Yield Strength f_y 40,000 psi

Addendum No. 2

6. Design Loads: Wind loads, including uplift and overturning shall be as required by the Florida Building Code and any local amendments to the Code.
7. Qualifications of Workmen: The foreman, nozzle men and gunmen shall be skilled in their duties and certified in accordance with the guidelines by ACI Committee 506 Certification, latest revision. The Contractor shall submit the names of the men performing the above duties, with a statement of certification as to their qualifications. Certification will be accomplished by a recognized authority such as ELF/FC&PA*, ACI, or approved equal.
 - *ELF - Engineering Laboratory Forum, Florida Institute of Consulting Engineers
 - FC&PA - Florida Concrete and Products Association
8. Concrete reinforcement, wall thickness, and loading shall be as certified by a Florida P.E.

1.03 SUBMITTALS

- A. Shop Drawings: The Contractor shall submit a complete set of detailed shop drawings signed and sealed by a Florida Registered Professional Engineer for the work to be done. Inside dimensions, pipe openings and provisions for mechanical equipment shall be maintained as established by the Engineer. Shop drawings must be approved before construction may begin.
- B. Design Computations: The Contractor shall submit complete signed and sealed design computations done under the direction of a Florida Registered Professional Engineer. The design computations shall address components of the tank, including inner wall, outer wall, floor and sumps, wall penetrations, pipe supports, stairway, the wall reactions to the bottom slab, and the loads imposed by the concrete dome cover. The design shall address all possible hydraulic conditions that might exist within the structure. The design shall include consideration of temperature differentials under various conditions, stresses at wire winding and completed stages with tank empty and full, flexure in walls and base, anticipated movement of base under circumferential wire stresses, special stresses at wire anchorages and a construction procedure listing in chronological order the various operations of construction. The design shall also address soils conditions described in the geotechnical report pertaining to the soils at the project site. The design computations shall be submitted for approval at least 30 days before the materials are assembled at the job site.

Addendum No. 2

- C. Shop drawings shall be submitted showing complete details, dimensions, materials, fastenings, anchorages and special details of wall reinforcement at attachment of accessories.
- D. If a sliding waterstop is used in the floor/wall joint, submit load/shear/deflection data to support shear and deflection calculations for base of wall. Tests shall have been generated for the particular waterstop configuration proposed.
- E. Submit to the Engineer a guarantee document as specified in Paragraph 1.04, herein.

1.04 WARRANTY

- A. The Tank Construction Company shall guarantee workmanship and materials on the entire tank structures for a period of five (5) years from date of acceptance of the work. In case leakage or other defects appear within the five (5) year period, the Tank Construction Company shall promptly make repairs at its own expense, upon written notice by the Owner that such defects have been found.
- B. The Tank Construction Company shall be required to furnish a written company warranty for the five-year period.
- C. If all experience requirements cannot be met as described in Paragraphs 1.02B.1. and 1.02B.2., an additional bond shall be required. This bond shall be in effect for four (4) years after expiration of the standard one (1) year performance bond and shall warrant the tank to be free of defects in materials and workmanship.
- D. Leakage is defined as the stream flow of liquid appearing on the exterior surface of the tank, or leakage through the base slab, the source of which is from the inside of the tank. Leakage shall be determined by leakage testing as defined in Section 03800, Leakage Testing of Hydraulic Structures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. The 1.0 MG tank is intended for storage of potable drinking water. Therefore, materials that come into contact with the contents of the tank shall be approved for use with potable water by the National Sanitation Foundation (NSF) in accordance with Standard 61.

Addendum No. 2

- B. Concrete shall have a 28-day compressive strength of 4,000 psi and shall be in conformance with the requirements for concrete that are set forth in Division 3. Cement shall be Type II.
- C. Shotcrete shall be in accordance with ACI Standard 506, latest revision, except as indicated otherwise herein. Proportions for all shotcrete shall be one part cement to 4 parts moist sand by weight, except that proportions of 1 to 3 shall be used for the cover coat on each side of the steel shell diaphragm and over the wire wrapping; these richer cover coats shall be at least 1/4-inch thick (measured from the outside of the wire for wire wrapping coat). Sand shall be composed of hard, strong, durable, uncoated grains of quartz in accordance with gradation limits in ACI 506, except that the fineness modulus maybe reduced to 2.0.
1. Compressive strength (fg) shall be 4,000 psi or greater at 28 days.
 2. Allowable compressive stress (fg) shall be determined by the formula $1250 + 75t$ with 0.45 fg maximum where t is the core wall thickness.
 3. Allowable compressive stress (fg) due to initial prestressing force shall be 0.50 fgi or less, with a minimum of 2,000 psi, where fgi is defined as compressive strength at time initial prestressing force is applied.
 4. Cement shall be in accordance with the requirements for cast-in-place concrete that are set forth in Division 3. Cement shall be Type II.
- D. Prestressing Wire:
1. Cold drawn, high-carbon steel wire complying with A821-93 Type B.
 2. Wire size shall be 0.162 inch diameter (8 gauge) or larger, but no larger than 0.250 inch.
 3. Working stress for wire in the wall (fs) shall be 115,000 psi.
 4. Allowable tensile stress before losses (fis) shall be 145,000 psi or no greater than 0.70 fs.
 5. Ultimate tensile strength (fsu) shall be 231,000 psi or greater.
- E. Reinforcing Bars:
1. In conformance with ASTM A615, Grade 60, and with the requirements set forth in Division 3.

Addendum No. 2

2. Floor slab bar supports shall be reinforced steel bolster.

F. Wire Fabric Reinforcement:

1. Welded wire fabric shall conform to ASTM A185: Welded Wire Fabric for Concrete Reinforcement. Wire fabric shall be electrically welded and galvanized wire. Welded wire fabric shall be furnished in flat sheets. Rolled WWF is not permitted.
2. Welded wire fabric supports shall be plastic tipped bolsters with galvanized bar ties or precast concrete blocks.

- G. Steel tank shell diaphragm shall be cold rolled sheet, minimum 26-gauge, ~~conforming to ASTM A366 for Commercial Quality Cold Rolled Steel, with a Class 2, rolled finish or approved equal.~~ with a minimum thickness of 0.017 inches conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall not be less than G 90 of Table 1 of ASTM A653/A653M. ②

- H. PVC waterstops shall have minimum thickness of 3/8 inch in areas exposed to hydraulic loads.

2.02 ACCESSORIES

A. Accessories to be provided with each water storage tank are as follows:

1. Inlet, outlet and drain pipe systems as shown on the Drawings.
2. One (1) exterior aluminum access ladder with lockable cage.
3. One (1) interior fiberglass ladder with TS safety rail.
4. Four (4) precast concrete overflow outlets.
5. One (1) fiberglass dome vent.
6. One (1) fiberglass access hatch for dome access.
7. One (1) fiberglass liquid level indicator.
8. Aluminum handrailing around dome hatch.
9. Miscellaneous dome and wall penetrations and accessories.
10. Two (2) access manholes.
11. Rooftop parapet wall system on the reclaimed water storage tank only.

Accessories shall be provided and installed by the Tank Construction Company unless otherwise allowed herein.

Addendum No. 2

2.03 TANK ACCESSORIES

A. An exterior aluminum ladder shall be provided to allow safe access to the tank dome. The ladders and appurtenances shall be designed and fabricated by the Tank Construction Company and shall comply with all requirements established by OSHA and the Florida Building Code for this application. Exterior aluminum ladders and cages shall be fabricated from aluminum alloy 6061-T6, or equal. Ladder uprights shall be 3/8-inch by 2 inches and shall be bent to shape and shall be spaced not over 5 feet apart. Ladders shall be rigidly supported not less than 7 inches from adjacent surfaces and shall be secured to the shotcrete wall by Type 316 stainless steel bolts embedded in the shotcrete during construction of the wall. Rungs shall be not less than 1 inch diameter, smooth, and spaced 12 inches on center with the ends fitted into and welded to the uprights. Goosenecks shall be provided and anchored to the top of the tank. An aluminum swing out cage gate with padlock brackets shall be provided at the bottom of each cage.

B. Interior Fiberglass Ladders:

Fiberglass ladders shall be completely fabricated of fiberglass reinforced plastic (FRP) structural shapes. Ladder uprights shall be 2-inch square tubing with a 1/8-inch wall thickness and shall be spaced 18 inches apart. Supports shall be 3/8-inch by 2-inch Type 316 stainless steel bars bent to shape and shall be spaced not over 5 feet apart. Ladders shall be rigidly supported not less than 7 inches from adjacent surfaces and shall be secured to the shotcrete wall by 316 stainless steel bolts embedded in the shotcrete during construction of the wall. Rungs shall be not less than 1-inch diameter, solid fiberglass bars, spaced 12 inches on centers with the ends fitted into and bonded to the uprights with epoxy. An approved rigid rail ladder safety device with 316 stainless steel rail, sleeve, and two safety harnesses shall be provided with the ladder, which shall be Saf-T-Climb as manufactured by Miller, Climbers Buddy Corporation, or equal. The ladder, and safety device shall be designed, fabricated, and erected in accordance with Part 1910 of the Occupational Safety and Health Standards of the Department of Labor.

C. Fiberglass Vent:

Fiberglass vent shall be fabricated of 1/4-inch thick laminated fiberglass. The vent shall be mounted onto a precast concrete curb cast into the dome cover. A neoprene gasket shall be provided between the concrete curb and the fiberglass vent to prevent the entrance of water and insects. The fiberglass vent shall have a throat opening of 50-inches in diameter. The vent area shall be adequate for air venting in a scenario in which a pipe failure causes rapid loss of tank contents. To prevent the entry of birds, animals and insects, the vent throat area and vent rim openings shall be covered with 24x24 mesh, vinyl covered or 316 SS fiberglass

Addendum No. 2

screening. All vent anchor bolts, fasteners and other hardware shall be Type 316 stainless steel.

- D. Overflow vents shall be of precast concrete with 24 x 24 mesh, vinyl covered fiberglass insect screen and fiberglass frame attached with Type 316 stainless steel bolts of the size and number required. The precast concrete overflow outlets shall be cast into the dome cover.
- E. Fiberglass hatch covers shall be fabricated of 1/4- inch thick laminated fiberglass. Dimensions of the hatch cover shall be as shown on the Drawings. The hatch cover shall be mounted onto a precast concrete curb cast into the dome cover. The oversized frame for the fiberglass cover shall lap over and down the side of the precast concrete curb to provide weathertightness. The fiberglass frame shall have an integrally fabricated curb for mounting of the access hatch. The access hatch shall lap over and down the side of the fiberglass frame curb to provide weathertightness. The fiberglass frame and access hatch shall be gasketed with a suitable neoprene gasket to prevent the entrance of water and insects. The hatch cover shall have a smooth, even, snug bearing in the locked position. All frame anchor bolts, hinges, lock loop, fasteners and other hardware shall be Type 316 stainless steel. The fiberglass hatch cover shall conform to the applicable requirements of Part 1910 of the Occupational Safety and Health Standards of the Department of Labor.
- F. The fiberglass liquid level indicator shall be a standard unit supplied by the Tank Construction Company. The indicator board and target shall be 1/4-inch thick laminated fiberglass. The indicator board shall be white with 4-inch high black numbers and divisions. The numbers and divisions shall be black resin that is integrally molded into the fiberglass laminate board. All anchor bolts, fasteners, cable and other hardware shall be Type 316 stainless steel.
- G. Aluminum handrailing shall be installed as shown on the Drawings shall be a three (3) (2) rail type handrail system ~~with a 4-inch toe board~~ compliant with OSHA and the Florida Building Code. Handrailing shall be constructed of 1 1/2-inch (1.90" o.d.), Schedule 40 aluminum pipe, Alloy 6063-T6, in accordance with applicable Sections of Division 5. 2
- H. The tank walls shall be thickened in various areas to accommodate anchor bolts for the level indicator, ladders, electrical control panels, and various accessories shown on the Drawings and specified herein.
- I. For the reclaimed water storage tank only, a parapet wall system shall be provided to direct all rainfall onto the tank dome to the tank interior. The potable water storage tank will not have a parapet wall system.

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J. Access Manholes:

1. Two (2) access manholes shall be provided for each prestressed concrete storage tank. The access manholes shall be located at the location shown on the Drawings. The access manholes shall include a fabricated stainless steel frame and a fabricated stainless steel cover. The frame and cover shall be fabricated of Type 316 stainless steel. The cover plate shall be suitably gasketed as necessary to provide permanent water tightness. The manhole shall have a waterstop and be sealed with epoxy on the inside perimeter to preclude leakage. The manhole opening shall be in the shape of a round-ended slot approximately ~~18~~ 17 inches high and ~~29~~ 52 inches long.
2. All bolting materials shall be ASTM A320, B8M, Class 2, Type 316 stainless steel, high strength bolts and nuts. Washers shall be Type 316 stainless steel. Nuts shall have a hardness that is lower than that of the bolts and the washers by a difference of 50 Brinnell hardness to prevent galling.

2.04 PAINTING

- A. Painting Interior Surfaces: The interior of the tanks shall not be painted.
- B. Painting exterior surfaces: The tanks' exterior above grade concrete shall be painted using Tnemec Series 156 Enviro-Crete or Sherwin-Williams Loxon XP, 2 coats, 4 – 8 mils DFT per coat. The tanks' exterior below grade concrete shall not be painted.
- C. Coatings may be applied by the General Contractor with approval from the Tank Contractor.

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. Excavation and Compaction: Excavation and compaction prior to tank construction shall be in conformance with the applicable requirements of Section 02200, Earthwork, and the foundation preparation recommendations in the geotechnical engineer's report (Appendix B).
- B. Floor:

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1. The concrete floor is to be designed to be compatible with the foundation preparation specified in the geotechnical Engineer's recommendations in the geotechnical investigation report (Appendix B).
2. The completed subgrade shall be wetted to a saturated condition just prior to placement of the concrete floor.
3. Concrete membrane floors (4 inches thick) shall have a minimum thickness of 8 inches of concrete over all pipe encasements. The minimum percentage, 0.6 percent, of reinforcing steel applies to these thickened sections and shall extend a minimum of 2 feet into the adjacent 4-inch thick floor. Thickness of floor shall be as required to overcome buoyancy requirements defined herein.
4. Floors shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

5. The floor shall be flat sloped to drain toward the tank effluent pipe with the finishing criteria stated in Division 3 for concrete, except that the finishing tolerance shall be 1/2 inch in 10 feet, as determined by a 10-foot straightedge placed anywhere on the slab in any direction. The floor shall have a light broom finish. ②

6. Floors shall be continuously water cured until tank construction is completed.

C. Core Wall:

1. The core wall shall be constructed of shotcrete, encasing a steel shell diaphragm continuous the full wall height without horizontal splices. The shotcrete shall be placed in accordance with ACI 506: A Guide to Shotcrete, latest revision.
2. The thickness of the core wall shall be calculated so as to resist the initial compressive forces applied by prestressing, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. In no case shall the core wall be less than 3-1/2 inches thick. Horizontal sections of the wall shall form true circles without flats, excessive bumps, or hollows.
3. To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall, as a minimum:

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- a. The top 2 feet of core wall shall have not less than 1 percent circumferential reinforcing.
 - b. The bottom 3 feet of core wall shall have not less than 1 percent circumferential reinforcing.
 - c. Inside Face:
 - 1) Vertical reinforcing steel: minimum of #4 bars at 12 inches center to center.
 - 2) Additional vertical and horizontal reinforcing steel as required by design computations.
 - d. Outside Face:
 - 1) Vertical reinforcing steel: minimum of #4 bars at 12 inches center to center.
 - 2) Additional vertical and horizontal reinforcing steel bars as required by design computations.
4. Curing:
- a. Interior core wall shall be continuously water cured until prestressing starts.
 - b. Exterior core wall shall be continuously water cured until prestressing starts.
5. Tolerances:
- a. Tank Radius: The maximum permissible deviation from the specified tank radius shall not be greater than 0.1 percent of the radius or 60 percent of the core wall thickness, whichever is less.
 - b. Vertical Walls: Walls shall be plumb within 3/8 inch per 10 feet of vertical dimension.

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D. Steel Shell Diaphragm:

1. A 26 gauge steel tank shell diaphragm, ~~complying with ASTM A366 for Commercial Quality Cold Rolled Steel~~, shall be used within and throughout the core wall, providing a positive waterstop. The galvanized steel diaphragm used in the construction of the core wall shall be 26-gauge with a minimum thickness of 0.017 inches conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall not be less than G 90 of Table 1 of ASTM A653/A653M.
2. The steel shell diaphragm shall be encased and protected with shotcrete no less than 1 inch thick at all places. The steel shell is to be formed and erected such that a mechanical key between shotcrete and diaphragm will be created. The sheets of steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices shall not be permitted.
2. All vertical joints in the diaphragm shall be sealed watertight by epoxy injection. This epoxy injection shall be carried out from bottom of wall to top of wall, using a pressure pumping procedure, after the steel shell diaphragm has been full encased, inside and outside with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C881, Type III, Grade 1, and shall be 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees Fahrenheit (°F).
3. The steel shell diaphragm design and the epoxy injection procedure shall have been used and proven satisfactory in the ten (10) tanks required for the Tank Construction Company's experience record.
4. No nail or other holes shall be made in the steel shell for erection or other purposes except for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.
5. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to this waterstop.
6. The steel shell diaphragm shall be suitably supported by temporary braces to preclude movement during construction. If the steel shell diaphragm is warm when ready for applications, the steel surfaces shall be sprayed with water for cooling approximately 30 minutes or less before shotcreting and again a few minutes before shotcreting.

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E. Shotcrete:

1. All shotcrete shall be placed in accordance with ACI 506, latest revision, and shall be applied by or under direct supervision of experienced nozzlemen certified in accordance with ACI Certification Program CP-60.
2. Shotcrete mixes, measured by weight, shall be:
 - a. First coat on steel shell diaphragm and prestressing wire: One (1) part cement to three (3) parts fine aggregate (minimum).
 - b. All other shotcrete: One (1) part cement to four (4) parts aggregate (minimum).
3. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer. No shotcrete shall be applied to reinforcing steel or diaphragm which is encrusted with overspray.

