CONTRACT DOCUMENTS & CONSTRUCTION SPECIFICATIONS

WASTEWATER RECLAMATION FACILITY HEADWORKS IMPROVEMENT

FOR

THE UTILITIES BOARD OF THE CITY OF GULF SHORES

PREPARED BY

Dewberry

PROJECT NUMBER 50132048
February 2022

Set No. _____

C O N T E N T S

DIVISION 1 – CONTRACT DOCUMENTS

Invitation for Bids

Proposal

Contract

Contract Bond

Labor and Materials Bond

Contractor's Acknowledgement of Change Orders

Notice of Award

Notice to Proceed

DIVISION II – SPECIFICATIONS & SPECIAL PROVISIONS

Technical Specifications
- GSU Standard Specifications
- Section 1401 Statement of Structural Test and Special Inspections
- Section 3300 Cast in Place Concrete
- Section 5510 Aluminum Grating Platforms and Stairs
- Section 5520 Pipe and Tube Railings
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DIVISION III – GENERAL CONDITIONS

General Conditions

ADDENDUM A

E-Verify Documentation

DIVISION I

CONTRACT DOCUMENTS

Utilities Board of the City of Gulf Shores

BID ADVERTISEMENT **September 30,2022**

Sealed proposals will be received by the Gulf Shores Utilities Board in Baldwin County, Alabama, in the Gulf Shores Utilities Board Conference Room, 1629 East 1st Street, Gulf Shores, Alabama 36542 until 10:00 AM October 25, 2022 and then publicly opened thereafter, for furnishing all labor and materials, and performing all work required by Gulf Shores Utilities Board and described as follows:

WASTEWATER RECLAMATION FACILITY HEADWORKS IMPROVEMENT

This work will involve adding new concrete structures, installing piping, lift stations, and installing equipment necessary to upgrade the existing headworks. Equipment and materials, except for concrete and earth work, will be purchased by the Utility Company. The contractor will be responsible for all labor, concrete, and earthwork to install all new equipment, and piping. Utility Company will be responsible for all electrical and startup of the equipment installed. Contractor will warranty all structural improvements and workmanship of the physical installation.

Plans and Specifications may be examined at Gulf Shores Utilities, **1629 East 1st Street, Gulf Shores, Alabama 36542**. Copies of the plans and specifications will be available for purchase at Dewberry, 25353 Friendship Road, Daphne, AL 36526, at a nonrefundable charge of $25 per set. Please make checks payable to Dewberry Engineers Inc., No plans and specifications will be issued to contractors later than one (1) week prior to the time indicated above for receiving bids.

Questions or comments pertaining to this bid must be presented in writing, as an e-mail to Andy Bobe, Project Engineer, (abobe@dewberry.com) forty eight (48) hours prior to the bid opening or will be forever waived.

All bids must be on the bid forms provided in the Bid Documents. Bids shall be accompanied by a Bid Security equal to 5% (percent) of the bid price, but in no event more than $10,000.00. Bid Security shall be in the form of a Bid Bond or a cashier's check payable to The Gulf Shores Utilities. No Bid Security is required on bids less than $10,000.00.

THERE WILL BE A MANDATORY PRE-BID MEETING AT 10:00 AM, October 18, 2022th. On-Site at 2500 East 10th Street, Gulf Shores, AL 36542. We will go over the details of the work to be bid.

The Gulf Shores Utilities Board is an Equal Opportunity Employer and requires that all contractors comply with the Equal Employment Opportunity laws and the provisions of the Contract Documents in this regard. The Utility also encourages and supports the utilization of Minority Business Enterprises on this and all public bids.

All bids, with their guarantee (when required), must be enclosed in a sealed, opaque envelope, clearly identified on the outside as a "**Sealed Bid" with Project Name, Utilities Board of the City of Gulf Shores Name and Address, Bidder's Name and Address, and Bidder's State of Alabama Contractor's License Number**. Each bid must be in a separate envelope. Bids made out in pencil will not be accepted.

Failure to observe the instructions contained herein will constitute grounds for rejection of your bid. Gulf Shores Utilities Board reserves the right to accept or reject all bids or any portion thereof whichever is in the best interest of the Gulf Shores Utilities.

The company that is awarded the bid must have Workman's Compensation Insurance on all of its employees. General Liability Insurance must be maintained to hold the Gulf Shores Utilities Board harmless in the event of an accident. Gulf Shores Utilities Board will require proof of Workman's Compensation Insurance and General Liability Insurance specifying coverage and listing The Utilities Board of the City of Gulf Shores as additional insured must accompany this bid packet. See contract documents for details.

No bids will be considered unless the CONTRACTOR, whether resident or non-resident of Alabama, is properly qualified to submit a proposal for this type of work in accordance with all applicable laws of the State of Alabama. Where applicable, this shall include evidence of holding a current license from the State Licensing board for General Contractors, Montgomery, Alabama, as required by Chapter 8 of Title 34, of the Code of Alabama, 1975. In addition, the awarded vendor, if non-resident of the State, and if a corporation, shall show evidence of having qualified with the Secretary of State to do business in the State of Alabama, www.sos.state.al.gov/BusinessServices/ForeignCorps.aspx. CONTRACTOR must have a current business license or purchase a business license with the City of Gulf Shores prior to work performed. No bids shall be withdrawn for the period of thirty (30) days subsequent to the opening of proposals without the consent of the Gulf Shores Utilities, Baldwin County, Alabama.

PROPOSAL

The Undersigned, (Bidder), hereby certifies that he has visited the site and is knowledgeable of all conditions relating to the property where the work is to be performed; and, that all plans, specifications, and contractual documents have been reviewed. The undersigned bidder also states that he has read and reviewed all Special Provisions furnished and that he is well informed regarding the work to be performed.

The Bidder, upon acceptance of the proposal, agrees to contract with **THE UTILITIES BOARD OF THE CITY OF GULF SHORES, ALABAMA** to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the work.