F. Horizontal Prestressing:

1. Circumferential prestressing of the tank walls shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM A821-93 Type B, placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel wire.
2. Placement of the prestressing steel wire to the core wall shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial predetermined force and unit compressive stress equivalent to that shown on the approved shop drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire, or when removing a defective section of wire.
3. Areas to be prestressed shall contain not less than ten (10) 8-gauge wires per foot of vertical wall. A maximum of 24 wires per layer per vertical foot will be allowed. Shotcrete shall be used to completely encase each individual wire, and protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one (1) wire diameter.
4. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not

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dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the approved shop drawings.

5. No circumferential movement of the wire along the tank wall shall be permitted during or after stressing of the wire. The steel wire bands on the core wall shall be so placed that the prestress "working force" per foot of wall height shall exceed the hydraulic ring tension forces by not less than 5 percent. The "working force" shall be defined as the force determined by multiplying the area of steel wire by the unit wire stress after an allowance for losses of 20,000 psi has been made from the initial unit wire stresses. Such initial unit wire stress readings shall be made the same day the wire is placed, or if made later and after some stress losses have already occurred due to creep of wire, plastic flow and shrinkage of core wall, allowances shall be made for such losses. The clear space between adjacent wires is to be no less than one wire diameter.

- G. Measurement of Wire Stress: Equipment shall be supplied at the construction site by the Tank Construction Company to measure tension in the wire after it is positioned on the tank wall. This stress measuring equipment shall include: electronic, direct reading, stressometer or other device which can demonstrate not less than 1 percent accuracy; calibrated dynamometers; and a test stand to field verify the accuracy of the stressometer. The initial tension in each wire shall be recorded.

- H. Exterior Cover Coat: After circumferential prestressing wires have been placed by the wire winding machine, they shall be protected by encasement in shotcrete. This shotcrete encasement shall completely encapsulate each wire, and shall permanently bond the wire to the tank wall. The shotcrete over cover shall have a thickness of no less than 1 inch over the wire. When multiple layers of wire are required, shotcrete cover between layers shall be no less than 1/8 inch thick.

- I. Wall Openings: When it is necessary for a pipe, access manhole or other appurtenance to pass through the vertical tank wall, the bottom of such appurtenance shall be no less than 18 inches above the floor slab. The prestressing wires required at the pipe or appurtenance elevation shall be distributed equally above and below the opening, leaving an unbanded strip around the entire tank. Ordinarily, unbanded strips shall have a vertical dimension of no more than 36 inches. All pipe sleeves passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

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- J. Shotcrete Finishes: The interior and exterior vertical surfaces of the tank walls shall have a fine, hairbrush broom finish to provide a finely textured, sandy type finish suitable for finish coating. Following finishing, all interior and exterior surfaces of the tank shall be lightly brushed to remove all loose particles of shotcrete or aggregate.
- K. Curing of Shotcrete: The finish surfaces of walls shall be cured, starting as soon as possible without damaging surface and not later than two (2) hours after placing, by any of the following methods:
1. Moist-mat cure or moist-cure for seven (7) days.
 2. Moist-mat curing shall be moist-curing by covering with at least two (2) layers of burlap, cotton mats, or other approved material. The mat shall be continuously sprayed or intermittently saturated by hosing not less than four (4) times during daylight hours. If intermittently saturated, the mat shall be saturated before 8:30 a.m. and within one and one-half hours of sundown. Saturating of the mat through the night hours will not be required except as may be directed during hot nights if humidity is low and the breeze is more than 5 mph.
 3. Moist-curing shall be accomplished by keeping the surface of the concrete continuously wet with water. Sprinklers or soaker hoses may be used to insure continuous complete water coverage of the concrete surfaces. The sprinklers, soaker hoses or other watering equipment shall be operated 24 hours a day for the duration of the curing period. The duration of the curing period shall be seven (7) days. To ensure that sprinkling water is not blown away by wind from its intended location, special attention shall be given to the number and location of sprinklers so that all concrete surfaces are kept continuously wet. The Contractor shall have personnel at the site check the operation of all wetting equipment, and the equipment shall be checked out not less than once each daylight hour and once every four hours during the night hours. Daylight hours shall be considered to be from one hour after sunrise to one hour before sundown. The remainder of the day shall be considered night hours.
 4. Curing during the multilayered shotcrete construction: The following curing procedures shall be used for any layer of shotcrete that will remain in place more than three (3) hours before the next layer of shotcrete is applied. During hot weather, to reduce cracks caused by quick drying shrinkage, each layer of shotcrete shall be moist-mat cured or moist-cured within one hour after application. The mat, if used, shall be kept moist until it is removed and shall not be removed until just before the next layer of shotcrete is applied. The mat shall be against the shotcrete surface

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enough to avoid circulation of warm air between the mat and the shotcrete. The exterior surface of the core wall (the surface to receive wire wrapping) shall not receive curing compound, but shall be continuously cured for at least seven (7) days using the moist-mat or moist-cured procedure. In hot weather, the surface of shotcrete shall be fogged as soon as possible after application before other curing methods are started to avoid quick loss of moisture from the fresh shotcreted surface.

3.02 FIELD QUALITY CONTROL

A. Shotcrete Compressive Testing:

1. All tests shall be performed by a testing laboratory employed by the Contractor. Each test of shotcrete compressive strength shall consist of the preparation and breaking of five (5) cylinders. The high and low strength cylinders shall not be counted and the strength of the test shall be the average compressive strength in pounds per square inch of the three (3) remaining cylinders.
2. If cylinders are made for determining when wire wrapping can begin, they shall be stored at the site and cured the same as the applicable portion of the structure. All other cylinders shall be removed the next day and stored in a testing laboratory vault similar to standard concrete cylinders. The test cylinders shall be shot with the same mix used in the permanent construction.
3. One (1) test shall be made for each 100 CY of concrete, but not less than 2 sets for the inside core wall, 2 sets for the outside core wall and 2 sets for the over coat. Capping and breaking of cylinders shall be done similarly to standard concrete cylinders and shall be done by a recognized testing laboratory approved by the Engineer.

- B. Leakage Testing: Before coatings are applied, each tank compartment shall be slowly filled with water and examined for leakage. Water for leakage testing shall be provided by the City and paid for by the Contractor at the City's standard rates for water and reclaimed water. Leakage shall be defined as a loss of water. Hydraulic testing of the tank shall be in accordance with requirements set forth in Division 3.

3.03 PAINTING

- A. All piping, supports, and other ferrous metal surfaces shall be coated in accordance with the applicable requirements of Section 09900: Painting.

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- B. The tank exterior is to be painted in accordance with the Painting Schedule in Section 09900: Painting.

3.04 DISINFECTION (POTABLE WATER TANK)

- A. Following painting and paint curing for the tank, the tank shall be disinfected before putting the tank into service. The tank shall be disinfected in accordance with the requirements of AWWA Standard C652, latest revision. Water for disinfection will be provided by the City but paid for by the Contractor at the City's standard rates. If the tank is contaminated following disinfection as a result of the Contractor's negligence or due to subsequent tank repairs required as a result of the leakage testing, the tank shall be re-disinfected at no additional cost to the Owner.
- B. Following disinfection, the tank shall be drained and filled with potable water. No water resulting from the disinfection process is discharged into the distribution system for use by customers. Samples shall be taken by the Contractor on two (2) consecutive days for bacteriological clearance testing as required by the regulatory agency. If bacteriological test results are unsatisfactory, the Contractor shall re-disinfect the tank and the tank will be retested for bacteriological clearance. All re-disinfection and retesting costs shall be at the Contractor's expense. The tank shall be re-disinfected and retested until bacteriological clearance is obtained.

END OF SECTION

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SECTION 13400

INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up, and place in satisfactory operation a complete and operating instrumentation and control system for Western storage, pumping and transmission facility.
2. The Work includes, but is not limited to, the following:
 - a. Panels and panel mounted instruments.
 - b. Field mounted instruments.
 - c. Programmable logic controllers (PLC) and software.
 - d. Remote telemetry units.
 - e. Telemetry system communication hardware.
 - f. Personal computers and human-machine interface (HMI) software.
 - g. Local area network hardware and software.
 - h. Uninterruptible power supply.
 - i. Field instruments, Ethernet network communication hardware and software required for interfacing various systems to provide one fully integrated system.

B. Coordination:

1. Instrumentation and Controls:
 - a. Providing central computer system, instruments, and controls are part of the Work by instrumentation and controls (I&C) Subcontractor obtained through the Contractor. Programming of control logic and configuration of human machine interface (HMI) software is also part of the Subcontractor's Work. Functional description of process system and associated equipment is included in Article 2.7 of this Section.
 - b. Some panels and equipment are furnished under other Specification Sections under this Contract. Coordinate with Suppliers of these panels and equipment to provide fully functional system in accordance with the Contract Documents and that interfaces with central computer system.
 - c. Computer system input/output list identifies inputs and outputs required and is part of this Section. Input/output list is for coordinating signals between equipment provided by other Suppliers and computer system Supplier, and identifying signals to be programmed by CONTRACTOR's configuration Subcontractor. Include Work for CONTRACTOR-furnished control options not on the input/output list at no additional cost to OWNER.
2. To centralize responsibility, materials and equipment provided under this Section shall be furnished by a single Supplier.

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3. With CONTRACTOR, Supplier shall assume the responsibility for adequacy and performance of materials and equipment provided under this Section.
4. To the greatest extent possible, provide materials and equipment from a single manufacturer.
5. Supplier's Responsibilities:
 - a. Preparing all instrumentation and control equipment submittals in accordance with the Contract Documents.
 - b. Proper interfacing of instrumentation and control equipment with field equipment, instruments, devices, and panels, including required interfacing with packaged control systems furnished by other equipment Suppliers, and required interfacing with the Site's electrical system.
 - c. Review and coordination with manufacturers, Suppliers, and other contracts of Shop Drawings and other CONTRACTOR submittals for equipment, valves, piping, and appurtenances for ensuring proper interfacing of hardware, and locations and installation requirements of inline devices and instrument taps.
 - d. Direct, detailed oversight of installation of instruments, panels, consoles, cabinets, wiring and other components, and related wiring and piping connections.
 - e. Calibrating, source quality control, field quality control, and start-up of the system.
 - f. Responsibility for correction period obligations for instrumentation and control system.
 - g. Training of operations and maintenance personnel in operation and maintenance (including calibration and troubleshooting) of the instrumentation and control system.

C. Related Sections:

1. Section 09900, Painting.
2. Section 11212, Skid Mounted Metering Pumps and Accessories
3. Section 11221, Horizontal Split Case Pumps
4. Section 11306, Grinder Pump Station
5. Section 13205, Prestress Circular Concrete Reclaimed Water Storage Tanks
6. Section 13220, Double Walled Chemical Storage Tanks
7. Section 15103, Butterfly Valves
8. Section 15110, Check Valves
9. Section 15117, Water Regulating Valves
10. Section 15119, Electric Motor Actuators
11. Section 15130, Pressure Gauges
12. Section 16060, Grounding
13. Section 16075, Electrical Identification
14. Section 16120, Wires and Cables
15. Section 16135, Cabinets, Boxes and Fittings
16. Section 16151, Variable Frequency Drive Unit
17. Section 16220, Motors
18. Section 16230, Standby Diesel Generator
19. Section 16238, Transfer Switches

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20. Section 16436, Low-Voltage Switchgear

1.2 REFERENCES

- A. Standards referenced in this Section are:
1. ANSI/ASQ Z1.4, Sampling Procedures and Tables For Inspection By Attributes.
 2. ASTM A269, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 3. ASTM A312, Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 4. ASTM A403, Specification for Wrought Austenitic Stainless Steel Piping Fittings.
 5. ASTM B88, Specification for Seamless Copper Water Tube.
 6. IEEE 802.1 LAN/MAN Bridging & Management
 7. IEEE 802.1X, Port Based Network Access Control.
 8. IEEE 802.3, Standards Defining Physical Layer and Data Link Layer Media Access Control (MAC) Sublayer of Wired Ethernet
 9. ISA 5.1, Instrumentation Symbols and Identification.
 10. ISA 5.4, Instrument Loop Diagrams.
 11. ISA 20, Specification Forms for Process Measurement & Control Instruments, Primary Elements & Control Valves.
 12. ISO 8802-3, Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
 13. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 14. NFPA 79, Electrical Standard for Industrial Machinery.
 15. UL 50, Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
 16. UL 508A, Industrial Control Panels.

1.3 QUALITY ASSURANCE

- A. Qualifications:
1. Supplier:
 - a. Shall be financially sound with at least five years continuous experience in designing, implementing, supplying, and supporting instrumentation and control systems for municipal water and/or wastewater treatment facilities comparable to the instrumentation and control systems required for the Project, relative to hardware, software, cost, and complexity.
 - b. Shall have record of successful instrumentation and control system equipment installations. Upon ENGINEER's request, submit record of experience listing for each project: project name, owner name and contact information, name and contact information for contractor, name and contact information for engineer or architect, approximate contract value of instrumentation and controls Work for which Supplier was responsible,

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- c. Shall have at time of Bid experienced engineering and technical staff capable of designing, supplying, implementing, and supporting the instrument and control system and complying with submittal and training requirements of the Contract Documents.
 - d. Shall be capable of training operations and maintenance personnel in instrumentation and control applications, and in operating, programming, and maintaining the control system and equipment.
 - e. Shall have UL-approved panel shop.
 - f. The following are approved list of Suppliers:
 - 1) Commerce Controls, Inc.
 - 2) Curry Controls Company
 - 3) Revere Control Systems
 - 4) Roch Controls
 - 5) Or Approved Equal
2. Manufacturer: Manufacturers of instrumentation and control equipment furnished under this Section shall be experienced producing similar equipment and shall have the following qualifications:
- a. Shall manufacture instrumentation and control system components that are fully-developed, field-proven, and of standardized designs.
 - b. Shall have system of traceability of manufactured unit through production and testing in accordance with ANSI/ASQ Z1.4.
 - c. Shall have guaranteed availability clause (99.99 percent, minimum for one year) for microprocessor-based components and appurtenances.
 - d. Shall have documented product safety policy relevant to products proposed for the Work.
- B. Pre-submittal Conference
- 1. Schedule and conduct pre-submittal conference for instrumentation and control system within 30 days after acceptance of the Contractor by OWNER.
 - 2. Required attendance for pre-submittal conference: CONTRACTOR, I&C Subcontractor, ENGINEER, and OWNER. Pre-submittal conference will be 4 hours. Conference will be held at location indicated by Owner unless otherwise acceptable to the entities attending.
 - 3. Purpose of pre-submittal conference is to review manner in which I&C Subcontractor intends to comply with requirements of the Contract Documents before submittals are prepared.
 - 4. Prepare items listed below for presentation at pre-submittal conference. Submit information to ENGINEER two weeks prior to pre-submittal conference.
 - a. List of materials and equipment required for instrumentation and control system, and brand and model proposed for each item.
 - b. List of proposed exceptions to the Contract Documents along with brief explanation of each.
 - c. Sample of each type of submittal specified in this Section. These may be submittals prepared for other projects.

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- d. Flow chart showing steps to be taken in preparing and coordinating instrumentation and control system submittals.
- e. General outline of types of tests to be performed to verify that all sensors and transducers, instruments, and digital processing equipment are functioning properly.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Field Instruments:

- 1) Manufacturer's product name and complete model number of devices proposed for use, including manufacturer's name and address.
- 2) Instrument tag number in accordance with the Contract Documents.
- 3) Data sheets and manufacturer's catalog literature. Provide data sheets in accordance with ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets using a format similar to ISA 20.
- 4) Description of construction features.
- 5) Performance and operation data.
- 6) Installation, mounting, and calibration details; instructions and recommendations.
- 7) Service requirements.
- 8) Dimensions of instruments and details of mating flanges and locations of closed tanks, pipe sizes for insertion instruments, and upstream/downstream straight run pipe lengths required.
- 9) Range of each device and calibration information
- 10) Descriptions of materials of construction and listing of NEMA ratings for equipment

b. Panels, Consoles, and Cabinets:

1) Layout drawings that include:

- a) Front, rear, and internal panel views to scale.
- b) Tag number and functional name of components mounted in and on panel, console, or cabinet, as applicable.
- c) Product information on panel components.
- d) Nameplate location and legend including text, letter size and colors to be used.
- e) Location of anchorage connections.
- f) Location of external wiring and piping connections.
- g) Mounting and installation details, coordinated with actual application.
- h) Proposed layouts and sizes of operator interface graphic display panels and alarm annunciator panels.
- i) Calculations for heating and cooling of panels
- j) Subpanel layouts and mounting details for items located inside control panels.