To fully comply with the requirements of the plans, specifications, and contract documents to the satisfaction of **THE UTILITIES BOARD OF THE CITY OF GULF SHORES, ALABAMA**, with a definite understanding that no additional monies will be allowed for extra work, except as set forth in the attached General Conditions and Contract Documents, for the unit prices listed for appropriate item.

It is further agreed, that the description listed under each, implies but does not detail all incidentals and that the prices stated are intended to cover all such work, materials, and incidentals that constitute the Bidder's obligations described in the specifications and any details not specifically mentioned.

The quantities for bid items listed on the proposal sheets are estimated quantities only for the purpose of bid comparison. Any difference between the actual quantities and estimated quantities required for construction shall not be construed as a basis for additional compensation by the Contractor. Compensation will be based on the unit price and actual construction quantities as set forth in the Unit Price Bid Schedule.

BID AMOUNT

BASE BID _____

ADDITIVE ALTERNATE #1 _____

ADDITIVE ALTERNATE #2 _____

ADDITIVE ALTERNATE #3 _____

ADDITIVE ALTERNATE #4 _____

ADDITIVE ALTERNATE #5 _____

ADDITIVE ALTERNATE #6 _____

ADDITIVE ALTERNATE #7 _____

ADDITIVE ALTERNATE #8 _____

ADDITIVE ALTERNATE #9 _____

ADDITIVE ALTERNATE #10 _____

ADDITIVE ALTERNATE #11 _____

I, the undersigned bidder, hereby acknowledge receipt of the following addenda:

ADDENDUM NO. _____
(INITIAL)

ADDENDUM NO. _____
(INITIAL)

The Bidder will begin work with an adequate force, plant and equipment at the time specified in the Notice to the Contractor from the Engineer to Proceed, and fully complete performance within **180 consecutive calendar days** from and after the date stated in said notice.

CONTRACTORS NAME:

_____

BY: _____

TITLE: _____

ADDRESS: _____

GSU WRF UNIT PRICE BID SCHEDULE

Item No.	Description	Unit	Quantity	Unit Price	Total
EARTHWORK FOR MAIN HEADWORKS CONCRETE STRUCTURE (BASE BID LABOR & MATERIALS)					
1	TOP SOIL STRIPPING FOR REUSE MAIN STRUCTURE APPROX, (8" DEEP) STOCK PILED FOR RE-USE	CY	170		
2	UNCLASSIFIED EXCAVATION DOWN TO ELEV. 17.5 (STOCK PILED ON SITE)	CY	600		
3	PAD FOR STRUCTURE (SELECT SAND FILL) 18" THICK COMPACTED TO 95% ASTM-D698 TO ELEVATION 19.0	CY	250		
4	GENERAL FILL TO FINISHED GRADE FROM STOCK PILE	CY	75		
5	SILT FENCE (As Directed by engineer)	LF	400		
6	ADDITIONAL UNDER CUT BELOW ELEV. 17.5	CY	65		
7	MOBILIZATION	LS	1		
SUB-TOTAL EARTHWORK FOR MAIN HEADWORKS CONCRETE STRUCTURE (BASE BID)					

Item No.	Description	Unit	Quantity	Unit Price	Total
MAIN HEADWORKS CONCRETE STRUCTURE (BASE BID LABOR AND MATERIALS) (BASE BID)					
8	Grit Chamber Drain 6" DI Bell End (Glass Lined) (2-6" Retainer Glands per) (Top @ 20.30) Length Approximately 18" (With temporary plug) (Cut end coated with duraplate 5900)	EA	4		
9	6" MJ DI 90 Degree Bend (Glass Lined) Connected to Bell end Drain (w/2 Retainer Glands Bolt and Gasket Packs	EA	4		
10	6" DI CL-52 Glass Lined Bell and Spigot Pipe (Concrete encased from drain to outter edge of slab)	LF	80		
11	REINFORCEMENT FOR 6" GRIT DRAIN (ENCASEMENT TRENCH)	LBS	870		
12	CONCRETE FOUNDATION MAIN STRUCTURE FROM (OVERFLOW TO END OF GRIT CHAMBER) (1'-4" Thick)	CY	105		
13	#6 BARS MAIN STRUCTURE FOUNDATION (OVERFLOW TO END OF GRIT CHAMBER) (1'-4" Thick)	LBS	25035		
14	CONCRETE EXTERIOR WALL OF ENTRANCE CHANNELS (OVERFLOW TO END OF PARSHALL FLUME TOP ELEV. 32.5)	CY	67		
15	#5 BARS IN EXTERIOR WALLS OF ENTRANCE CHANNELS (OVERFLOW TO END OF PARSHALL FLUME TOP ELEV. 32.5)	LBS	10885		
16	#5 HOOKS BETWEEN WALLS AND LOWER SLAB SLAB (OVERFLOW TO END OF PARSHALL FLUME TOP ELEV. 32.5)	LBS	1070		
17	UPPER SLAB AT SCREENS (TOP OF SLAB ELEV. 26.50) w/ WATERSTOP	CY	11		
18	#5 BARS IN UPPER SLAB AT SCREEN (TOP OF SLAB ELEV. 26.50)	LBS	2355		
19	OVERFLOW WALL (TOP ELEV@ 30.75)	CY	2.5		
20	#5 OVERFLOW WALL (TOP ELEV@ 30.75)	LBS	553		
21	SLAB AT OVERFLOW WALL (3'-4" X 6'-0" X 1) (TOP ELEV. @ 23.50 w/ WATERSTOP	CY	0.76		
22	# 5 BARS IN SLAB AT OVERFLOW. (3'-4" X 6'-0" X 1) (INCLUDING #4 BARS)	LBS	130		
23	SHAPING GROUT (3'-4" X 6'-0" X VARIES))	CY	0.85		
24	#4 BARS IN SHAPING GROUT	LBS	55		
25	WALKING DECK (ELEV. @ 32.50) w/ WATERSTOP AND GRATE SEATS FOR FRP PANELS	CY	19		
26	CHANNEL STOP GATE STOP GATE 1/2" SS PLATE (42" X 96")	EA	4		
27	1" SS CHANNEL 96 X 42 X 96 (FOR STOP GATES)	EA	4		
28	#5 BARS IN UPPER WALKING DECK (ELEV. @ 32.50)	LBS	5600		
29	CENTER WALL @ SCREEN CHANNELS (w/ WATERSTOP)	CY	6.85		
30	#5 BARS IN CENTER WALL @ SCREEN CHANNELS	LBS	2180		
31	PVC WATER STOP 6" WIDE	LF	600		
32	SELF EXPANDING WATER STOP	LF	500		
33	DOWELS IN SLABS	LBS	1100		
34	PARSHALL FLUME SLAB (TOP ELEV. @ 24.50)	CY	2.6		
35	#5 BARS IN PARSHALL FLUME SLAB	LBS	615		
36	GROUT @ PARCHALL FLUME (INCLUDING INSTALL OF PARSHALL FLUME)	CY	3.8		
37	#4 BARS IN GROUT AT PARSHALL FLUME	LBS	185		
38	WALL AT NORTH END OF PARSHALL FLUME	CY	0.5		
39	#5 BARS IN WALL AT NORTH END OF PARSHALL FLUME	LBS	210		
40	WALKING SLAB AT EAST END OF GRIT CHAMBERS	CY	4		
41	#5 BARS IN WALKING SLAB AT EAST END OF GRIT CHAMBER	LBS	860		
42	#5 DOWELS 90 DEGREE BEND	LBS	465		
43	LOWER SLAB AT EAST END OF GRIT CHAMBER	CY	4.85		
44	#5 BARS IN LOWER SLAB AT EAST END OF GRIT CHAMBER	LBS	890		
45	#5 DOWELS IN LOWER SLAB AT EAST END OF GRIT CHAMBER	LBS	95		
46	WALL BELOW LOWER SLAB AT EAST END OF GRIT CHAMBER	CY	1.15		