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- k) Calculations for battery backup of panels (if applicable).
- 2) Product information on panel components including:
 - a) Manufacturer's product name and complete model number of devices being provided, including manufacturer's name and address.
 - b) Instrument tag number in accordance with the Contract Documents.
 - c) Data sheets and catalog literature. Submit data sheets as shown in ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets with format similar to ISA 20.
 - d) Description of construction features.
 - e) Performance and operation data.
 - f) Installation, mounting, and calibration details; instructions and recommendations.
 - g) Service requirements
- 3) Wiring and piping diagrams, including the following:
 - a) Name of each panel, console, or cabinet.
 - b) Wire sizes and types.
 - c) Pipe sizes and types.
 - d) Terminal strip and terminal numbers.
 - e) Wire color coding.
 - f) Functional name and manufacturer's designation for components to which wiring and piping are connected.
 - g) Lightning and surge protection grounding, refer to Electrical specification section 16060, Grounding and drawings. .
- 4) Electrical control schematics in accordance with NFPA 79. Drawings shall be in accordance with convention indicated in Annex D of the NFPA 79. Typical wiring diagrams that do not accurately reflect actual wiring to be furnished are unacceptable. Tables or charts for describing wire numbers are unacceptable.
- 5) Stock list or bill of materials for each panel including tag number, functional name, manufacturer's name, model number and quantity for components mounted in or on the panel or enclosure.
- 6) Detail showing anchorage plan of wire bundles between subpanels and front panel mounted devices.
- c. Field wiring and piping diagrams, include the following:
 - 1) Wire and pipe sizes and types.
 - 2) Terminal numbers at field devices and in panels.
 - 3) Fiber optic termination designations in the field and in panels.
 - 4) Color coding.
 - 5) Conduit numbers in which wiring will be located.
 - 6) Locations, functional names, and manufacturer's designations of items to which wiring or piping are connected.
- d. Proposed operator interface graphics layouts. Each graphic display and process report layout will be subject to modification from CONTRACTOR's submitted format within limits of software package used for development. Implement such modifications in accordance with ENGINEER's comments.
- e. Supervisory Control and Data Acquisition (SCADA) System:

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- 1) Submit the following general information:
 - a) Detailed block diagram showing system hardware configuration and identifying model numbers of system components.
 - b) Software listings for operating system, applications, and HMI.
 - c) Software language and organization.
 - d) Format, protocol and procedures for data transmission and communications with input/output modules and peripheral devices, including wide area network (WAN) or local area network (LAN).
 - e) HMI interfacing details, licensing structure, and included functions.
 - f) Control and failure modes.
 - g) Online and offline capabilities for programming, system utilities, and diagnostics.
 - h) Input/Output Information:
 - i. Input/output (I/O) point listing with I/O module cross-reference identification.
 - ii. I/O module cross-reference identification based on I/O address list developed by I&C Subcontractor .
 - i) Database listing, including all I/O points.
 - j) Suggested detailed format and configuration of log reports, alarm summaries, printer outputs, displays, and graphics.
- 2) Hardware:
 - a) Layout drawings showing front, rear, end and plan views to scale of equipment, I/O components, power supplies, and peripheral devices.
 - b) Equipment ventilation requirements.
 - c) Interconnection diagrams, including termination details, cable identification list, and cable length.
 - d) Drawings showing equipment layout.
 - e) Installation requirements, instructions, and recommendations.
- 3) Software:
 - a) Licensing agreement with name of licensee, renewal requirements, release and versions, expiration dates (if any) and upcoming releases scheduled before Project completion. When upcoming releases are expected, provide descriptions, when available, of features that differ from the proposed release.
 - b) Standard technical and instructional documentation covering software for utility, system support, system documentation, display, communications, data logging and storage and diagnostic functions. Submit this information on electronic media.
 - c) Standard technical documentation covering all aspects of the computer system software functions and capabilities, including instruction set description and programming procedures related to monitoring, display, logging, reporting and alarming functions.
 - d) Detailed functional descriptions of application programs explaining control, display, logging and alarming features to be provided and functions to be performed.

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- 4) Documentation describing memory type, size and structure and listing size of system memory, I/O and Data Table memory and size of memory available for control programs.
 - 5) System I/O Loop Wiring Diagrams: Prepare Shop Drawings on module-by-module basis and include the following information
 - a) Rack numbers, module type and slot number, and module terminal point numbers. Include location and identification of intermediate panel and field terminal blocks and terminal numbers to which I/O wiring and power supply wiring is connected. Identify power supply circuits with designation numbers and ratings.
 - b) Wiring types, wire numbers, and color coding.
 - c) Designation of conduits in which field I/O wiring will be installed.
 - d) Location, functional name, tag numbers and manufacturer's module numbers of panel and field devices and instruments to which I/O wiring will be connected.
 - e) Prepare loop wiring diagrams in accordance with ISA 5.4.
 - f. Complete point-to-point interconnection wiring diagrams of field wiring associated with the system. Diagrams shall include the following:
 - 1) Field wiring between each equipment item, panel, instruments, and other devices, and wiring to control stations, panelboards, and motor starters. Some of this equipment may be specified in other Divisions, CONTRACTOR is responsible for providing complete point-to-point interconnection wiring diagrams for control and monitoring of that equipment.
 - 2) Numbered terminal block and terminal identification for each wire termination.
 - 3) Identification of assigned wire numbers for interconnections. Assign each wire a unique number.
 - 4) Schedule showing the wiring numbers and the conduit number in which the numbered wire is installed.
 - 5) Junction and pull boxes through which wiring will be routed.
 - 6) Identification of equipment in accordance with the Contract Documents.
2. Product Data:
 - a. Product data for field instruments in accordance with requirements for Shop Drawings in this Section.
 - b. Product data for panels, consoles, and cabinets in accordance with requirements for Shop Drawings in this Section.
 - c. Product data for field wiring and piping provided for instrumentation and control service and not included under other Sections or contracts.
 - d. Product data for SCADA system, including software and hardware. Requirements for software product data are included in requirements for Shop Drawings under this Section.
 3. Samples:
 - a. Color charts for finish paint for panels. Provide full range of paint manufacturer's standard and custom colors. Color selection will be by ENGINEER.
 - b. Color charts for FRP panels. Provide full range of panel manufacturer's standard and custom colors. Color selection will be by ENGINEER.

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4. Factory Acceptance Test Procedure: Submit factory testing procedures that will be performed to fulfill requirements of the Contract Documents. Test procedure shall include the following:
 - a. Visual inspection of components and assembly.
 - b. Description of hardware operational testing.
 - c. Description of software demonstration.
 - d. Description of testing equipment to be used.
 - e. Sign-off sheets to be used at time of testing.
- B. Informational Submittals: Submit the following:
1. Documents to be submitted prior to pre-submittal conference, in accordance with Article 1.3 of this specification.
 2. System Software Documentation: Submit preliminary software documentation not later than four weeks prior to scheduled start of factory testing. Software documentation shall include the following:
 - a. Complete printed copies of all programming.
 - b. Complete listing of external and internal I/O address assignments, register assignments and preset constant values with function point descriptions. List unused/undefined I/O and data table registers available.
 - c. Copies of all configured HMI screens.
 3. Manufacturer's Instructions:
 - a. Shipping, handling, storage, installation, and start-up instructions.
 4. Source Quality Control Submittals:
 - a. Factory test reports and results.
 5. Special Procedure Submittals:
 - a. Submit notification to OWNER and ENGINEER at least 14 days before readiness to begin system checkout. Schedule system checkout on dates agreed to by OWNER and ENGINEER.
 - b. Submit written procedure for system checkout to ENGINEER three months prior to starting system checkout. Three months prior to starting system checkout submit written procedure for start-up to ENGINEER.
 6. Field Quality Control Submittals:
 - a. Submit the following prior to commencing system checkout and start-up.
 - 1) Completed calibration sheets for each installed instrument showing five-point calibration (0, 25, 50, 75, 100 percent of span), signed by factory-authorized serviceman.
 - b. Field calibration reports
 - c. Field testing reports.
 7. Supplier's Reports:
 - a. Installation inspection and check-out report.
 - b. Submit written report of results of each visit to Site by Supplier's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
 8. Qualifications Statements:
 - a. Supplier.

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- b. Manufacturer, when required by ENGINEER.
- C. Closeout Submittals: Submit the following:
- 1. Operations and Maintenance Data:
 - a. Submit in accordance with Section 01730, Operation and Maintenance Data.
 - b. Include complete up-to-date system software documentation. Provide hardcopy and electronic copies.
 - c. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.
 - 2. Record Documentation:
 - a. Prepare and submit record documents in accordance with Section 01720, Project Record Documents.
 - b. Revise all system Shop Drawing submittals to reflect as-built conditions in accordance with the following.
 - 1) Two copies of each revised Shop Drawings and documentation to replace out-dated drawings and documentation contained in operation and maintenance manuals. Submit half-size black line drawings for each drawing larger than 11 inches by 17 inches. Include specific instructions for out-dated drawing removal and replacement with record documents submittal.
 - 2) Half-size black line prints of wiring diagrams applicable to each control panel shall be placed in clear plastic envelopes and stored in a suitable print pocket or container inside each control panel.
 - 3) Submit CADD drawings of the point-to-point interconnection wiring diagrams updated to reflect final as-built equipment information and as-installed field installation information.
- D. Maintenance Materials Submittals: Submit the following:
- 1. Spare Parts and Test Equipment
 - a. General
 - 1) Furnish the spare parts and test equipment as indicated below, identical to and interchangeable with similar equipment provided under this Section.
 - 2) Provide source quality control for spare parts as part of factory testing prior to shipment of instrumentation and control equipment.
 - 3) For process sensors and other analog instruments, Supplier shall submit a separate quotation for recommended list of spare parts and test equipment. Separately list and price each item recommended. Spare parts quotation shall include a statement that prices quoted are valid for a period of one year from date of equipment installation and that Supplier understands that OWNER reserves the right to purchase none, any, or all parts quoted. Upon request, Supplier shall submit documentation that stock of spare parts and test equipment is obtainable within 48 hours of receipt of OWNER's order.
 - b. Furnish the following spare parts:
 - 1) Five of each type of input/output relay for each quantity of forty or fraction thereof provided under the Contract.

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- 2) One of each type of PLC input/output module or card used.
 - 3) One replacement power supply for each type and size provided under the Contract.
 - 4) One-year supply of all expendable or consumable materials.
 - 5) One per quantity of five or fraction thereof of gauges, indicators, and switches provided, complete with diaphragm seals, filled and ready to use.
 - 6) One per quantity of ten or fraction thereof provided, per range of field instruments including insertion type instruments. No spares are required for inline instruments such as magnetic flow meters and flumes or venturis that include flow tubes through which flow is conveyed.
 - 7) Twelve of each type and size of fuse used in instruments.
- c. Furnish the following test equipment:
- 1) Fluke, Hewlett-Packard, or equal (latest in series) digital multimeter plus amprobe, high-voltage probe, test leads, case, and other recommended spares and accessories.
 - 2) Tooling required to insert, extract, and connect internal or external connectors, including edge connectors.
 - 3) Special calibration equipment required for system calibration.
 - 4) One thermocouple calibrator, including case.
 - 5) signal simulator (four to 20 mA DC; one to five VDC), including case. Simulator shall be battery-powered and shall include charger.
 - 6) One portable flow meter calibrator, for magnetic flow meter use only.
2. Software:
- a. Submit software submittal with configuration along with licensing and version details.
 - b. Submit copies of programming and configuration files developed specifically for the Project in accordance with Section 01 78 23, Operations and Maintenance Data.

1.5 STORAGE AND HANDLING

- A. Prior to packaging, each manufacturer or Supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument.
- B. Comply with Section 01600, Material and Equipment Requirements.

PART 2 – PRODUCTS

2.1 SYSTEM REQUIREMENTS

- A. Power Supplies:
 1. Electrically powered equipment and devices shall be suitable for operation on 115-volt plus-or-minus 10 percent, single-phase, 60 Hertz plus-or-minus two Hertz, power supply. If different voltage or closer regulation is required, provide suitable regulator or transformer at no additional cost to OWNER.

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2. Provide appropriate power supplies for field instruments requiring power source less than 115 volts. Power supplies shall be mounted in control panels or enclosures installed near associated instrument or in field panels.
 3. Power supplies shall be capable of minimum of 130 percent of maximum simultaneous current draw.
 4. Provide power on-off switch or air circuit breaker for each item provided under this Section that requires electric power.
- B. Signal Requirements:
1. Control system shall use four to 20 mA DC analog signals, unless otherwise shown or indicated.
 2. Provide signal converters and repeaters where required. Adequately size power supplies for signal converters and repeater loads.
 3. Isolate signals from ground.
 4. Signals transient DC voltage shall not exceed 300 volts over one millisecond, and shall not have a DC component over 300 volts.
 5. Discrete signals shall use 24 vdc unless otherwise shown on drawings.
- C. Surge Protection Requirements:
1. Provide surge protection to protect electronic instrumentation and control systems from surges propagating along signal and power supply cabling. Protection systems shall be such that the protection level shall not interfere with normal operation, but shall be lower than instrument surge withstand level, and be maintenance-free and self-restoring.
 2. Provide instruments in suitable metallic cases, properly grounded. Ground wires for surge protectors shall be connected to good earth ground and, where practical, run each ground wire individually and insulated from other wires. Mount protectors within instrument enclosure or in separate junction box compatible with the area designation coupled to the enclosure.
- D. Miscellaneous:
1. General:
 - a. Instrumentation components shall be heavy-duty types, constructed for continuous service.
 - b. System shall consist of equipment models currently in production.
 - c. Materials and equipment, including cabling and interconnections, shall be in accordance with Division 16, Electrical, and manufacturer's recommendations, unless indicated otherwise in the Contract Documents.
 - d. Materials and equipment shall, where applicable, be in accordance with UL standards and be so marked and labeled.
 2. Logic and control loops shall be fail-safe. Instrumentation components shall return automatically to accurate measurement within 15 seconds upon restoration of power after power failure and when transferred to standby power supply.
 3. Provide surge protection for instruments and other control system components that could be damaged by electrical surges. Provide lightning arresters on both ends of

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- communication lines, except for fiber optic cabling, external to buildings or structures, including leased telephone lines and similar communication lines.
4. Field-mounted instruments and system components shall be constructed for use in humid and corrosive service conditions. Field-mounted instrument enclosures, junction boxes and appurtenances shall have NEMA rating appropriate for hazardous rating requirements shown or indicated on Electrical Drawings, instrument data sheets, and elsewhere in the Contract Documents.
 5. Miscellaneous hardware such as fittings, fasteners, and screws, be Type 316 stainless steel or other appropriate material to prevent galvanic reactions, and shall be suitable for service intended. Piping stands shall be provided for fastening instruments as required. Provide threaded pipe stands with flange bolted to slab. Use carbon steel piping and flanges painted in accordance with Section 09 91 00, Painting.
 6. Data processing equipment and relays with interconnections to field devices shall be wired through field wiring terminal blocks in the panel. Terminals as part of relay base are unacceptable.
 7. Arrange panel-mounted instruments, switches, and other devices ergonomically for functional use and ease of maintenance. Similar types of panel-mounted devices shall be by one same manufacturer and of the same model line.
 8. Equipment furnished shall be of modular construction and be capable of field expansion through installation of plug-in circuit cards and additional cabinets as necessary.
 9. Field- and panel-mounted instruments shall be tagged with equipment number and nomenclature indicated in the Contract Documents; if not so indicated, tag in accordance with approved Shop Drawings.
 10. Coordinate ranges and scales specified in the Contract Documents with manufacturer of the equipment actually furnished for operability over the intended range. Complete the coordination prior to submitting Shop Drawings to ENGINEER.
 11. Treat field-mounted devices with anti-fungus spray.
 12. Protect field-mounted devices from exposure to high and freezing temperatures to provide complete operability under the environmental conditions indicated in the Contract Documents.

E. Environmental Conditions:

1. Provide control system suitable for continuous operation under the following conditions:
 - a. Indoor Instruments:
 - 1) Ambient Temperature: Zero degrees F to 120 degrees F.
 - 2) Relative Humidity: 100 percent, maximum.
 - b. Outdoor Instruments
 - 1) Ambient Temperature: -15 degrees F to 120 degrees F.
 - 2) Relative Humidity: 100 percent, maximum.
2. Protect outdoor-mounted field instruments from direct sunlight by providing sunshade for instruments. Construct sunshade out of non-corrosive material. Sunshade shall withstand wind velocity of 150 miles per hour.

2.2 PROCESS TAPS, SENSING LINES, AND ACCESSORIES

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- A. Water Pressure Sensing Lines and Accessories for Flow and Pressure Transmitters:
1. Material: Copper water tubing, ASTM B88, Type L, drawn temper or annealed.
 2. Pressure Rating: Same as connecting pipe.
 3. Size: 1/2-inch O.D. for water.
 4. Connections: Brass compression type.
 5. Shut-off Valves:
 - a. Type: Ball.
 - b. Pressure Rating: Same as connecting pipe .
 - c. Body, Ball, and Stem: Brass.
 - d. Packing: High-density Teflon.
 - e. Handle: Nylon with metal travel stops.
 - f. Support Rings: TFE coated brass.
 - g. End Connections: Removable.
 6. Manifolds:
 - a. Type: Five-valve and three-valve meter manifolds.
 - b. Materials: Type 316 stainless steel body, bonnets, and stems; delrin seats; Teflon packing.
 - c. Manufacturers: Provide products of one of the following:
 - 1) Anderson-Greenwood.
 - 2) Swagelok by Crawford.
 - 3) Or equal.
- B. Pressure Tap Sensing Lines and Accessories for Pressure Gauges and Pressure Switches:
1. For Process Sensing Taps in Ductile Iron, Steel and Stainless Steel Piping Systems:
 - a. Material and Fittings: Type 304 stainless steel pipe, ASTM A312; and threaded fittings and adapters, ASTM A403.
 - b. Sizes: 1/2-inch diameter minimum for main sensing piping and 1/4-inch diameter gauge and switch connections.
 - c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in the Contract Documents.
 - d. Accessories:
 - 1) For applications not requiring diaphragm seals, provide separate 1/2-inch diameter Type 316 stainless steel threaded ball valve for each gauge and switch.
 - 2) For applications requiring diaphragm seals, provide separate 1/2-inch diameter threaded Type 316 stainless steel ball valve for seal process side shutoff.
 2. For Process Sensing Taps in Copper and Thermoplastic Piping Systems:
 - a. Pipe Material and Fittings: Use same type of pipe material and fittings as that used in the process piping system. Provide PVC and CPVC piping in accordance with Section 15070 Schedule 80 PVC pipe and fittings.
 - b. Sizes: 1/2-inch diameter minimum for main process sensing piping and 1/4-inch diameter for gauge and switch connections.
 - c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in the Contract Documents.
 - d. Accessories:

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- 1) For copper piping system taps with or without seals, provide separate 1/2-inch diameter minimum threaded brass or bronze ball valve for each gauge and switch.
- 2) For PVC and CPVC piping systems with or without diaphragm seals, provide separate 1/2-inch diameter threaded ball valve for process sensing line shutoff.

2.3 PANELS

A. General Provisions:

1. Provide electrical components and devices, support hardware, fasteners, and interconnecting wiring and piping required to provide control panels complete and operational.
2. Locate and provide hardware so that connections can be easily made and there is ample room for servicing each item.
3. Prevent movement by adequately supporting and restraining devices and components mounted on or within panel.
4. Provide panels with sub-panels for installation of all internally mounted hardware.
5. Provide numbered terminal strips for terminating field wiring and wiring from other panels, unless otherwise shown or indicated.
6. Provide copper grounding studs for hardware requiring grounding.
7. Provide the following convenience accessories inside each panel:
 - a. Three 120 vac, 20-amp duplex, grounding type receptacle.
 - b. One 120 vac LED service light fixture.
 - c. One 120 vac snap switch, to turn on service light, mounted in outlet box with cover and located so that switch is easily accessible from access door.
 - d. Service light with switch and duplex receptacle shall have a dedicated circuit breaker.
8. Control of Environment (for Panels Mounted Outdoor or in unconditioned spaces):
 - a. Provide 120 vac thermostatically-controlled fan-driven heater units to maintain stable temperature within enclosure to protect equipment from harmful effects of condensation, corrosion, and low temperatures inside panels.
 - b. Provide automatically controlled closed-loop heat exchangers or closed-loop air conditioners to maintain temperature inside each enclosure at optimum operating temperature rating of components inside the enclosure.
 - c. Each heat exchanger or air conditioner shall have a dedicated, properly-sized and -rated circuit breaker.
 - d. Submit supporting calculations as part of panel Shop Drawing submittal if panel equipment to comply with specified environmental requirements is proposed to be deleted as unnecessary.
9. Panels to be located in non-hazardous (non-classified) environments shall comply with UL 50 and UL 508A.
10. Provide panels under this Section with 20% percent additional space requirements for future use. Install nothing in space reserved for future use.

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11. CONTRACTOR is responsible for detailed layout and design of panels, in accordance with the Contract Documents. Base cutouts and design on instrument manufacturers' requirements.
12. Lower 12 inches of free standing panels shall be free of devices, including wireways and terminal strips, for ease of installation and maintenance.
13. Install no device less than three feet above operating floor level, unless otherwise shown or indicated.
14. Wire bundles between subpanels and front panel-mounted devices shall be anchored and protected from damage by opening and closing of panel door.
15. Do not locate front panel-mounted devices requiring manipulation by operating personnel, such as pushbuttons, hand switches, controllers, and similar devices, higher than 5.5 feet above finished floor.
16. Wireways located on either side of terminal strips shall have minimum clearance of 1.5 inches between Wireways and terminal strip.
17. Provide three-inch high channel base assembly, drilled to mate panel to floor pad.
18. Provide easily-accessible pocket built into panel door to enclose "as built" panel wiring diagrams.
19. Panels shall be UL-listed and shall bear UL label.

B. Identification:

1. Refer to specification section 16075, Electrical Identification for wiring and panel identification requirements.
2. Provide laminated plastic nameplate for identification of panels. Use self-tapping stainless steel screws for fastening nameplates to panels. When self-tapping screws may degrade panel's NEMA rating, retain NEMA rating intact by using gaskets on each side of panel surface and use retaining plate on the panel back that is same size as nameplate. When gaskets and retaining plate are used, use full-penetration screws with nuts.
3. Panel identification nameplates shall have 1/2-inch high engraved letters.
4. Identify front panel-mounted devices with nameplates engraved with functional description of the device. Nameplate engraving shall be in accordance with the identification provided in the Drawings.
5. Tag electric components and devices mounted within panels with high adhesive labels.
6. Identify terminal strips with nameplate engraved as "TB-XX" where "XX" is the numerical identification of terminal strip.
7. Identify terminals within each terminal strip with sequential numbers and wire numbers.
8. Internal panel wiring shall be color-coded and numerically identified with unique wire numbers affixed at each end of each wire. Color coding shall be in accordance with panel wiring color code table, below:

Panel Wiring Color Code Table

Description	Color
110 vac panel power before fuses or breakers	Black
Controlled 110 vac power (e.g., after relay contacts, selector switch contacts, and similar equipment.)	Red

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110 vac power source from devices external to panel	Yellow
110 vac neutral	White
24 vdc positive power from power supplies	Brown
24 vdc negative power from power supplies	
Controlled 24 vdc power (e.g., after PLC output contacts, relay contacts, and similar)	Blue
24 vdc positive power from devices external to panel	Orange
24 vdc negative power from devices external to panel	
24 vdc four to 20 mA DC signal cable	Grey with red positive, clear negative
Grounding wire	Green

C. Panel Construction Features:

1. Panels located inside control or electric room areas shall be rated NEMA 12 with the following features:
 - a. Fabricate enclosures using minimum 12-gage for free standing enclosures. Steel shall be free of pitting and surface blemishes.
 - b. Continuously weld exterior seams and grind smooth. Surface grind panel to completely remove corrosion, burrs, sharp edges, and mill scale.
 - c. Reinforce sheet steel with steel angles where required to adequately support devices and equipment and ensure rigidity and to preclude resonant vibrations.
 - d. Panel shall be flat within tolerance of 1/16-inch over two-foot by two-foot area, or flat within tolerance of 1/8-inch for larger surface area. Acceptable out-of-flatness shall be gradual, in one direction only, and shall not consist of obvious depressions or a series of wavy sections.
 - e. Use pan type construction for doors. Door widths shall not exceed three feet.
 - f. Mount doors with full-length heavy-duty piano hinge with stainless steel hinge pins.
 - g. Provide oil resistant gasket completely around each door or opening.
 - h. Provide handle-operated, oil-tight, key-lockable three-point stainless steel latching system with rollers on latch-rods for easy door closing.
 - i. Use stainless steel fasteners throughout.
 - j. Provide interior mounting panels and shelves constructed of minimum 12-gage steel with white enamel finish.
 - k. For prints, provide steel pocket with white enamel finish.
 - l. Provide enclosure mounting supports as required for floor, mounting.
 - m. Completely clean interior and exterior surfaces so surfaces are free of corrosive residue, oil, grease, and dirt. Zinc phosphatize for corrosion protection.
 - n. Provide one coat of primer paint to interior and exterior surfaces immediately after applying corrosion protection, in accordance with coating manufacturers' instructions. Provide surface preparation in accordance with coating manufacturer's requirements.
 - o. Paint interior surfaces with two coats of semi-gloss white polyurethane enamel.
 - p. Paint exterior surfaces with minimum of three finish coats of polyurethane enamel to produce a finish that is smooth and free of imperfections. Color shall be selected

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- by ENGINEER from complete selection of standard and custom color charts furnished by manufacturer.
- q. Primer and finish paint shall be compatible and shall be low-VOC, high-solids polyurethane enamel.
2. Control panels located in non-environmentally controlled areas shall be rated NEMA 4X and with the following features:
 - a. Construct panels of fiberglass mat-reinforced polyester resin, with minimum thickness of 3/16-inch for all surfaces, except areas requiring reinforcement.
 - b. Panels shall be precision-molded to form one-pieced unit with rounded corners.
 - c. Exterior surfaces shall be gel-coated to provide corrosion-resistant, maintenance-free satin finish that does not require painting or other protective coating.
 - d. Color pigments shall be molded into the resin.
 - e. Color shall be selected by ENGINEER from complete selection of standard and custom color charts furnished by manufacturer.
 - f. Panels shall have front access doors where rear access is not feasible.
 - g. Provide clear-plastic and gasketed lockable hinged door to encompass non-NEMA 4X front-of-panel devices.
 - h. Hardware, including hinge and means of locking shall be corrosion resistant.
 3. Control panels located outdoors shall be rated NEMA 4X and with the following features:
 - a. Panels shall be Type 316L stainless steel construction with minimum thickness of 12-gage for all surfaces, except areas requiring reinforcing, with a smooth-brushed finish.
 - b. Stainless steel screw clamp assemblies on three sides of each door.
 - c. Rolled lip around three sides of door and along top of enclosure opening.
 - d. Hasp and staple for padlocking.
 - e. Provide clear-plastic, gasketed lockable hinged door to encompass non-NEMA 4X front-of-panel devices.
 4. Wall-Mounted Panels:
 - a. General: Wall-mounted panels shall comply with applicable features and standards specified in this Section for the associated NEMA-rated panel.
 - b. Unless otherwise indicated or approved by ENGINEER, depth of wall-mounted panels shall not exceed 18 inches.
 - c. Provide appropriate size and number of external mounting feet.
 - d. Drilled holes or knockouts in back of wall-mounted panels are not allowed.
 - d. Provide corrosion-resistant polyester quick release latches (for non-stainless steel panels) or stainless steel screw clamp assemblies (for stainless steel panels).
 6. Network Hardware Cabinets
 - a. Cabinets shall be rated NEMA 12, steel construction, with minimum thickness of 14-gage for except areas requiring reinforcing.
 - b. Seams shall be continuously welded and ground smooth.
 - c. Surfaces shall be powder-coated. Color will be selected by ENGINEER from color charts submitted by CONTRACTOR.
 - d. Upper portion of front panel shall have clear, plastic viewing window of suitable size to view the operator interface.

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- e. Upper interior section of cabinet shall provide ample space to house a 24-inch computer monitor.
- f. Provide retractable keyboard tray to house standard size keyboard and mouse.
- g. Lower door shall be solid construction and hinged.
- h. Do not mount devices on doors.
- i. Provide tamper-proof locking mechanism on each access panel and access door.
- j. Provide interior vertical and horizontal brackets for mounting equipment and appurtenances.
- k. Provide air louvers or similar feature for cabinet ventilation.
- l. Provide holes and cutouts for installing conduit and equipment. Conduit, cables, and piping shall enter through back of enclosure. Seal watertight conduit and piping openings and all conduits
- m. Hardware, including hinge and means of locking, shall be corrosion-resistant. Provide hardware as required.

D. Electrical Systems:

1. Power Source and Internal Power Distribution:

- a. Provide in the panel, near where incoming power is terminated, nameplate with panel power supply source, type, voltage, and circuit number.
- b. Protect incoming 120 vac power feeds to power the panel by providing lightning and surge arrestors, properly connected to grounds.
- c. Provide panels with internal 120 vac power distribution system with properly-sized and -rated circuit breakers to distribute power. Power not more than six devices from a single breaker. When power supplies are included in the panel, not more than two power supplies shall be powered from a single breaker. Convenience receptacles and interior panel lights shall have their own breakers. When one or more field instruments require 120 vac power from the panel for instrument power, power not more than three instruments from a given breaker.
- d. Provide space for a minimum of two spare breakers in each panel.

2. Electrical Systems:

- a. Internal wiring shall be Type MTW and THW stranded copper wire with thermoplastic insulation rated for 600 volts at 85 degrees C for single conductors, color-coded and labeled with wire identification.
- b. For DC signal wiring, use shielded cable with 18-gage conductors. DC field signal wiring terminal strips shall be capable of handling wires up and including No. 12 size.
- c. For AC power wiring, use No. 12 minimum AWG. For AC signal and control wiring, use No. 16 minimum AWG.
- d. Inside of panels, route DC signal wiring separately from power wiring with minimum separation distance of six inches.
- e. Use covered wireways to route internal panel cables and wiring. Wireways in each section of panel shall be appropriately sized to accommodate the quantity of wires to be routed with a spare capacity of 40 percent.
- f. Install wireways inside panels along horizontal or vertical routes to present a neat appearance. Angled runs are unacceptable.

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- g. Wiring that is routed without wireways shall be adequately supported and restrained to prevent sagging or other movement. Use of adhesive anchors to support or restrain wiring is unacceptable.
- h. Terminate internal panel wiring using forked, insulated, crimp-on connectors; soldered connectors are unacceptable. Provide panels with 600-volt rated barrier type terminal strips mounted on Din rails. Identify terminal strips as indicated in this Section. Identification devices shall be self-stick, plastic tape strips with permanent, machine-printed numbers. .
- i. Wiring in panels shall be installed such that, if wires are removed from any one device, power will not be disrupted to other devices.
- j. Provide spare terminals equal in number to 20 percent of terminals used for each type of wiring (e.g., DC signal and AC power).
- k. Provide ground terminals to terminate the shield wire of shielded cables. Termination of more than two shielded wires on a single ground terminal is unacceptable.
- l. Provide a single copper bus bar with 5/16-inch diameter copper grounding stud to connect the panel to external ground. Panel's internal grounds shall be terminated to the bus bar.
- m. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.
- n. When DC power or low voltage AC power is required, furnish and install in the panel required power supplies and transformers.
- o. Provide complete wiring diagram of "as-built" circuitry enclosed in transparent plastic.

2.4 COMPUTER HARDWARE AND SOFTWARE

A. Its is the intent of this specification that the hardware and software furnished for this project provide the latest available technology at the time of installation. The following paragraphs contain the minimum requirements for each piece of equipment, however the contractor shall furnish similar or better equipment to provide the highest available quality of installation.

2

AB. Personal Computer Hardware

1. Workstation Computers:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Dell Precision Tower, manufactured by Dell Computer.
 - 2) Hewlett Packard.
 - 3) Or equal.
 - b. Computers shall have the following features:
 - 1) Next-generation Intel Xeon quad-core processors, 2.5 GHz or higher.
 - 2) Random-Access Memory: Three GB DDR3, minimum.
 - 3) Hard Drive: 250 GB 7200 RPM SATA hard drive, minimum.
 - 4) Local bus IDE interface.
 - 5) Graphic adapter (SVGA), minimum 1024 by 768 pixels, with 32K colors, 128 MB video memory.

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- 6) One serial port and one parallel port.
 - 7) 105-key keyboard.
 - 8) 16X DVD+/-RW w/ Cyberlink PowerDVD and Roxio Creator.
 - 9) 10/100/1000 ethernet card for connecting to process control data highway.
 - 10) USB 2.0 Ports: Provide two on front panel and six on back panel.
 - 11) One RJ 45 jack.
 - 12) Power Supply: 1100 watts 85 percent (or higher) efficiency power factor correcting power supply.
 - 13) Quantity Required: 2 (TWO).
2. Server Computer
- a. Products and Manufacturers: Provide products of one of the following:
 - 1) Dell Computers.
 - 2) Hewlett Packard.
 - 3) Or equal.
 - b. General:
 - 1) Provide equipment to operate on 115 vac, single-phase, 60-Hertz electrical service.
 - 2) Provide all necessary items for installation, including mounting brackets, interconnecting cables, hardware and appurtenances.
 - c. Server:
 - 1) Rack-mount configuration with hardware and cables required for mounting the unit.
 - 2) Dual Core Intel Xeon 5148LV, 4MB cache, 2.33 GHz, 1333 MHz front side bus, Engineering Sample.
 - 3) Additional processor Dual Core Intel Xeon 5148LV, 4 MB cache, 2.33 GHz, 1333 MHz front side bus, Engineering Sample.
 - 4) Memory: 4GB 667MHZ (2x2GB), dual ranked DIMMS,
 - 5) Operating System: Windows Server 2003 R2, Standard Edition with Service Pack 2 (SP2), with 5 client access licenses.
 - 6) Raiser Card: Raiser with 3 PCIe slots
 - 7) Power Supply: Redundant power supply with dual cards.
 - 8) Primary Hard Drive: 146 GB 10,000 serial attached SCSI 3 GBps Hard Drive, 2.5-inch, Hot Plug.
 - 9) Primary Controller: PERC6i SAS RAID Controller, 2x4 Connectors, Int, PCIe, 256MB cache, x8 Back.
 - 10) Second Drive: 146 GB 10,000 serial attached SCSI 3 GBps hard drive, 2.5-inch, Hot Plug.
 - 11) Third Drive: 146 GB 10,000 serial attached SCSI 3 GBps hard drive, 2.5-inch, Hot Plug.
 - 12) Fourth Drive: 146 GB 10,000 serial attached SCSI 3 GBps hard drive, 2.5-inch, Hot Plug.
 - 13) Hard Drive Configuration: Integrated SAS/SATA Raid 5, PERC 6/I Integrated.
 - 14) Internal 1.44MB floppy drive.

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- 15) Network Adapter: Intel Pro 1000PT Dual Port Server Adapter, Gigabit NIC, Cu, 4 PCIe slots.
 - 16) CD/DVD Drive: 24X IDE CD-RW/DVD rom drive.
 - 17) Rack Bezel.
 - 18) Backplane: 1 by 8 backplane for 2.5-inch hard drives.
 - 19) Documentation: Furnish all documentation, manual and licenses.
 - 20) Chassis Configuration: Rack chassis with sliding rapid/versa rails and cable management arm, universal.
3. Monitors:
- a. Products and Manufacturers: Provide products of one of the following:
 - 1) Dell Computer.
 - 2) Hewlett Packard
 - 3) Or equal.
 - b. Computer monitors shall have following features:
 - 1) 24-inch diagonal widescreen thin-film transistor (TFT) active-matrix liquid crystal display (AMLCD).
 - 2) Minimum resolution of 1920 by 1200.
 - 3) Display Image Aspect Ratio: 16:10.
 - 4) Image Brightness: 400 candela per square meter (cd/m²).
 - 5) Image Contrast Ratio: 3000:1.
 - 6) Maximum Horizontal View Angle: 178 degrees.
 - 7) Maximum Vertical View Angle: 178 degrees.
 - 8) Dot Pitch per Pixel Pitch: 0.27 mm.
 - 9) Response Time: Six milliseconds.
 - 10) On-screen display menu control buttons for display position and quality adjustments.
 - 11) Signal Input: HDMI, 2xDVI-D, VGA, display port.
 - 12) Service Voltage: 100/240 vac.
 - 13) Quantity Required: 2 (TWO).