47	#5 BARS AND DOWELS AT WALL BELOW SLAB EAST END OF GRIT CHAMBER.	LBS	475		
48	PERIMETER WALL OF GRIT CHAMBER, WIER AND EFFLUENT CHANNEL	CY	45		
49	#5 BARS IN PERMETER WALL	LBS	14620		
50	GROUT @ EAST END OF GRIT CHAMBER	CY	1.7		
51	#4 IN GROUT @ EAST END OF GRIT CHAMBER INCLUDING DOWELS	LBS	160		
52	CENTER WALL IN GRIT CHAMBER 8' TALL	CY	9.65		
53	#5 BARS IN CENTER WALL IN GRIT CHAMBER 8' TALL	LBS	2655		
54	CONCRETE (NORTH/SOUTH PARTITION WALL 3.25' TALL IN GRIT CHAMBER)	CY	1.7		
55	#5 BARS IN NORTH/SOUTH PARTITION WALL (3.25' TALL IN GRIT CHAMBER)	LBS	355		
56	GROUT FOR GRIT CHAMBERS	CY	40		
57	#4 REBAR FOR GROUT IN GRIT CHAMBERS	LBS	860		
58	CONCRETE WALL SUPPORTING OVERFLOW WIER	CY	4.75		
59	#5 BARS IN WALLS SUPPORTING (OVERFLOW WIER)	LBS	1710		
60	CONCRETE (WALLS AT FOG BELT)	CY	3.2		
61	#5 REBAR IN WALLS AT FOG BELT	LBS	280		
62	#3 STIRUPS ALL WALLS	LBS	380		
63	4" DI SPOOL FLG X PLAIN END (5'-4 1/2") (BLOWER PIPING)	LS	1		
63	3/8" X 5" WIDE STEEL PLATE WITH 50 1/8" DIA HOLES SPACED AT 3.5" (BUBBLER PLATE)	LS	1		
64	1/8" MIN. THICK NEOPRENE TO FLUSH MOUNT AND SEAL THE PLATE	LF	35		
62	FOG BEACH STRUCTURE	CY	9.75		
63	#5 BARS IN FOG STRUCTURE	LBS	1215		
64	GROUT FOR FOG BEACH	CY	4.25		
SUB-TOTAL MAIN HEADWORKS CONCRETE STRUCTURE (BASE BID)					

Item No.	Description	Unit	Quantity	Unit Price	Total
GRIT DECANT STATION STRUCTURE AND EXCAVATIONS (BASE BID)					
65	Lift Station Wet Well 12.6' deep x 10.5' dia (with Wall and Top, pipe Penetrations)	LS	1		
66	UNCLASSIFIED EXCAVATION (HAUL OFF) (GRIT DECANT STATION	CY	66		
67	UNCLASSIFIED EXCAVATION (TO BE REPLACED)	CY	70		
68	Concrete Pad At Station 15 x 16.5 feet (Less Wet well Encroachment) 8" Thick (Concrete included in price)	LS	1		
69	DEWATERING FOR WET WELL INSTALL GRIT DECANT STATION	LS	1		
70	CONCRETE BASE FOR ELECTRIAL PANEL STAND (GRIT DECAN AND CLASSIFER PANEL)	LS	1		
SUB-TOTAL GRIT DECANT STATION STRUCTURE AND EXCAVATIONS (BASE BID)					

Item No.	Description	Unit	Quantity	Unit Price	Total
GRIT CLASSIFIER STRUCTURE AND EXCAVATIONS (BASE BID)					
104	GRIT CLASSIFIER CONCRETE SLAB (CONC)	CY	20		
105	#4 @ 12" OC TOP AND BOTTOM E.WW REBAR (BOTTOM SLAB)	LBS	1280		
106	GRIT CLASSIFIER WALLS	CY	7.5		
107	#5 REBAR 12" OC	LBS	990		
108	#5 DOWEL w/ STD 90 DEGREE HOOK (2.5+1)	LBS	210		
109	CONCRETE FILL PAD	CY	11		
110	#4 @ 12" OC TOP AND BOTTOM E.WW REBAR (CONCRETE FILL PAD)	LBS	330		
SUB-TOTAL GRIT CLASSIFIER STRUCTURE AND EXCAVATIONS (BASE BID)					
TOTAL BASE BID					