~~B. Printer~~

~~1. Color Printer~~

~~a. Products and manufacturers: Provide products of one of the following:~~

- ~~1) Xerox.~~
- ~~2) Hewlett Packard.~~
- ~~3) Or equal.~~

~~b. Printers shall have the following features:~~

- ~~1) Print Speed:

 - ~~a) Color: up to 42 pages per minute~~
 - ~~b) Black: up to 42 pages per minute~~~~
- ~~2) Standard Paper Capacity: 700 sheets~~
- ~~3) Output Capacity: 250 sheets~~
- ~~4) Two-sided Output: Standard~~
- ~~5) First page out Time, Printing: Nine seconds (color)~~
- ~~6) Maximum Print Resolution: 2400 by 600 dpi~~

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- ~~7) Processor: 1 GHz~~
- ~~8) Print Memory: 1 GB~~
- ~~9) Connectivity: 10/100 Base-TX Ethernet, IPv6, USB 2.0 (optional: Wireless (IEEE 802.11a/b/g))~~
- ~~10) Page Description Languages (PDL): Adobe PostScript3, PCL 5c emulation (optional: PDF direct)~~
- ~~11) Print Features:

 - ~~a) Banner size printing, booklet printing, N-up, overlays, run black (extended font/form storage, personal print)~~
 - ~~b) Collation, configuration card, covers, custom size pages, driver saved settings, email alerts, intelligent ready, Phaser SMART automated troubleshooting, RAM collation, separator pages, smart trays, supply life indicator, transparency separators, watermarks, xerox installer (optional: hard disk collation, personal print, personal saved print, print with, proof print, saved print)~~~~
- ~~12) OS Support: Linux, Mac OS X version 10.2 or higher, Windows 2000 or higher, Windows Vista, Xerox Walk-up Printer Driver~~
- ~~13) Color Standards: Adobe PostScript device independent color, Apple ColorSync, CIE International color standards, ICC, ICM, PANTONE Color Approved.~~
- ~~14) Media Handling: Paper capacity:

 - ~~a) Tray 1 (multipurpose tray): 150 sheets~~
 - ~~b) Tray 2: 550 sheets.~~
 - ~~c) Tray 3: 550 sheets.~~
 - ~~d) Tray 4: 1,100 sheets.~~~~
- ~~15) Temperature (operating): 50 to 90 degrees F (10 to 32 degrees C)~~
- ~~16) Relative humidity (operating): 15 to 85 percent RH (noncondensing)~~
- ~~17) Electrical Requirements: 120 vac, 50/60 Hertz~~

C. Fast Ethernet Switch

1. General:
 - a. Provide equipment to operate on 115 vac, single-phase, 60-Hertz electric service.
 - b. Provide required items for installation, including mounting brackets, interconnecting cables, hardware, and appurtenances.
2. Products and Manufacturers: Provide one of the following:
 - a. 100Base-TX Switch, manufactured by Cisco.
 - b. RuggedCom.
 - c. Or equal.
3. Features:
 - a. Minimum of eight RJ-45 ports supporting 100 Base-TX transmission over two pair of Category 5, unshielded twisted pair (UTP) cable.
 - b. One DB-9 RS-232 interface port.
 - c. Jumbo Frames: 10K.
 - d. MAC Address Table: 8K.
 - e. Switching Method: Store and forward.
 - f. Security: IEEE 802.1X, RADIUS authentication, MD5 encryption access.

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- g. Control: ACLs – drop or rate limit based on: Source and destination MAC-based source and destination IP address protocol TOS/DSCP port VLAN EtherType.
- h. One IEC320 power cord.
- i. One expansion cable.
- j. Per Unit LEDs: Power status, collision, over temperature.
- k. Per Port LEDs: Packet reception, partition, link status.
- l. LCD unit ID indicator.
- m. Quantity: As shown or indicated on the Drawings..
- n. Fast Ethernet hub shall be in accordance with:
 - 1) IEEE 802.3u, 100 Base-T compliant.
 - 2) IEEE 802.3x flow control, IEEE 803.3ad LACP, IEEE 802.1d STP, IEEE 802.1 Q/p VLAN, IEEE 802.1 Rapid STP, IEEE 802.1s Multiple STP, IEEE 802.1X port access authentication.
 - 3) ISO 8802-3.

D. SCADA Software:

1. Products and Manufacturers: Match existing Rockwell SCADA software which is utilized at the existing water plant.
2. Products and Manufacturers: Provide the following: Modify existing systems to which the plant will report.
 - a. Existing water plant – Rockwell
 - b. Existing wastewater plant - Wonderware
 - a. ~~GE SCADA Package – iFIX.~~
 - b. ~~Wonderware.~~
 - c. ~~Or equal.~~
23. Software licenses shall be purchased by CONTRACTOR under OWNER’s name. Licenses purchased under the CONTRACTOR’s name and transferred to OWNER at a later date are unacceptable.
34. Software system shall provide access to system elements that allow direct operations personnel interface to documentation, process management information, process control blocks, and system configuration elements.
45. Software packages and subsystems shall enable user to configure system and build and use multiple process control blocks, and allow operations personnel access to manipulate and monitor control blocks and operations environment. Tasks allocated to systems and process engineers and process operators shall be simplified for easy use.
56. Software shall be comprised of:
 - a. System configuration utilities.
 - b. Database manager.
 - c. Environment configuration utilities.
 - d. Graphic screen painter.
 - e. Graphic screen viewer.
 - f. Historical data manager.
 - g. Reporting system.
 - h. Real-time data manager.
 - i. Communications subsystem.

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- j. Alarm handler.
 - k. Supervisory control system.
67. System software shall work as virtually independent units or in concert with other internal software. Human interface software shall support operations such as:
- a. Setting up I/O database.
 - b. Accessing I/O point settings.
 - c. Editing graphic displays and building new displays.
 - d. Editing and creating objects within displays.
 - e. Editing system configuration.
 - f. Setting up and tracking process control trends.
 - g. Checking system performance.
78. Software shall provide standard process control algorithms for use with control schemes as shown and specified in this Section, and to enable operations personnel to develop new supervisory and regulatory distributed digital, control schemes on-line. Provide algorithms consisting of modular, function block type of control elements which are familiar to control engineers. Algorithms shall include input blocks for acquiring, converting, and characterizing signals representing process variables; computational blocks for performing arithmetic, scaling, and compensating operations; control blocks for performing control functions; and special algorithm blocks for switching, fan-out, display, and user-specified operations, including interacting with supervisory programs. Tuning constants shall be easily set from operator consoles and workstation keyboards.
89. System shall provide support for Active X controls by acting as an Active X container.
910. Graphical user interface shall support distributed access through the alarm and historical modules as well as application development and transfer across a network with built-in network application development (NAD) functionality. NAD shall provide automatic notification of application changes and automatic distribution of updated applications to runtime (view) nodes.
101. Graphical user interface shall be capable of exporting entire database of I/O points into CSV file format for import and subsequent editing to a Microsoft Excel spreadsheet.
121. Software shall facilitate import of entire database from CSV file created with Microsoft Excel.
132. Software shall facilitate development of new control schemes, and modification of existing schemes on-line, in the background mode without affecting normal operation of the facility or system. Addition of new control schemes or modification of existing schemes via control engineering oriented statements shall be possible.
143. Software Operation:
- a. System shall be interactive and menu-driven for ease of use. Select various action menu entries and data fields via computer mouse
154. Electronic Documentation:
- a. Documentation for control system shall be provided with the system in electronic format. Documentation shall be available and accessible from within the applications programs.
 - b. Documentation shall be broken down by function. Information usually required for an authorized person to perform configuration shall be included in a guide;

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information required to configure the process I/O blocks shall be included in control blocks documents.

1) Online Help:

- a) Online help shall provide information and assistance to user as user uses an application program. Information available through online help shall relate to the current display, current program operation or selection, and changes as user proceeds through the program to provide user with appropriate information.
- b) Help shall be requested by selecting "HELP" from the menu bar. Menu of topics relating to current display or selection shall appear on the screen. Help text shall be displayed in a partial screen overlay.
- c) Screen control functions shall be displayed as menu selections.

156. Access Security:

- a. Each operations person accessing the system shall be required to log on, with user name and password, to view, edit, add, or delete data. System security shall be selectable for each operations person. System administrator shall have ability to set passwords and security levels for all other personnel. Each operations personnel password shall be able to restrict person's access for viewing and changing each system application, full screen editor, and object. Each operations person shall automatically be logged off the system if no keyboard or mouse activity is detected.

176. Real- Time Displays:

- a. Furnish capability to develop graphic screens using any drawing package capable of generating bitmap or jpeg file formats. Use of proprietary graphic file formats is unacceptable. In addition to, or in lieu of a graphic background, graphical user interface shall support use of scanned images.
- b. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, and links to other graphic screens.
- c. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
- d. Graphics editor shall allow layering of objects to activate specific objects based upon specific conditions in control system.
- e. Graphics editor tool shall allow object placement via "snap-to-grid" feature with configurable grid spacing. The operator has the ability to configure the pixel interval on the "snap-to-grid" tool.
- f. System shall support import of DXF files with the drawing elements imported as native objects. It shall be possible to animate such objects using a full set of object animation properties.
- g. User shall be able to configure graphic screens while system is monitoring the process.

187. System Configuration:

- a. At minimum, graphical user interface shall allow user to perform the following tasks with proper password access.

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- 1) Create, delete, or edit control strategies.
 - 2) Add and delete objects to the system.
 - 3) Tune control loops through editing of control loop parameters.
 - 4) Enable and disable control strategies.
 - 5) Select points to be alarmed and define the alarm status.
 - 6) Select points to be trended over a period of time and initiate recording of values automatically.
198. Provide built-in editor for development of logic scripts. Editor shall be a full-featured text editor with single keystroke entry of logic constructs and script functions. When script function is placed in editing window, arguments necessary for script function to operate shall be automatically pasted into the window. Logic editor shall also allow use of built-in script functions by double-clicking on list, as well as extensive script validation capability. Provide online help for all script functions. User shall be able to configure and edit logic scripts while system is online and functioning.
2019. Software shall have the ability to execute user-defined logic scripts. Logic scripts shall be created in a statement-based programming environment. Compilers or linkers shall not be required. System logic shall be able to automatically perform functions such as increase set points, perform totalization, and check status of process set points to take action. System logic shall be able to control and start other application programs running in multitasking environment. System logic shall be able to contain locally-defined variables that are script-specific. System logic shall be able to use methods and properties of any ActiveX controls used in the application. System logic architecture shall be such that user-defined functions can be created; parameters can be passed, and returns values. Such user-defined functions shall be usable directly from animation links as well as within other system logic.
210. Alarm Subsystem:
- a. Provide system with alarm window or console. Window shall notify user of alarm conditions and allow user to view details of alarm and acknowledge the alarm.
 - b. When alarm console is not visible, separate alarm notification window will supersede other windows on the display and shall not be capable of being minimized by user. This window will notify user of new alarms and unacknowledged alarms. Alarm notification windows or banners that can be minimized by the user are unacceptable.
 - c. User shall be able to select alarms displayed by object alarms by group and priority by using command buttons. Up to 98 priority levels shall be supported. User shall be able to view and acknowledge alarms from any node in the enterprise.
 - d. Alarms shall be color-coded according to alarm status and priority, including an acknowledged alarm, unacknowledged alarm, and alarm that has returned to normal but is not yet acknowledged.
 - e. System shall be configurable such that the user is notified of alarm no matter what display the user is currently viewing. Notification shall include the option

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- of pop-up alarm display window, flashing symbol, alarm text message that is available on each display, or dedicated alarm display window on the screen.
- f. User shall be able to view alarms on individual or a group basis, with support for 16 groups each having up to 16 sub-groups. Alarm hierarchy shall be capable of being nested up to eight levels deep.
 - g. Provide capability of performing alarm acknowledgment on all alarms, on alarms in a single group, and on alarms in collection of groups as defined in an alarm group hierarchy, or on a point-by-point basis.
 - h. Provide system capable of storing alarms in structured query language (SQL) database for long term storage of alarm information.
 - i. Standard alarm display shall support display of the following alarm parameters which are user-selectable in the configuration mode:
 - 1) Date
 - 2) Time
 - 3) Event
 - 4) Alarm type
 - 5) Operator
 - 6) Priority
 - 7) Comment
 - 8) Tag name
 - 9) Group name
 - 10) Value of variable in alarm
 - 11) Alarm limit
 - 12) Alarm status

221. Process Report Generation:

- a. Process report generation software shall provide means to process, store, and print data for historical records by utilizing dynamic data exchange (DDE) incorporated in Microsoft Windows operating system.
- b. Software shall be flexible so that contents of reports can be easily modified.
- c. Software shall provide for collecting, processing, and storing values for minimum of 800 database points.
- d. Provide the following minimum data collection functions:
 - 1) Instantaneous value; value at end of data collection interval.
 - 2) Average value during time interval.
 - 3) Totalization over time interval.
 - 4) Highest value over time interval.
 - 5) Lowest value over time interval.
 - 6) Where “indicating light” on/off is indicated, provide run time counter for each device.
- e. At maximum, data shall be collected at ten-minute intervals.
- f. Provide capability for data values to be manually input by the user. Also provide capability for the user to flag any data field. .
- g. Each log report page shall have the capability to contain information for ten log points, minimum.
- h. Periodic log reports shall be printed automatically at end of time period.

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- i. Provide calculation extension capability to perform calculations on data that has been accumulated for report generation. Calculations shall consist of addition, subtraction, multiplication, and division functions for calculations of such items as engineering unit changes, totalization values where measurement values are different, and performance indexes. Include provisions for minimum of fifty calculation extensions.
- j. Reports shall be free-form, thereby printing all general information, headings, and data in established format at time of generation. Preprinted sheets are unacceptable. Each report page shall include facility name, type of report, date and time the report was printed, and page numbers.
- k. Provide software for generating special event, hourly, daily, monthly and annual reports. Reports shall be generated using process input/output, event information, and manual or computed point information from records in database.
- l. Historical data display should allow the user to zoom in and out in time from one second to up to six weeks in one display. Provide capability to activate zoom-in and zoom-out features using action scripted command buttons available to the user. System shall allow user to pan backward and forward in time through historically logged data.
- m. Provide capability for user to print historically trended information in form of printed record. Historically-collected data shall be available for export to spreadsheet for analysis, additional reports, and other manipulation.

n. Provide a minimum of 15 trends as directed by the owner. Trends shall be developed at the existing water and wastewater plant.

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232. Quantity Required: One complete SCADA package and one report generator software package.

D. General Purpose Software:

- 1. Provide two copies of the following: Microsoft Office Professional 2007 or higher, including the following: Microsoft Windows 7, Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Microsoft Outlook, Adobe Acrobat Reader, and Microsoft Access.
- 2. Antivirus Software:
 - a. Provide products of one of the following:
 - 1) Symantec.
 - 2) Trend Micro.
 - 3) Or equal.

E. Operating System

- 1. Windows 7 Enterprise.

2.5 DATA SHEETS – PANEL INSTRUMENTS AND PRIMARY SENSORS AND FIELD INSTRUMENTS

A. General:

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1. Panel-mounted devices and instruments and primary sensors and field instruments shall be in accordance with the “data sheets” included I Part 3 of this specification.
2. Do not fabricate, ship, or assemble instruments and devices in panels until require Shop Drawings and other submittals required for fabrication are approved or accepted as required.

2.6 IDENTIFICATION

A. Instrument Tagging

1. Headings on the instrument index in the Contract Documents have the following meaning:
 - a. “TAG” is divided into two sections. The first seven to nine alphanumeric characters represent the OWNER’s equipment number and the remaining characters comply with ISA Standard S5.1.
 - b. “DESCRIPTION/LOCATION” is an explanation of instrument function and location.
 - c. “RANGE/SET POINT” is the limit for the specified units of the instrument and set point is the precise value within the instrument’s range.
 - d. “SPEC REF” is the paragraph reference in the Specifications where the instrument’s requirements are specified.
 - e. “DRAWING NO.” indicates the Drawing where the device is shown or indicated.
 - f. “REMARKS” contains specific notes relative to the instrument.

B. Input/Output List Identification

1. I/O point list contains information required to configure PLC I/O interface hardware, and to indicate range conversion or signal functions.
2. “POINT NUMBER” is an alphanumeric character string. For example, for the point “MP-FI-806-0123” the following apply:
 - a. The first two characters (MP) refer to the specific facility area (MP = Main Pump, for example).
 - b. The third character is the functional identifier and conforms with ANSI/ISA S5.1. In the example, “F” represents flow.
 - c. The fourth (and sometimes fourth and fifth) alphabetical character (I) is the function identifier. In the example, the “I” represent indication input.
 - d. The first three-digit number (806) identifies the P&ID number.
 - e. The next four-digit number (0123) identifies the loop or field device.
 - f. Suffix, where required, is used for distinguishing between similar variables.
3. “DESCRIPTION” is an alphanumeric character string up to 40 characters in length. Points described as “SPARE” indicate pre-wired I/O.
4. “SIGNAL TYPE” is one of the following:
 - a. AI indicates analog input.
 - b. DI indicates discrete input.
 - c. PI indicates pulse input.
 - d. AO indicates analog output.
 - e. DO indicates momentary, maintained or latched discrete output.

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- f. FB indicates foundation field bus.
- g. PB indicates profi bus.
- h. MB indicates Modbus.
- i. DN indicates device net.

C. ISA Identification

- 1. A = Analytical.
- 2. B = Burner, Combustion.
- 3. C = Cooling (Cooling Condenser).
- 4. D = Dissolved.
- 5. E = Voltage.
- 6. F = Flow.
- 7. G = Intrusion.
- 8. H = Hand.
- 9. I = Current.
- 10. J = Power.
- 11. K = Time.
- 12. L = Level.
- 13. M = Manual.
- 14. N = UNDEFINED.
- 15. O = Overload.
- 16. P = Pressure.
- 17. Q = Communication.
- 18. R = Reverse.
- 19. S = Speed, Frequency.
- 20. T = Temperature.
- 21. U = Universal (Common).
- 22. V = Vibration.
- 23. W = Torque (Weight or Force).
- 24. X = Critical (Emergency).
- 25. Y = Event, State or Presence.
- 26. Z = Position, Dimension.

D. Function Identifier:

- 1. A = Alarm
- 2. B = UNDEFINED.
- 3. C = Control.
- 4. D = Differential.
- 5. E = Element.
- 6. F = Failure.
- 7. G = UNDEFINED.
- 8. H = High.
- 9. I = Indication.
- 10. J = UNDEFINED.
- 11. K = Factor.

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- 12. L = Low.
- 13. M = Mode.
- 14. N = Normal.
- 15. O = Oxygen.
- 16. P = UNDEFINED.
- 17. Q = Quantity.
- 18. R = Rotation.
- 19. S = Switch.
- 20. T = Timer
- 21. U = UNDEFINED.
- 22. V = Slow (output)
- 23. W = Slow (input)
- 24. X = Selector Switch (input)

2.7 PROCESS CONTROL DESCRIPTIONS

A. Reclaimed Water Pump Control:

1. Overview
This system consists of the three main pumps, one jockey pump, chemical feed system and storage tank. VFD driven reclaimed high service pumps are controlled based on the discharge pressure, the number of pumps in operation and vfd speed will be adjusted to maintain a constant setpoint pressure (operator adjustable) in the discharge header.
2. Monitoring and Control
LIT – 103 Reclaimed Storage Tank PSV – 102 Open/Close Status VFD – Reclaim Pump #1-#4 Status and Speed Setpoints LS – 113,123,133,143 Flow Switch Status PIT – 146 Discharge Pressure
3. Local (Manual) Display/ Control
Control of pumps can be done by switching the H-O-A to HAND and manipulating the pump speed by the VFD keypad.
4. Remote Control
A. REMOTE - AUTO:

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The operator shall have the following setup in place on the OIT to allow remote-auto operation of the pumps:

- i. Set the desired pressure output to be maintained.
- ii. Set the maximum allowable discharge pressure (100 psi maximum).
- iii. Set the VFD in REMOTE control mode.
- iv. Set the HOA at the pump in AUTO.
- v. Set the minimum tank water level “all pumps off” setpoint.
- vi. Set the minimum and maximum speeds of the pumps (with different settings for jockey and large pumps).
- vii. Set the pump stage time delays.
- viii. Set the pump cycle on-off time delays.
- ix. Set the pressure alarm setpoints.
- x. The operator shall select pump ramp up and ramp down time intervals.
- xi. The operator is prompted to initiate automatic control.