Item No.	Description	Unit	Quantity	Unit Price	Total
Grit Decant Station (Installation Labor Only) (ADDITIVE ALTERNATE #1)					
71	Aluminum Access Hatch (30 x 48), 300 psf rated w/ Safety Grate	EA	3		
72	8" Plug Valve, w/ handwheel, Flg x flg,	EA	2		
73	8" Check Valve, flg x flg	EA	2		
74	Isolation pressure gage	EA	2		
75	8" Restrained Flange Adapter	EA	3		
76	650 GPM Pumps, TDH 20 Feet, 480 V (Wilo EMU FA10.82E or approved Equal) Base Elbow, Guide Rails, Guide Rail Brackets, Lifting Cable, Wire Grips	EA	2		
77	Adjustable Saddle Pipe Support 8" Dia (1'-2" Tall)	EA	2		
78	Adjustable Flange Pipe Support 8" Dia (1'-2" tall)	EA	1		

79	8" DI Flg x Flg 45 degree Bend C-110	EA	1		
80	8" Spool Piece Flg x Plain End (2'-0")	EA	1		
81	8" DI Tee Flg x Flg, C110 w/Bolt and gasket pack	EA	1		
82	8" Flg x Flg Spool (6.75" Long)	EA	2		
83	8" Flg x Plain End Spool (4'-0) Long, (Wall Penetration) w/ Link Seal	LS	1		
84	12" Spool Flg x Plain End, (Wall Penetration) w/Link Seal (2'-2")	LS	1		
85	12" 90 degree bend Flg x Flg C-110 w/ Bolt and Gasket Pack	EA	1		
86	12" MJ 90 degree bend C-110 w/ Bold and Gasket Pack	EA	1		
87	12" Spool Flg x Plain End, (6'-0")	LS	1		
88	6" DI 90 Degree Bend flg x flg w/bolt and Gasket Pack	EA	2		
89	6" Bird Screen for Vent	EA	1		
90	8" DI Pipe, CL 52 (Bell &Spigot) (Permox Lined)	LF	40		
91	8" DI Pipe Spool Piece Flg x PLN End (12'-0") (Permox Lined)	LS	1		
92	8" DI Pipe Spool Piece Flg x Flg (3'-7") (Permox Lined)	LS	1		
93	8" DI Pipe Spool Piece Flg x PLn End (1'-9") w/ water stop & 2 Retainer Glands (Permox Lined)	LS	1		
94	8" DI 90 Degree Bend MJ x MJ (Permox Lined) w/ 2-retainer glands bolt and gasket packs	EA	1		
95	8" DI 90 Degree Bend Flg x Flg	EA	2		
96	4x4x3/8 316 SS Angle Brackets w/ Adhesive Anchors and U-Bolts (Pipe Support)	EA	2		
97	8" x 4" Reducer Flg x Flg DI C-110 Permox Lined.	EA	1		
98	8" DI Spool Flg x Flg (24") Permox Lined	EA	1		
99	8" SS Blind Flange with Bolt and gasket pack	EA	1		
100	8" Restraind Flange Adaptor	EA	1		
101	8" PVC PVC C-900, Cut to length with Openings as detailed	LF	20		
102	Submersible Level Transducer KPSI Model 705 or Approved Equal	EA	1		
103	(1) Grinnel Riser Clamp Fig 261 w/ (2) Grinnel Light Welded Steel Braket Fig 194 Size 2	EA	2		
SUB-TOTAL Grit Decant Station (Installation Labor Only) (ADDITIVE ALTERNATE #1)					

Item No.	Description	Unit	Quantity	Unit Price	Total
Grit System Piping & Hardware (Labor Only) (ADDITIVE ALTERNATE #2)					
111	Grit Classifier set in place with all piping connections	LS	1		
112	6" DI Piping Spool flg x plain end (glass lined) (grit piping) (7')	LS	1		
113	6" DI Piping Spool FlgxFlg (glass lined) (Grit piping) (6'-1")	LS	1		
114	6" DI Piping Spool Flg x flg (glass lined) Grit Piping (10'-1-3/4")	LS	1		
115	6" DI Piping Spool flg x flg (glass lined) Grit Piping (1'-7")	LS	1		
116	6" DI Piping CL 52 (Glass Lined) Bell and spigot	LF	80		
117	6" MJ Retainer glands for floor penetrations	EA	8		
118	6" DI MJ 90 Degree Bend (Glass lined)	EA	4		
119	6" Restrained Flange Adaptor	EA	1		
120	4"x 4" Wye (Flg xFlg) Glass Lined	EA	5		
121	6" x 4" Wye (Flg x flg Glass Lined	EA	3		
122	4" Plug Valve with Hand wheel	EA	9		
123	6" x 4" (flg x flg) Reducer (glass lined)	EA	1		
124	6" x 4" (flg x flg) Reducer (eccentric) (glass lined)	EA	4		
125	12" x 6" (flg x flg Reducer (glass lined)	EA	1		
126	12" DI Spool, glass lined flg x flg (2'-4")	LS	1		
127	12" DI Spool, CL 52 flg x flg (2'-4")	LS	1		
128	4" DI Spool Glass Lined Flg x Flg (12'-0")	EA	4		
129	4" DI Spool Glass Lined Flg x Plain End (12'-0")	EA	4		
130	4" Restrained Flange Adaptor	EA	4		
131	12" Restrained Flange Adaptor	EA	1		
132	12" DI CL 52 Bell and Spigot Pipe, with Link Seal Permox Lined.	LF	40		
133	12" Saddle Pipe Support	EA	1		
134	6" Saddle Pipe Support	EA	1		
135	6" Flange pipe support	EA	3		
136	4" Flange Pipe Support	EA	1		
137	2" Sch 40 Stainless Steel Drain Line 304 Treaded NTP	LF	50		
138	2" Stainless Steel 90 fittings threaded NTP	EA	7		
139	2" Stainless Steel Tee fittings threaded NTP	EA	1		
140	2" Stainless Stee Ball Valve Threaded NTP	EA	2		

141	12" Stainless Steel Flanged 90 degree Bend (Standard ANSI Dim.) w/ Bolt and Gasket Packs	EA	2		
142	12" Flanged DI Tee, Permox Lined. With Bolt and Gasket Packs and 12" Blind Flange	EA	1		
143	2" x 2" x 0.25" S.S. w/ Conc. Anchors Angle Mounted Flush in Wall (Grate Seat Plate Settlers)	LF	214		
144	Plate Settler Install (As Detailed)	LS	1		
SUB-TOTAL Grit System Piping (Labor Only) (ADDITIVE ALTERNATE #2)					

Item No.	Description	Unit	Quantity	Unit Price	Total
Influent Piping & Overflow Piping (Installation, Labor Only) (ADDITIVE ALTERNATE #3)					
145	24" DI Pipe (Class 52) Buried (w/ Interior Permox Coating) Bell & Spigot	LF	80		
146	24" DI Pipe Spool MJ x FLG Influent (w/ Interior Permox Coating) 18'-8"	LS	8		
147	24" MJ retainer gland DI w/ Bolt and gasket pack	EA	21		
148	24" MJ Plug valve (gear operated)with Valve Box	EA	2		
149	24" DI Pipe Spool Piece FLG X FLG (w/ Interior Permox Coating) 3'-4" Flange to Flange	LS	1		
150	24" DI Pipe Spool Piece FLG x PLN End (w/ Interior Permox Coating (7'-4 3/4")	LS	1		
151	24" DI Spool Piece Flg x Plain end (Wall Penetration) 2'-2"	LS	1		
152	24" DI Spool Piece Flg x Plain end (Top Penetration) 1'-11"	LS	1		
153	24" DI MJ 45 Degree Bend C110w/ Retainer Glands, Bolt and Gasket Packs (w/ Interior Permox Coating)	EA	3		
154	24" DI MJ Tee C110 w/ Retainer glands, Bolt and Gasket Packs (w/ Interior Permox Coating)	EA	1		
155	24" DI FLG 90 Degree Bend C110 w/ Retainer Glands, Bolt and Gasket Packs (w/ Interior Permox Coating)	EA	2		
156	24" DI FLG 90 Degree Bend C110 w/ Retainer Glands, Bolt and Gasket Packs (w/ Interior Permox Coating) (with 3" Tap for Vacuum Break)	EA	1		
157	24" DI MJ 90 Degree Bend C110 w/ Retainer Glands, Bolt and Gasket Packs (w/ Interior Permox Coating)	EA	2		
158	24x18 MJ Reducer C110w/ Retainer Glands, Bolt and Gasket Packs (w/ Interior Permox Coating)	EA	1		
159	18" DI 90 MJ Degree Bend, C110 w/ Retainer Glands. Bolt and Gasket Packs (w/ Interior Permox Coating)	EA	1		
160	18" DI Pipe (Class 52) Buried (w/ Interior Permox Coating)	LF	20		
161	18" x 12" DI C110 w/ Retainer Glands, Bolt and Gasket Packs (w/ Interior Permox Coating)	EA	1		
162	12" DI Pipe Class 52 Interior Permox Coated Bell and Spigot (From Grit decant Station to overflow piping)	LF	40		
163	18" DI Sleeve C110 w/ Retainer Glands, Bolt and Gasket Packs (w/ Interior Permox Coating)	EA	2		
164	3" Ball Valve SS NPT (AT 24" INFLOW 90)	EA	1		
165	3" Stainless Steel 90 degree bend NPT (316)	EA	2		
166	3" Stainless Steel Piping (316) threaded (NPT) Nipple (2'-2")	LS	1		
167	3" Stainless Steel Piping (316) threaded (NPT) Nipple (6")	EA	2		
168	3" Stainless Steel Piping (316) threaded (1 End) (NPT) Nipple(6'-4")	LS	1		
169	Anvil International Figure 199 SS Heavy Welded Bracket	EA	2		
170	Anvil International Figure 212 SS Socket Clamp for DI Pipe (24")	EA	1		
171	Anvil International Figure 206 SS Angle Bracket (Typ of 4)	EA	2		
172	3/4" Dia SS Adhesive Anchor Bolts	EA	6		
Subtotal Influent and Overflow Piping. (INSTALLATION & LABOR) (ADDITIVE ALTERNATE #3)					

Item No.	Description	Unit	Quantity	Unit Price	Total
VAC TRUCK DUMP STATION (Installation Labor Only) (ADDITIVE ALTERNATE #4)					
173	Lift Station Wet Well 6' Dia. 11' deep (with Wall and Top, pipe Penetrations)	LS	1		
174	36" x 48" Aluminum Hatch (300 psf) with Safety Grate	LS	1		
175	200 GPM Pumps, TDH 20 Feet, 480 V (Wilo EMU FA10.22W or approved Equal) Base Elbow, Guide Rails, Guide Rail Brackets, Lifting Cable, Wire Grips and Cable Rack	LS	2		
176	4" DI Spool Flg x Flg (7'-10.5") Permox Lined	LS	2		
177	4" DI 90 degree bend flg x flg C-110 Permox Lined	EA	6		
178	4" Restrained Flange Adaptor	EA	2		
179	4" Pressure Transducer on Isolation Ring	EA	2		
180	4" Check Valve (flg x flg)	EA	2		
181	4" Plug Valve with hand wheel (flg x flg)	EA	2		
182	4" DI Flg Tee C110 Permox Lined	EA	1		
183	4" MJ DI 90 w/ Retainer Glands, Bolt and Gasket Pack Permox Lined	EA	3		
184	4' DI Spool Flg x Plain End Permox Lined (4'-0" Long) Permox Lined	EA	2		
185	Adjustable Saddle Pipe (4" dia) Support (1'-4" tall)	EA	1		
186	Adjustable Flange Pipe Support 4" Dia (1'-4" tall)	EA	2		
187	4" Bird Screen	EA	1		