After operator prompt to start, the control system shall confirm equipment status and shall prompt the operator if there are conditions that preclude automatic control. The control system shall provide error messages to alert the operator of any problem. If the control system determines acceptable operating parameters, the control system shall start the operator selected pumping unit(s) required to maintain setpoint based on the following control strategy modes:

1. Pump #1 - Jockey Pump Control Mode: The control system shall start the jockey pump and automatically adjust its speed to maintain the pressure setpoint, if the flow required to maintain discharge pressure is within the capacity of the jockey pump (650 gpm).
2. Pump # 2, #3 & #4 - Large Pumps Control Mode: If the flow required to bring pressure to the pressure setpoint is more than the flow that can be supplied with the jockey pump, the control system shall start one large pump (slowly ramping up pump speed) and shut down the jockey pump (ramped down) and automatically adjust speed of the large pump to attain the discharge pressure setpoint. If the flow required to attain the pressure setpoint is greater than the capacity of one large pump (1,300 gpm), the control system shall start a 2nd large pump and automatically adjust speed of the units in unison so that all pumps are operating at the same speed to provide the required flow to maintain pressure set point. If the flow required to maintain pressure set point is greater than the capacity of 2 pumps at 100% speed (2,600 gpm), the third large pump shall be energized and ramped and the system will automatically adjust speed of the units in unison so that all pumps are operating at the same speed to provide the required flow to maintain pressure set point.
3. Pump #1, #2, #3, & #4 – All Pumps Control Mode: If the flow required to maintain pressure set point is greater than the capacity of 3 pumps at 100% speed (3,900 gpm), the jockey pump shall be energized and ramped and the system will automatically adjust speed of the jockey pump with the large pumps concurrently operating at 100% speed to maintain pressure set point.

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4. On increasing discharge pressure, the control system shall decrease pump speed and/or the number of units in operation to maintain the desired pressure set point. The pumps' speed will not be reduced below the operator selected preset minimum speeds. If the system demand decreases such that the jockey pump is operating at its minimum speed and pressure continues to rise above the pressure set point, the control system shall not further decrease jockey pump speed and the jockey pump will continue to operate at its minimum speed, with discharge pressure rising to the 6" pressure relief valve pressure setting. At this point part of the pumped flow from the jockey pump will be recycled back into the suction line from the tank. If pressure should continue to rise above the pressure relief valve setting due to valve failure, a closed valve, or other circumstance, an alarm will be triggered at the station high pressure alarm setpoint and the signal will be sent to the SCADA system. Pressure alarms shall have time delays to accommodate pressure spikes during pump start, check valve opening, and other interlocks.
5. Additional programming shall be provided as follows:
 - i. Provide selection of Lead/Lag 1/Lag 2/Standby. Sequential pumps are called to RUN once pump speed has reached 90% (adj) and retired once speed has reached 40% (adj)
 - ii. Pump ready signal shall be generated when the VFD HOR switch is in the REMOTE position and the drive transmits a "READY" signal and the local disconnect switch is closed.
 - iii. The pumping unit(s) that are not "ready" shall be considered "out-of-service". The control system will automatically control the next pumping unit as required by the operator setpoint(s) and the process. Operator involvement shall not be required.
 - iv. In the event of a VFD failure, the control system shall control the remaining drives.
 - v. Provide Auto Alternation of pumps based on runtimes. The control system shall have pump alternation programming to equalize run time for the three large pumps. The programming shall use a user configurable alternation matrix. Each pump shall be operator configurable into an "Out Of Service" condition. If a pump is "Out Of Service", the alternation matrix shall skip that pump and move to the next pump in the alternation matrix. This operator feature shall include provisions so that the alternation may be disabled by the operator.
 - vi. Provide 'Out-Of Service' selector switch for Reclaimed Storage Tank.
 - vii. Provide 'Out-Of Service' selector switch for all pumps and is inclusive of respective flow switch.

B. REMOTE - Manual:

The operator shall have the ability to start any reclaimed pumps from the MCP or SCADA system. The operator can start pump(s) manually through the MCP or main control room SCADA screen by placing the software switch to MANUAL and using additional software switches the operator shall have ability to manually start and stop and vary pump speed from SCADA.

5. Transfer

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Bumpless transfer of pump control between pump modes.
6. Interlocks
A. Not Applicable
7. Alarm
<ul style="list-style-type: none"> A. PIT-146 exceeds 5%(adjustable) Alarm to SCADA B. LIT-103 exceeds 5%(adjustable) Alarm to SCADA C. LS –113,123,133,143 - Alarm to SCADA in the event of a pump shutdown due to the failue of a check valve to open. Start timer (0-60secs adj.) on time out shutdown respective pump and start next pump in sequence. D. Alarm on LOW LEVEL of Recliamed Storage Tank. (X ft.) E. Shutdown of pumps related to Recliamed Storage Tank on LOW-LOW Level (X ft.) F. Alarm on HIGH LEVEL of Contactor Recliamed Storage Tank. (X ft.) G. Alarm and Shutdown of entire Reclaimed water system on HIGH LEVEL of storage tank. (X ft.)
8. Fault Mode
A. Not Applicable
9. Power Outage
A. Autorestart of recliamed pumps based on storage tank level condition on power return

C. Potable Water Pump Control:

1. Overview
This system consists of the three main pumps, one jockey pump, chemical feed system and storage tank. VFD driven potable high service pumps are controlled based on the discharge pressure, the number of pumps in operation and vfd speed will be adjusted to maintain a constant setpoint pressure (operator adjustable) in the discharge header.
2. Monitoring and Control
<ul style="list-style-type: none"> LIT – 203 Potable Sotrage Tank PSV – 201 Open/Close Status VFD – Pump #1-#4 Status and Speed Setpoints LS – 213,223,233,243 Flow Switch PIT – 246 Discharge Pressure
3. Local (Manual) Display/ Control
Control of pumps can be done by switching the H-O-A to HAND and manipulating the pump speed by the VFD keypad.

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4. Remote Control

A. REMOTE - AUTO:

The operator shall have the following setup in place on the OIT to allow remote-auto operation of the pumps:

- i. Set the desired pressure output to be maintained.
- ii. Set the maximum allowable discharge pressure (100 psi maximum).
- iii. Set the VFD in REMOTE control mode.
- iv. Set the HOA at the pump in AUTO.
- v. Set the minimum tank water level “all pumps off” setpoint.
- vi. Set the minimum and maximum speeds of the pumps (with different settings for jockey and large pumps).
- vii. Set the pump stage time delays.
- viii. Set the pump cycle on-off time delays.
- ix. Set the pressure alarm setpoints.
- x. The operator shall select pump ramp up and ramp down time intervals.
- xi. The operator is prompted to initiate automatic control.

After operator prompt to start, the control system shall confirm equipment status and shall prompt the operator if there are conditions that preclude automatic control. The control system shall provide error messages to alert the operator of any problem. If the control system determines acceptable operating parameters, the control system shall start the operator selected pumping unit(s) required to maintain setpoint based on the following control strategy modes:

1. Pump #1 - Jockey Pump Control Mode: The control system shall start the jockey pump and automatically adjust its speed to maintain the pressure setpoint, if the flow required to maintain discharge pressure is within the capacity of the jockey pump (625 gpm).
2. Pump # 2, #3 & #4 - Large Pumps Control Mode: If the flow required to bring pressure to the pressure setpoint is more than the flow that can be supplied with the jockey pump, the control system shall start one large pump (slowly ramping up pump speed) and shut down the jockey pump (ramped down) and automatically adjust speed of the large pump to attain the discharge pressure setpoint. If the flow required to attain the pressure setpoint is greater than the capacity of one large pump (1,250 gpm), the control system shall start a 2nd large pump and automatically adjust speed of the units in unison so that all pumps are operating at the same speed to provide the required flow to maintain pressure set point. If the flow required to maintain pressure set point is greater than the capacity of 2 pumps at 100% speed (2,500 gpm), the third large pump shall be energized and ramped and the system will automatically adjust speed of the units in unison so that all pumps are operating at the same speed to provide the required flow to maintain pressure set point.
3. Pump #1, #2, #3, & #4 – All Pumps Control Mode: If the flow required to maintain

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pressure set point is greater than the capacity of 3 pumps at 100% speed (3,750 gpm), the jockey pump shall be energized and ramped and the system will automatically adjust speed of the jockey pump with the large pumps concurrently operating at 100% speed to maintain pressure set point.

4. On increasing discharge pressure, the control system shall decrease pump speed and/or the number of units in operation to maintain the desired pressure set point. The pumps' speed will not be reduced below the operator selected preset minimum speeds. If the system demand decreases such that the jockey pump is operating at its minimum speed and pressure continues to rise above the pressure set point, the control system shall not further decrease jockey pump speed and the jockey pump will continue to operate at its minimum speed, with discharge pressure rising to the 6" pressure relief valve pressure setting. At this point part of the pumped flow from the jockey pump will be recycled back into the suction line from the tank. If pressure should continue to rise above the pressure relief valve setting due to valve failure, a closed valve, or other circumstance, an alarm will be triggered at the station high pressure alarm setpoint and the signal will be sent to the SCADA system. Pressure alarms shall have time delays to accommodate pressure spikes during pump start, check valve opening, and other interlocks.
5. Additional programming shall be provided as follows:
 - i. Provide selection of Lead/Lag 1/Lag 2/Standby. Sequential pumps are called to RUN once pump speed has reached 90% (adj) and retired once speed has reached 40% (adj)
 - ii. Pump ready signal shall be generated when the VFD HOR switch is in the REMOTE position and the drive transmits a "READY" signal and the local disconnect switch is closed.
 - iii. The pumping unit(s) that are not "ready" shall be considered "out-of-service". The control system will automatically control the next pumping unit as required by the operator setpoint(s) and the process. Operator involvement shall not be required.
 - iv. In the event of a VFD failure, the control system shall control the remaining drives.
 - v. Provide Auto Alternation of pumps based on runtimes. The control system shall have pump alternation programming to equalize run time for the three large pumps. The programming shall use a user configurable alternation matrix. Each pump shall be operator configurable into an "Out Of Service" condition. If a pump is "Out Of Service", the alternation matrix shall skip that pump and move to the next pump in the alternation matrix. This operator feature shall include provisions so that the alternation may be disabled by the operator.
 - vi. Provide 'Out-Of Service' selector switch for Reclaimed Storage Tank.
 - vii. Provide 'Out-Of Service' selector switch for all pumps and is inclusive of respective flow switch.

B. REMOTE - Manual:

The operator shall have the ability to start any potable water pumps from the MCP or SCADA system. The operator can start pump(s) manually through the MCP or main control room SCADA screen by placing the software switch to MANUAL and using additional software switches the operator shall have ability to manually start

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and stop and vary pump speed from SCADA.
5. Transfer
Bumpless transfer of pump control between pump modes.
6. Interlocks
B. Not Applicable
7. Alarm
<ul style="list-style-type: none"> A. PIT-246 exceeds 5%(adjustable) Alarm to SCADA B. LIT203 exceeds 5%(adjustable) Alarm to SCADA C. LS -213,223,233,243 - Alarm to SCADA in the event of a pump shutdown due to the failue of a check valve to open. Start timer (0-60secs adj.) on time out shutdown respective pump and start next pump in sequence. D. Alarm on LOW LEVEL of Recliamed Storage Tank. (X ft.) E. Shutdown of pumps related to Recliamed Storage Tank on LOW-LOW Level (X ft.) F. Alarm on HIGH LEVEL of Contactor Recliamed Storage Tank. (X ft.) G. Alarm and Shutdown of entire Potable water system on HIGH LEVEL of storage tank. (X ft.)
8. Fault Mode
B. Not Applicable
9. Power Outage
B. Autorestart of potable pumps based on storage tank level condition on power return

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C. Standby Generators

1. Overview

- A. The generator system is controlled and monitored by ~~a Parallel switchgear control panel (PSCP) located in the Control Room~~ the automatic transfew switch (ATS).
- B. The ~~PSCP-ATS~~ serves as the primary controller for automatic backup power sequencing ~~and load shedding~~.
- C. The ~~PSCP-ATS~~ is located in the ~~control-electrical~~ room and will communicate to the MCP.
- D. ~~The PSCP serves as the primary communications link between the generators and the rest of the facility. The panel utilizes Ethernet network communication protocols to interface with equipment around the facility. The PSCP utilizes the facilities Ethernet network to communicate with the SCADA system. For a detailed illustration of the various communications protocols and equipment connections, refer to the Network Architecture Diagram.~~

~~E.D.~~

2. Monitoring and Control

- ~~Start and Stop (READY)~~Loss of normal power-
- ~~Run~~Normal power available
- ~~Common warning alarm~~Standby power available
- ~~Common shutdown alarm~~Generator is remote
- ~~Low fuel oil sub base tank~~Diesel tank level
- Diesel tank low level
- Diesel tank leak detection
- Power monitoring via network connection as indicated on the P&ID
- Generator status monitoring via network connection as indicated on the P&ID

Additional Control Feature: The generator shall alarm if there are any alarms associated with standby fuel system.

3. Local (Manual) Display/ Control

- A. In Local mode the generator units ~~are is~~ manually started and stopped at the generator control panels.

4. Remote Control

- A. REMOTE - AUTO: ~~There are two modes for the auto control:~~
- ~~Automatic Backup Sequencing~~—Upon loss of normal utility power, ~~plus an adjustable time delay,~~ the ~~PSCPATS~~ automatically starts the generator ~~and sequences the opening and closing of breakers to shift the facility over from normal (utility) to backup generator power. Once the generator is up to speed and providing power at the appropriate voltage and frequency, the ATS will switch and power the facility with the generator. Upon return of utility power, and after an adjustable delay, the ATS will return to utility power. The generator will enter its cooldown cycle then will turn off.~~
- ~~1. Load Shedding~~—The PSCP provides automatic, flexible load shedding control of equipment around the facility. ~~PSCP RTU/PLC logic interlocks with both switchgear and process controls RTUs/PLCs over the SCADA network. An Electrical Load Shedding Setup screen, on the facility~~

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~~SCADA system, allows operators to assign load priority levels 0, 1 or 2 to equipment. Equipment assigned a load priority level 0, will not be permitted to run via the facilities SCADA system while the facility is running on backup generator power. Equipment with a load priority assignment of level 1 takes precedence over a level 2. Equipment that is assigned a load priority value of 1 or 2 will be permitted to run as long as the total load on the 480V system remains at or below 95% of the maximum available running kW, otherwise the lowest priority load will be shed.~~

B. REMOTE - Manual:

1. The operator shall have the ability to start the generator from the ~~PCP or~~ SCADA system. The operator can start the generator manually through the SCADA screen by placing the switch to MANUAL and using a software switch the operator shall have ability to manually start and stop from SCADA.

5. Transfer

- A. ~~See section 4. The generators shall be assigned a duty/standby status. If a generator is at fault or not available for operation, then the standby generator shall start automatically.~~

6. Interlocks

- A. An E-STOP is provided for an Emergency Stop of the generator and shall be located on the Generator. If the E-Stop is activated, an alarm shall sound and the generator shall shut down. The activation of E-Stop shall signal the SCADA through the PSCP and the generator shall be taken out of operation until the E-Stop is de-activated.

7. Alarm

- A. As shown on I&C contract drawings sheet no. I-103 and specification section 16230

~~Standby Generator Fail~~

8. Fault Mode

- A.

9. Power Outage

- A. Not Applicable

2

2.8 PROGRAMMABLE LOGIC CONTROLLER

- A. Subject to compliance with specified requirements, manufacturers offering products which shall be incorporated in Work include the following as noted on the drawings:

1. Programmable Logic Controller (PLC):

- a. Allen-Bradley Controllogix (No Substitutes).

2. PLCs shall have permanently installed system software for process input/output servicing, PLC intercommunications, LAN communication, diagnostics, and process control. The basic model for PLC operations shall be "ladder diagram."

3. Data elements shall be grouped according to type or function into registers or files. Provide a consistent addressing structure for PLC and external machines to reference data elements. The following basic data types shall be provided:

- a. Input.

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b. Output.

c. Bit.

d. Integer (16-bit).

e. Timer.

f. Counter.

g. Character (ASCII).

4. Process Control: Program elements shall be provided to execute the following kinds of actions:

a. Basic Relay Logic.

b. Timers: On-delay, Off-delay, Retentive.

c. Counters: Count-up, Count-down.

d. Arithmetic: Add, Subtract, Multiply, Divide, Square Root.

e. Logic: Negate, And, Or, Exclusive Or.

f. Conditionals.

g. Data transition.

h. One-shot.

i. Stepper Switches (sequencers).

j. Branching Instructions.

k. Subroutines.

l. File Instructions.

m. Analog PID Control:

Addendum No. 2

[1\) ISA Algorithm.](#)

[2\) Independent Gain Algorithm.](#)

[3\) Ratio Control.](#)

2.89 SOURCE QUALITY CONTROL

A. General:

1. Factory Test:

- a. Representatives of OWNER and/or ENGINEER will have the option to witness factory test at testing facility during operational test of equipment, either for individual units or as an integrated system. Give minimum of 30 days notice to ENGINEER prior to the proposed testing date so that arrangements for test witnessing can be made. Presence of OWNER and ENGINEER during testing does not relieve CONTRACTOR from complying with the Contract Documents and shall not imply acceptance of equipment. When factory tests have been successfully completed, a submit factory test report to ENGINEER.
3. Factory test results will be acceptable when all components within tested control panel or system being tested successfully operate and meet its intended function, and are so certified by the testing entity.
4. Do not ship the equipment until obtaining ENGINEER's acceptance of factory test results.