188	2" Rubber Duckbill Backflow Preventer	EA	1		
189	6" DI Spool Piece 15" length Flg x plain end (15" Long) Pemox Lined	EA	1		
190	6" Blind Flange with 3/4" Coupling (w/both and gasket pack)	EA	1		
191	3/4" Rigid PVC (to connect to coupling in Blind Flange) 2 feet	EA	1		
192	Siemans Hydroranger 200 with XRS-5 (Transducer) or approved equal	EA	1		
193	4" DI Spool Flange x Plain End (2'-3") Permox Lined	EA	2		
194	4" DI Spool Flange x Flange (0'-11") Permox Lined	EA	1		
195	4" DI Pipe C52 Bell and Spigot (Permox Lined)	EA	40		
196	4" DI Class 53 Flange to Plain End (Permox Lined)	LF	20		
197	Anvil International Figure 103 S.S. Offset pipe clamp for DI Pipe 4"	EA	2		
198	3/4" Stainless Steel Adhesive Anchors	EA	4		
SUB-TOTAL VAC TRUCK DUMP STATION (Installation Labor Only) (ADDITIVE ALTERNATE #4)					

Item No.	Description	Unit	Quantity	Unit Price	Total
VAC TRUCK DUMP PAD STRUCTURE AND EXCAVATIONS (Labor Only) (ADDITIVE ALTERNATE #5)					
199	Concrete DRAIN AND WALL FOOTER PAD FOOTER 4.83 X14.5	CY	5		
200	Concrete SLOPED PAD 21.83 X 12.5	CY	8.5		
201	CONCRETE CONTAINMENT WALL	CY	7		
202	CONCRETE STEM WALL FOR DRAIN	CY	1		
203	#5 REINFORCEMENT IN CONTAINMENT WALL	LBS	630		
204	#5 HOOK FOR WALL TO FOOTER CONNECTION	LBS	255		
205	#5 REINFORCEMENT IN FOOTER	LBS	840		
206	#5 IN SLOPED PAD	LBS	580		
207	SHAPING GROUT	CY	1		
208	REINFORCEMENT FOR SHAPING GROUT #4 (INCLUDING EPOXIED IN DOWELS)	LBS	52		
209	UNCLASSIFIED EXCAVATION	CY	45		
210	1/2" EXPANSION JOINT AND SEALANT	LF	50		
211	6" PIPE BOLLARD	EA	2		
212	12" DI Pipe CL 52 Bell and Spigot	LF	6		
213	UNCLASSIFIED EXCAVATION (HAUL OFF)	CY	15		
214	UNCLASSIFIED EXCAVATION (To be uses as back fill)	CY	40		
215	Concrete Pad At Station 7 X 8 feet (Less Wet well Encroachment) 8" Thick **(Concrete included in price)**	LS	1		
216	DEWATERING FOR WET WELL INSTALL GRIT DECANT STATION	LS	1		
217	CONCRETE BASE FOR ELECTRIAL PANEL (VAC TRUCK DUMP STATION)	LS	1		
SUB-TOTAL VAC STATION STRUCTURE & EXCAVATIONS (ADDITIVE ALTERNATE #5)					

Item No.	Description	Unit	Quantity	Unit Price	Total
BLOWER SYSTEM GRIT CHAMBERS (LABOR ONLY) (ADDITIVE ALTERNATE #6)					
218	BLOWER ENCLOSURE	LS	1		
219	HILTI TI-X- FCP-R ACNCHORS	EA	24		
220	1/2" X 1/2" STAINLESS ANGLE w/ 4" LONG HAS AT 12" OC.	LF	30		
221	4" DI SPOOL FLG X PLAIN END (2'-0)	LS	1		
222	4" Restrained Flange Adaptor	EA	1		
223	4" DI TEE w/TAPPED BLIND FLANGE FOR WEIGHTED SURGE VALVE w/ BOLT AND GASKET PACK	EA	1		
224	WEIGHTED SURGE VALVE FOR BLOWER PIPING (SEE M4.3 NOTE 1)	EA	1		
225	4" DI FLG X FLG C110 TAPPED FOR 1" BOSS (NPT) w/ BOLT AND GASKET PACK	EA	2		
226	1" SS BALL VALVE (THREADED NPT)	EA	1		
227	1" SS THREADED NIPPLE 2" (NTP)	EA	2		
228	1" SS THREADED 90 (NTP)	EA	1		
229	4" SWING CHECK VALVE (FLG X FLG)	EA	1		
230	4" BUTTERFLY VALVE (FLG X FLG)	EA	1		
231	4" DI SPOOL FLG X FLG (1'-2")	EA	1		
232	4" DI FLG 90 DEGREE BEND C110	EA	3		
233	4" DI SPOOL FLG X FLG (5'-6 3/4")	LS	1		
234	4" DI SPOOL FLG X FLG (5'-6")	LS	1		
235	4" DI SPOOL FLG X FLG (3'-5")	LS	1		
236	ANVIL INTERNATIONAL FIGURE 103 OFFSET PIPE CLAMP FOR DI PIPE 4" w/ 2-3/4" SS ADHESIVE ANCHOR BOLTS.	EA	3		

237	BLOWER FOUNDATION (8" THICK 7'-0" X 4.5" SLAB)	LS	1		
SUB-TOTAL BLOWER SYSTEM GRIT CHAMBERS (LABOR ONLY) (ADDITIVE ALTERNATE #6)					

Item No.	Description	Unit	Quantity	Unit Price	Total
WASH WATER BOOSTER PUMP (Labor Only) (ADDITIVE ALTERNATE #7)					
238	3" GATE VALVE FLG X FLG	EA	2		
239	3" DI 90 TAPPED FOR PRESSURE GAGE	EA	1		
240	3" PRESSURE REDUCING VALVE FLG X FLG	EA	1		
241	3" CHECK VALVE FLG X FLG	EA	1		
242	3" DI SPOOL FLG X FLG w/ 3" BLIND FLANGE TAPPED WITH 2" THREADED PIPE (1"-6")	EA	2		
243	3"X2" FLG X TREADED SPOOL TAPPED FOR PRESSURE GAGE	EA	2		
244	PRESSURE GAGE, NIPPLE, & BALL VALVE	EA	2		
245	3" DI 90 DEGREE BEND FLG X FLG	EA	1		
246	SADDLE PIPE SUPPORT 3" DI. (1'-11")	EA	2		
247	FLG PIPE SUPPORT	EA	1		
248	BOOSTER PUMP	EA	1		
249	3" DR 11 Electrofusion Weld HDPE (NEW service) w/ 2 MJ ADAPTORS	LF	25		
250	6X3 TAPPING VALVE AND SLEEVE	EA	1		
251	3" SCH 40 316 Stainless Steel Pipe NPT	LF	60		
252	3" SCH 40 316 Stainless Steel 90 degree fitting	EA	4		
253	3" SCH 40 316 Stainless Steel 45 Degree Fitting	EA	2		
254	3" SCH 40 316 Stainless Steel Tee	EA	1		
255	3" x 1.5" Sch 40 316 Stainless Steel Reducer	EA	2		
SUB-TOTAL WASH WATER BOOSTER PUMP (Labor Only) (ADDITIVE ALTERNATE #7)					

Item No.	Description	Unit	Quantity	Unit Price	Total
NON POTABLE WATER PIPING AND YARD HYDRANTS (Labor Only) (ADDITIVE ALTERNATE #8)					
256	2" TAPPING SADDLE WITH CORPORATION STOP	EA	3		
257	2" DR 11 Electrofusion Weld HDPE (Water Service)	LF	210		
258	YARD HYDRANT	EA	4		
259	PIPE BOLLARD FOR YARD HYDRANT	EA	8		
260	HOSE RACK As detailed or approved equal.	EA	4		
NON POTABLE WATER PIPING AND YARD HYDRANTS (Labor Only) (ADDITIVE ALTERNATE #8)					

Item No.	Description	Unit	Quantity	Unit Price	Total
FOG BEACH (Labor Only) (ADDITIVE ALTERNATE #9)					
261	FOG SUMP PUMP	LS	1		
262	2" SS SCH 40 PIPING TREADED NPT	LS	10		
263	2" SS CHECK VALVE TREADED NPT	EA	1		
264	2" SS BALL VALVE THREADED NPT	EA	1		
265	2" SS 90 DEGREE BEND NPT	EA	2		
266	B22 CHANNEL SS 12 GAUGE UNISTRUT	LF	3		
267	B2000 SERIES PIPE CLAMP	EA	3		
268	B279SQ SS BASE PLATE	EA	3		
269	1/2" SS ADHESIVE BOLTS	EA	12		
270	1/2" EXPANSION JOINT MATERIAL (BETWEEN WALLS AND SLAB)	LF	20		
271					
SUB-TOTAL FOG BEACH (Labor Only) (ADDITIVE ALTERNATE #9)					

Item No.	Description	Unit	Quantity	Unit Price	Total
HAND RAILS & STAIRS (Labor Only) (ADDITIVE ALTERNATE #10)					
272	Aluminium Handrail at top of Wall (1.5" Sch 40 Rails, 1.5" Sch 80 Vertical Rail post) (Main Structure)	LF	320		
273	Aluminium Toe Kick at top of Wall (1/4" Thick x 4" Plate w/ Connections to verticle Rails (Main Structure)	LF	320		
274	Mounting Flange (Wall or surface) w/ w/ 3/4" x 4" min. 316 SS Adhesive Anchors	Ea	90		
275	Stair segment (A) 13 tread, 2-C12x12.1, 2-guardrails, 2-Handrails, L4x4x3/8 at each guardrail post	LF	18.5		
276	Mounting Brakets Stair segments (L3 x 3 x 3/8 x 8 Aluminum Angle w/ (2)-3/4" dia x 3 1/2" long S.S. HAS-R316 treaded rods (Or approved Equal) Set in Hilti HY 200 Adhesive Anchoring System and 2- 1 1/2" Horizontally slotted Holes and 2 S.S Bolts	EA	8		

277	Mounting Brakets Stair segment A (L3 x 3 x 3/8 x 8 Aluminum Angle w/ 2-3/4" dia x 6" long S.S. Expansion Anchors (2 per Stringer)	EA	8		
278	2.5" Dia x 8" long Sch 80 Aluminum (min) Aluminum Pipe Sleve w/ 3/8" Aluminum Plate with Min, 2-3/4" Bolts (Gaurdrail flange on Stairs)	Ea	16		
279	Stair segment (B) 5-treads, 2-C12x12.1, 2-guardrails, 2-Handrails, L4x4x3/8 at each guardrail post	LF	10.25		
280	Aluminium Hand Rail (1.5" Sch 40 Rails, 1.5" Sch 80 Vertical Rail post) @ Vac Truck Dump	LF	52		
281	Mounting Flang (Wall or Surface) w/3/4" x 4" min. 316 SS Adhesive Anchors At Vac Truck Dump	Ea	14		
Sub-total HAND RAILS & STAIRS (Labor Only) (ADDITIVE ALTERNATE #10)					

Item No.	Description	Unit	Quantity	Unit Price	Total
ALUMINUM ANGLE AND I-BEAMS & FRP DECKING (Labor Only) (ADDITIVE ALTERNATE #11)					
281	6'-11" W12x11.7 Aluminium I Beam to support FRP Decking	Ea	18		
282	5'-11" W12x11.7 Aluminum I Beam to support FRP Decking	Ea	1		
283	14'-11" W12x11.7 Aluminum I beam to support FRP Decking	Ea	5		
284	L6x6x5/8 x 8" Long (Anchoring Plate)	Ea	96		
285	3/4" DIA. SS R316 Threaded Rod (3-1/2" Embedment) w/ Hilti HY 200 Adheasive, 1 SS Nut	Ea	192		
286	3/4" DIA. SS R316 Threaded Rod w/ 2 SS nuts	Ea	96		
287	Aluminum 2.3125 x 2.3125" x 5/16" Bent Plate w/ 1/2" x 4" Long Headed Studs at 12" OC	LF	182		
288	6" wide 1/4" x 32" Aluminum Plate	Ea	69		
289	3/8" Dia. SS HAS R316 Treaded Rod Set in Hilti HY 200 Adheasive (2.5" embedment)	Ea	207		
290	Aluminum L4x4x5/8 Provide Support Bracket	LF	30		
291	Hilti HY 200 Adhesive Anchoring w/3/4" Dia. 316 Treaded Rods 3-1/2" Min Embedment) w/Nut	Ea	190		
292	1/4" SS Bolt w/ 3-(1.5" Dia. X 1/4" Thick Round Washer and Nut)	Ea	210		
293	FRP Panels	SF	990		
ALUMINUM ANGLE AND I-BEAMS FOR FRP DECKING (Labor Only) (ADDITIVE ALTERNATE #11)					