B. Factory Inspection:

1. Inspect each panel, console, device, and cabinet before testing and before shipping. Inspection shall include, but not be limited to the following:
 - a. Verify all "Approved as Noted" comments on Shop Drawings were implemented.
 - b. Verify presence of and accuracy of nameplates and tags.
 - c. Verify that wire sizes and color-coding comply with the Contract Documents.
 - d. Verify presence of terminal blocks, terminal block numbers, and required quantity of spares.
 - e. Verify annunciator window engravings and quantity of spare windows comply with the Contract Documents.
 - f. Verify proper wiring practices and grounding.
 - g. Verify enclosure flatness, finish, and color.
 - h. Verify anchoring of wire bundles between subpanels and front panel-mounted devices.
 - i. Verify presence of applicable items specified in this Section.

- j. Check and verify software licenses for latest release and license types.
- C. Panel Operational Testing:
- 1. Test all input/output components to verify that internal panel wiring is properly terminated at correct locations. Verify initial ranges and settings.
 - 2. Test all system hardware and software to verify proper operation as stand-alone units. Test shall include, but not be limited to, the following:
 - a. Power distribution and breaker ratings to match approved Shop Drawings.
 - b. Power fail/restart tests.
 - c. Diagnostics checks.
 - d. Demonstrate that all specified equipment functional capabilities are working properly.
 - e. Check and verify process displays are in accordance with approved Shop Drawings.
 - 3. Test components and devices requiring data transmission to verify that communication between such components is working properly. Verify communication by using the same media required for the completed system at the Site as indicated in the Contract Documents.
 - 4. Perform integrated system test with all system equipment and simulated inputs/outputs connected to verify that equipment is performing properly as an integrated system.
 - 5. Simulation devices shall be of suitable quality to not mask control panel defects.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Environmental Requirements:
 - 1. Do not install instruments in areas where construction may cause instrument to be damaged, without providing adequate protection for said instrument.
- B. Installation of Instrumentation:
 - 1. Secure field-mounted instruments to stands or brackets in accordance with manufacturer's recommendations, approved or accepted (as applicable) submittals, and the Contract Documents.
 - 2. Locate sensors where shown on the Drawings. Confirm exact locations in the field with ENGINEER.

3. Install all devices so that devices are readily accessible for service and do not cause potential hazards.
- C. Services and Operator Instructions:
1. Provide repairs or replacement of defective materials, equipment or workmanship, including with respect to equipment, the services of factory-trained servicemen.
 2. In addition to the calibration required for check-out, provide two additional calibrations on all instruments. The first re-calibration shall be approximately six months after acceptance of the system, and the second shall be approximately eleven months after acceptance. As part of each calibration, provide two copies of the calibration sheets, a detailed list of deficiencies (should any be found), and a statement that the entire system is in proper operation and condition (except for the deficiencies noted) and shall be turned over to the OWNER.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections: Field-verify calibration and performance of each instrument prior to start-up of the associated equipment, and document on a separate sheet for each.
1. For each calibration certification sheet, include the following information:
 - a. Project name.
 - b. Tag number and description.
 - c. Manufacturer.
 - d. Model and serial number.
 - e. Date, time and person who performed calibration.
 - f. Calibration data to include.
 - 1) Input, output, and error at 0, 25, 75, and 100 percent of span for analog instruments.
 - 2) Switch setting, contact action and deadband, if applicable, for discrete elements.
 - g. Space for comments.
 - h. Signature and date.
 2. System Check-Out and Start-Up Responsibilities:
 - a. CONTRACTOR shall retain the services of the System Supplier to supervise and/or perform check-out and start-up of all system components. As part of these services, the System Supplier shall include for those equipment items not manufactured by him the services of an authorized manufacturer's representative to check the equipment installation and place the equipment in operation. The manufacturer's representative shall be thoroughly knowledgeable about the installation, operation and maintenance of the equipment.
 - b. Check and approve the installation of all instrumentation and control system components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.

- c. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in the Work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.
- d. CONTRACTOR shall provide all test equipment necessary to perform the testing during system checkout and start-up.
- e. CONTRACTOR and System Supplier shall be responsible for initial operation of monitoring and control system and shall make any required changes, adjustments or replacements for operation, monitoring and control of the various processes and equipment necessary to perform the functions intended at no additional cost to the OWNER. These changes or adjustments shall be documented by the CONTRACTOR and submitted to the ENGINEER as part of the Installation Inspection Report described in Paragraph g. below.
- f. CONTRACTOR shall furnish to the ENGINEER certified calibration reports for field instruments and panel mounted devices specified in this Section as soon as calibration is completed.
- g. CONTRACTOR shall furnish ENGINEER an Installation Inspection Report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both CONTRACTOR and the System Supplier.
- h. Instrumentation and Control System Field Test:
 - 1) Following the instrumentation and control system checkout and initial operation, CONTRACTOR, under the supervision of the System Supplier, shall perform a complete system test to verify that all equipment and programmed software is operating properly as a fully integrated system, and that the intended instrumentation and control functions are fully implemented and operational. Any defects or problems found during the test shall be corrected by CONTRACTOR and then retested to demonstrate proper operation.
 - 2) Following demonstration of all system functions, the instrumentation and control system, including field sensors/transducers and instruments, and telemetry system shall be running and fully operational for a continuous 48 hour period.

3.4 MANUFACTURER'S SERVICES

A. General:

- 1. CONTRACTOR shall retain the services of the System Supplier to provide operation and maintenance training for all instrumentation and control system equipment as specified herein.
- 2. For equipment items not manufactured by the System Supplier, he shall provide for on-Site training by an authorized representative of the equipment manufacturer as part of his services. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of the equipment.

3. CONTRACTOR shall be responsible for all costs associated with training and shall provide all required materials, texts and required supplies.
- B. On-Site Training:
1. General:
 - a. Provide on-Site operation and maintenance training by System Supplier and the equipment manufacturer representatives prior to placing the equipment in continuous operation.
 - b. Training courses shall include time for students to develop and demonstrate understanding of training concepts. Testing shall include hands on training with equipment.
 - c. At the conclusion of each course students shall be tested on course material. Testing shall include exercises where students must demonstrate proper response to normal operational needs, emergencies and maintenance tasks. Every student shall be tested individually.
 - d. Training shall accomplish the following:
 - 1) Provide instruction covering use and operation of the equipment to perform the intended functions.
 - 2) Provide instruction covering procedures for routine, preventive and troubleshooting maintenance, including equipment calibration.
 - 3) Explain procedures for placing the equipment in and out of operation and explain necessary actions and precautions to be taken regarding the overall facility monitoring and control system.
 - 4) Provide classes and field training as to how to change process control and alarm set points in all microprocessor based controllers and transmitters. Maintenance personnel shall be trained to enter passwords, programming or configuration data, etc.
 2. Primary Sensors/Transducers and Field Instruments:
 - a. The services of equipment manufacturer's representatives shall be provided for a minimum of 2 hours for each type of instrument.
 - b. Training shall include:
 - 1) Basic repair and maintenance capabilities of installed equipment.
 - 2) Procedures for placing the equipment in and out of operation.
 - 3) Use of any special repair equipment or software packages that are used for repair or maintenance.
 - 4) Procedures for testing any repair before placing equipment back in service.
 3. PLC and OIT Training
 - a. Training shall include
 - 1) Hardware and software configuration of PLC and OIT programs.
 - 2) Perform a walk through with students identifying system components. Instructor shall test each student's knowledge of system components during walk through.
 - 3) Identify key operating and alarm features of the project specific PLC and HMI programs.
 - 4) Test students knowledge of proper response to alarms, capabilities to replace hardware components, switch hardware and software

between online and offline, add new components, know when to call for assistance, demonstrate understanding of hardware and safety requirements, understand impact of changes made to rest of the control system.

- 5) Provide instruction covering basic editing of PLC programs and OIT screens. Instruction shall include testing students programming capabilities by having students make minor changes to programs and test changes online.
4. Telemetry Equipment:
- a. The supplier shall allow two full working days for training.
 - b. The supplier shall provide training that covers telemetry system as follows:
 - 1) Provide an overview of hardware and software.
 - 2) It shall train people in configuration and operation of the system.
 - 3) The emphasis shall be placed on how to perform minor configuration changes, range changes, diagnostics and upkeep of documentation.
 - 4) Instruction for hardware and software maintenance, troubleshooting and maintenance planning.

3.5 SUPPLEMENTS

A. The supplements listed below, following the “End of Section” designation, are part of this Specification section.

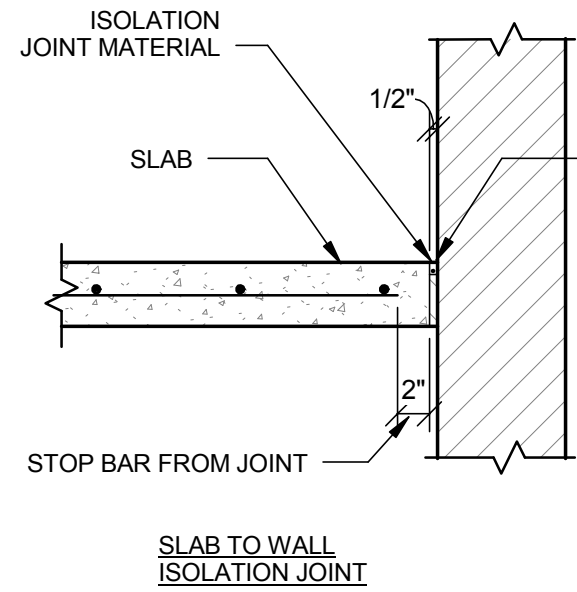
B. Data Sheets – Panel Instruments and Devices

<u>Parag.</u>	<u>Description</u>	<u>Page</u>
3.5.B.1	Annunciator System	47
3.5.B.6	Current Isolater	48
3.5.B.11	Horn - Electronic Type	49
3.5.B.17	Power Supply - Single Unit	50
3.5.B.21	Relay - Control	51
3.5.B.22	Relay - Current Alarm	52
3.5.B.23	Relay - Time Delay	53
3.5.B.24	Selector Switches, Pushbuttons and Indicating Lights	54
3.5.B.25	Timer - Cycle Type	55
3.5.B.26	Timer - Elapsed Time Meter (Hour Meter)	56
3.5.B.29	Uninterruptible Power System	57

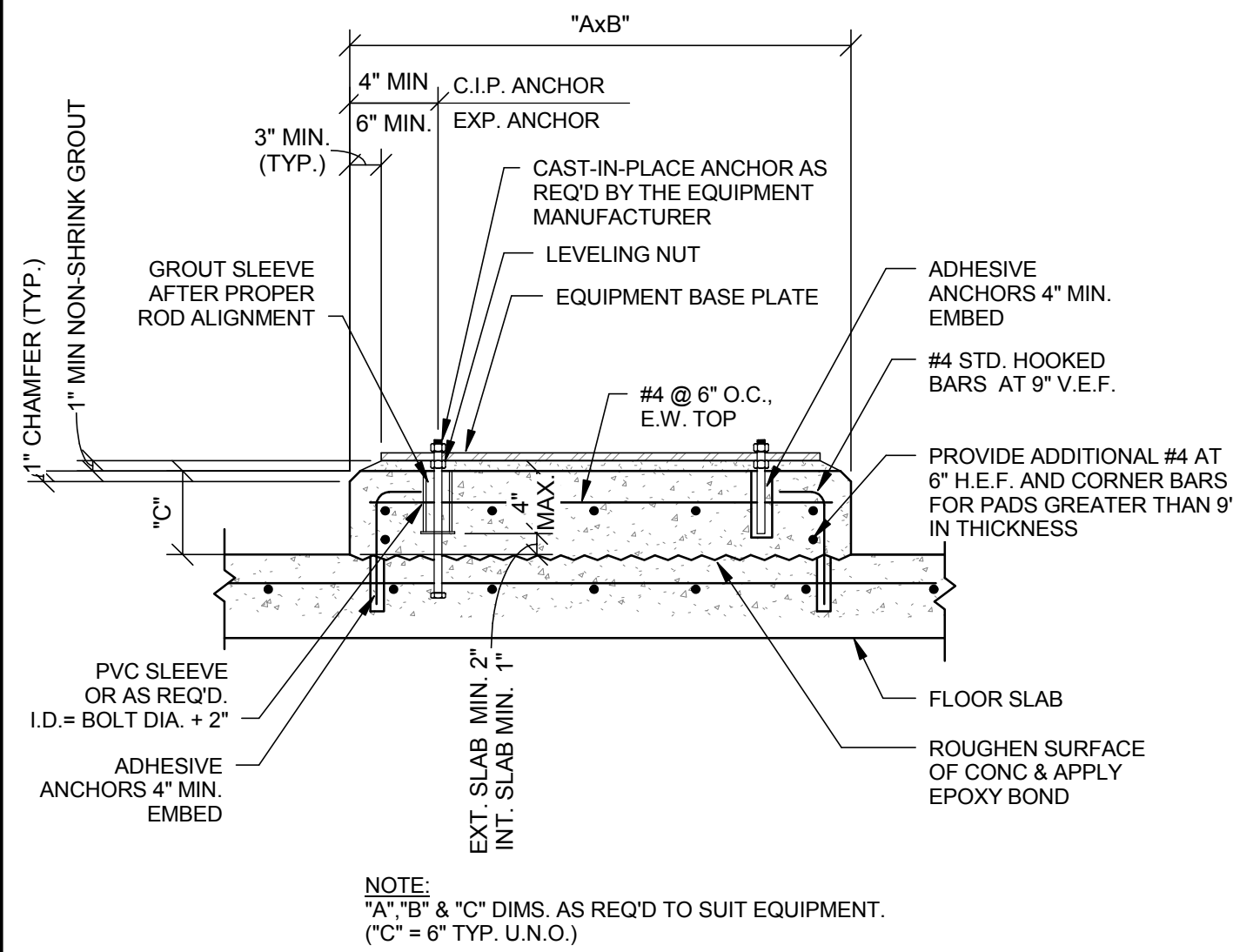
C. Data Sheets – Primary Sensors and Field Instruments

<u>Parag.</u>	<u>Description</u>	<u>Page</u>
3.5.C.4	Analyzer - Chlorine	58
3.5.C.29	Flow Meter - Magnetic Flow Tube	59
3.5.C.54	Level Transmitter - Ultrasonic Type	60
3.5.C.59	Level Switch - Float Type (Single Point)	62
3.5.C.76	Pressure Transmitter	64
-	References	65
E.	Input/Output List	66

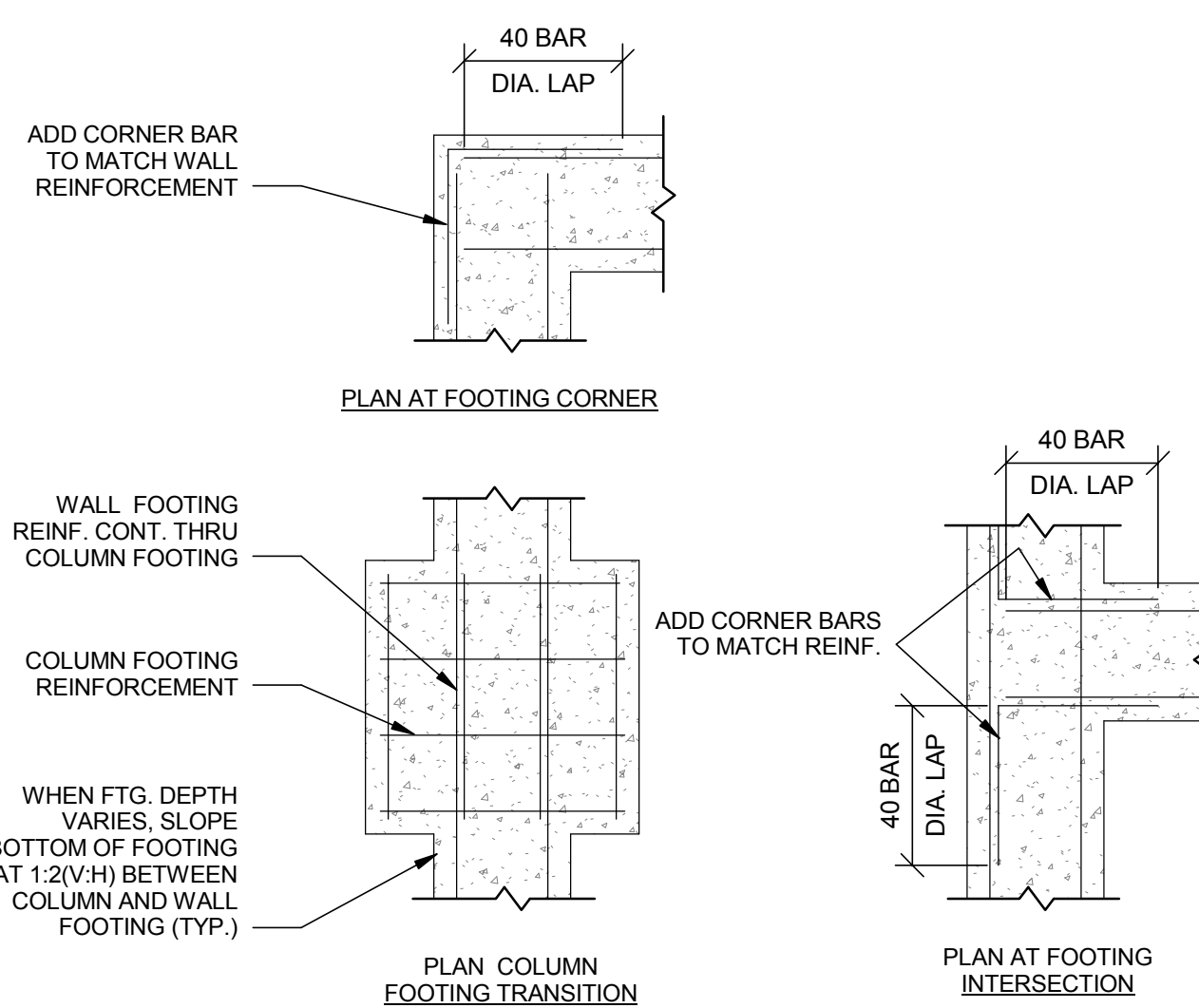
END OF SECTION



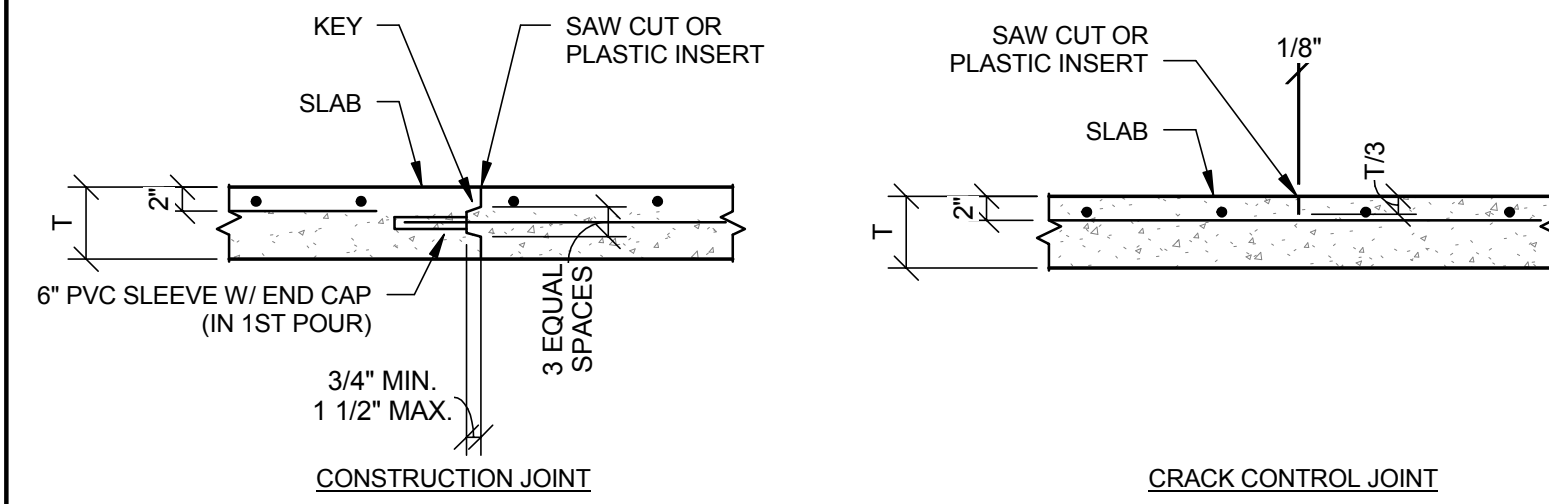
1 SLAB TO WALL ISOLATION JOINT
SCALE: 1" = 1'-0"



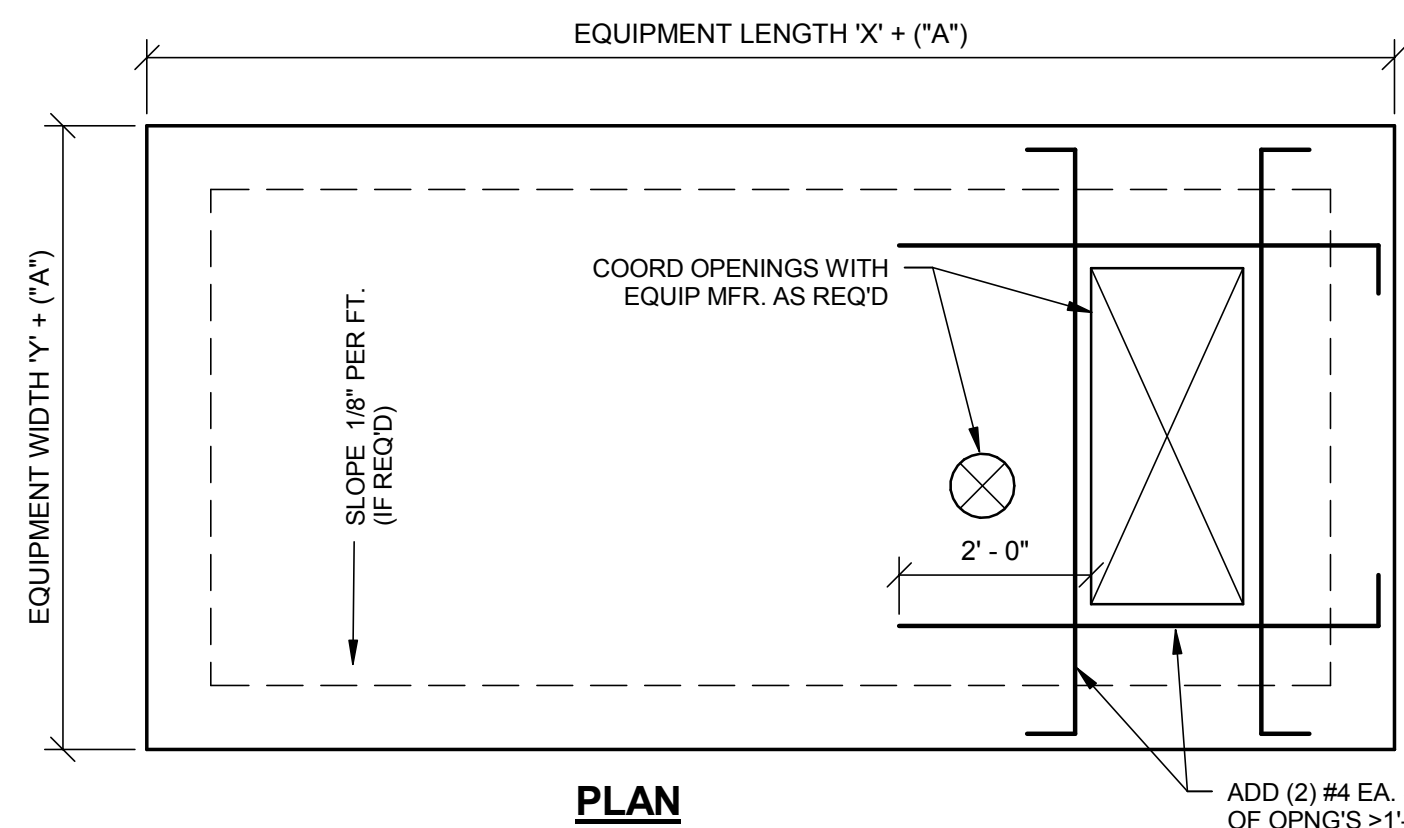
2 TYP. EQUIPMENT PAD
SCALE: 3/4" = 1'-0"



3 TYP. FOOTING INTERSECTIONS
SCALE: 3/4" = 1'-0"

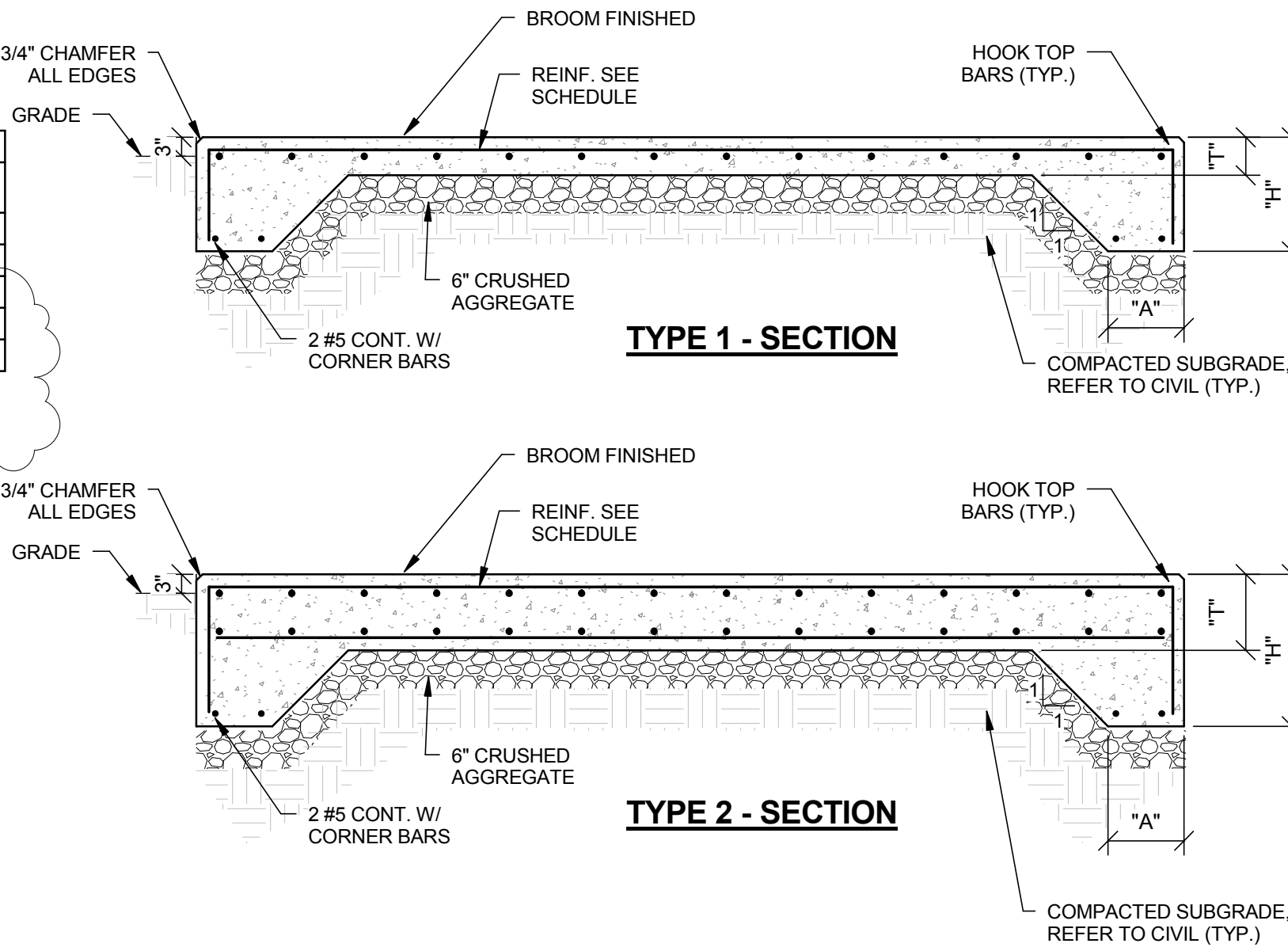


4 TYP. REINF SLAB DETAILS
SCALE: 3/4" = 1'-0"

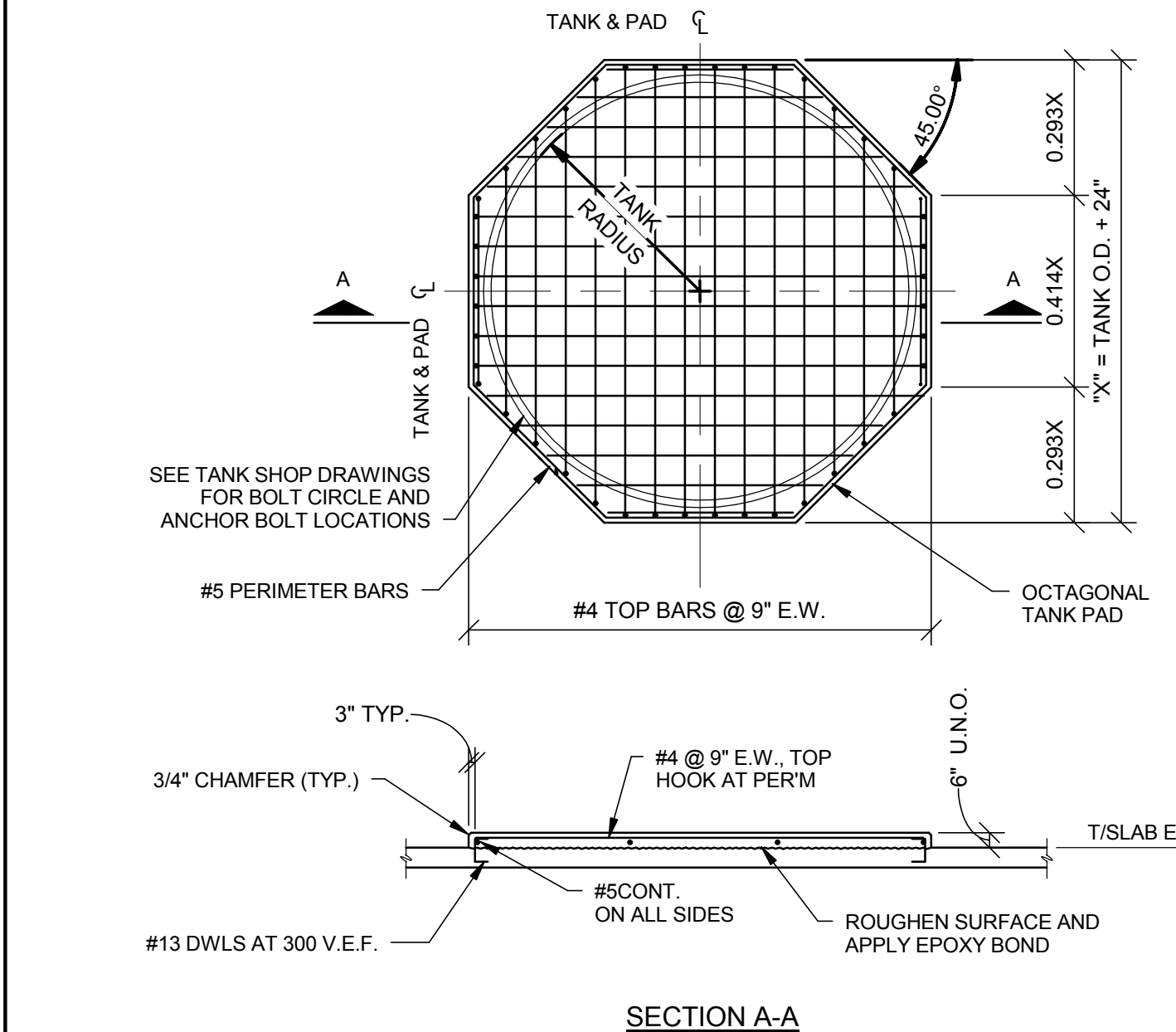


EQUIPMENT PAD SCHEDULE					
NAME	"A"	"T"	"H"	REINF.	EQUIP. PAD TYPE
FUEL PAD	1'-0"	0'-8"	1'-4"	#5 @ 12" E.W. O.C.	TYPE 1
GENERATOR PAD	1'-0"	1'-6"	2'-0"	#5 @ 12" E.W. O.C.	TYPE 2
TRANSFORMER PAD	1'-0"	0'-8"	1'-4"	#5 @ 12" E.W. O.C.	TYPE 1
VALVE ASSEMBLY PAD	1'-0"	0'-8"	1'-4"	#5 @ 12" E.W. O.C.	TYPE 1
BACKFLOW PREV. PAD	1'-0"	0'-6"	1'-4"	#5 @ 12" E.W. O.C.	TYPE 1

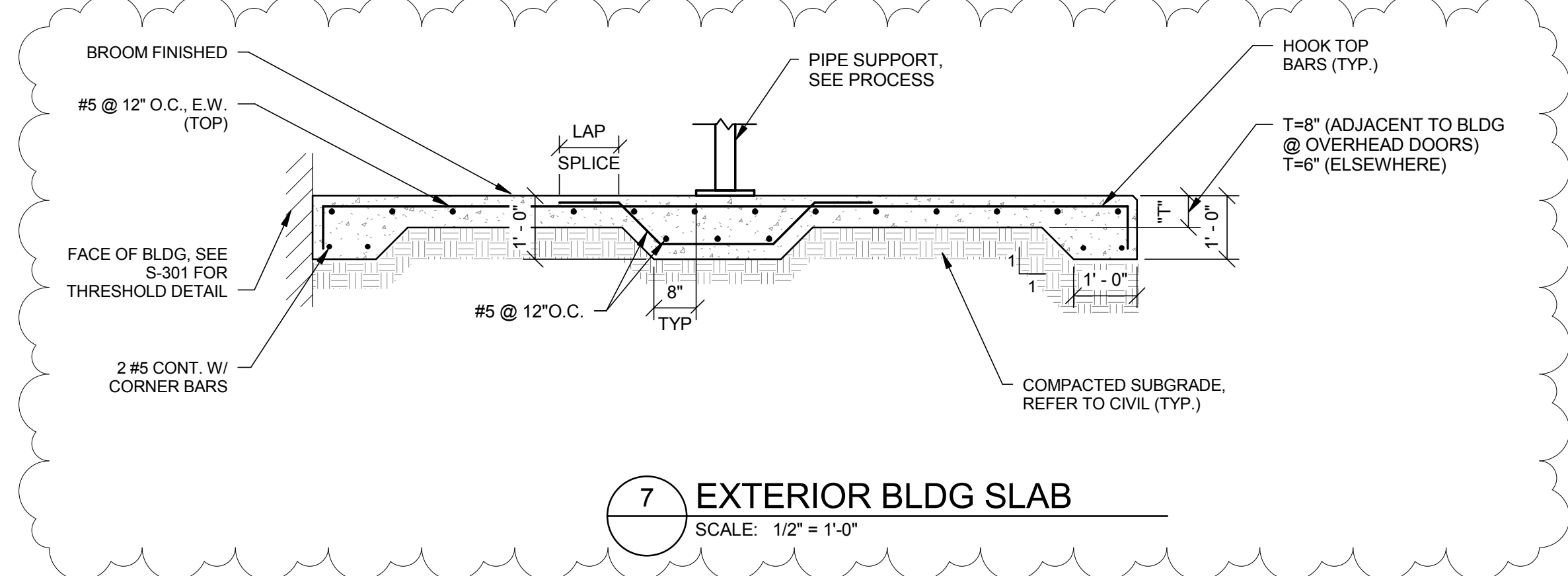
NOTE: SEE 7/S-501 FOR THICKENED SLAB AT PIPE SUPPORTS



5 EQUIPMENT PAD
SCALE: 1/2" = 1'-0"



6 TYP. OCTAGONAL TANK PAD
SCALE: 3/4" = 1'-0"



7 EXTERIOR BLDG SLAB
SCALE: 1/2" = 1'-0"

MARK	DATE	DESCRIPTION
2	5/1/18	Addendum No. 2