CONTRACT

THIS AGREEMENT made and entered into the_____ day of _____, 2022 by and between _____ _____ (Contractor) party of the first part, and **THE UTILITIES BOARD OF THE CITY OF GULF SHORES,** party of the second part.

WITNESSETH:

That the first party, for the consideration hereinafter fully set out, hereby agrees with the second party as follows:

1. That the first party shall furnish all the materials, and perform all of the work in the manner and form as provided by the following enumerated Instruction to Bidders, Form of Proposal, General Conditions, Special Provisions, Detailed Specifications, Form of Contract, Form of Bond, Drawings and Addenda, which are attached hereto and made a part hereof, as if fully contained herein; for the construction of:

WASTEWATER RECLAMATION FACILITY HEADWORKS IMPROVEMENT

2. That the first party shall commence the work to be performed under this agreement on a date to be specified in a written order of the second party and shall fully complete work within **180** consecutive calendar days. Each day in excess of the allowable time shall be subject to liquidated damages as set forth in these contract documents in the amount of **$1500 per day**.

3. The second party hereby agrees to pay to the first party for the faithful performance of the agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the United States as follows:

   Approximately _____ _____ in accordance with the unit prices set forth in the proposal. This is a unit price contract; as such the final cost of the project may differ from the value stated above.

4. On or before the 25th day of each calendar month, the second party shall make partial payments to the first party on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the first party, less five percent (5% **of the first 50% of the value of the work**) of the amount of such estimate which is to be retained by the second party until all work has been performed strictly in accordance with this agreement and until such work has been accepted by the second party.

5. Upon submission by the first party of evidence satisfactory to the second party that all payrolls, material bills, and other cost incurred by the first party in connection with the construction of the work have been paid in full, final payment on account of this agreement shall be made within thirty days after the completion by the first party of all work covered by this agreement and the acceptance of such work by the second party. The Contractor shall advertise the completion of the project in accordance with the Alabama State Bid Law. Final settlement shall not be made upon contract until the expiration of thirty days beyond the completion of said notice.

6. It is mutually agreed between the parties hereto, that time is of the essence in this contract, and in the event the construction of the work is not completed within the time herein specified, it is agreed that from the compensation otherwise to be paid to the Contractor, the second party may retain the sum of **$1500** per day for each day thereafter, Sundays, national holidays and other legal holidays of the State of Alabama excluded, that the work remains uncompleted, which sum shall represent the actual damages which the Owner will have sustained per day for interest, administration, engineering and inspection by failure of the contractor to complete the work within the time stipulated, and this sum is not a penalty, being the stipulated damages the second party will have sustained in the event of such default by the first party.

7. It is further mutually agreed between the parties hereto that if any time after the execution of this agreement and the surety bond hereto attached for its faithful performance, the second party shall deem the surety or sureties upon such bond to be unsatisfactory, or if for any reason, such bond ceases to be adequate to cover the

performance of the work, the first party shall, at its expense within five days after the receipt of notice from the second party so to do, furnish an additional bond or bonds in such form and amount and with such surety or sureties as shall be satisfactory to the second party. In such event, no further payment to the first party shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the second party.

8. In the event a dispute arises between the Contractor and The Utilities Board of the City of Gulf Shores for an amount claimed owed to the Contractor, both parties agree that the proper venue for that action will be Baldwin County, Alabama. Any dispute not related to account collection by the Contractor and which arises out of or is in connection with this agreement or negotiations or discussions leading up to this agreement shall be resolved by **litigation within the proper venue within Baldwin County, Alabama**. The parties hereby acknowledge that the transaction made the basis of this agreement sufficiently affects interstate commerce so as to warrant the **litigation** of any dispute between the Contractor and The Utilities Board of the City of Gulf Shores. The **litigation judgment** shall be final and binding upon all the parties and may be entered thereon in any court within **Baldwin County, Alabama**. In the event The Utilities Board of the City of Gulf Shores prevails in any such litigation, the Contractor agrees to pay reasonable attorney's fees and expenses of The Utilities Board of the City of Gulf Shores associated with said litigation.

IN WITNESS WHEREOF the parties hereto have executed this agreement on the day and date above written in two (2) counterparts, each of which shall, without proof or accounting for the other counterpart, be deemed an original contract.

CONTRACTOR: _____

BY: _____

TITLE: _____

ATTEST: _____

OWNER:

THE UTILITIES BOARD OF THE CITY OF GULF SHORES

By: _____

TITLE: _____

ATTEST:_____

CONTRACT BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____ (Hereinafter called the "Principal") and _____ (Hereinafter called the "Surety") are held and firmly bound unto **THE UTILITIES BOARD OF THE CITY OF GULF SHORES** (Hereinafter called the "Owner") in the penal sum of _____ for the payment of which we bind ourselves, our heirs, executors, administrators, successors and assigns for the faithful performance of a certain written contract dated the ___ of _____, 2022 entered into between the Principal and the Owner for the construction of:

WASTEWATER RECLAMATION FACILITY HEADWORKS IMPROVEMENT

a copy of which said contract is incorporated herein by reference and is made a part hereof as if fully copied herein.

NOW, THEREFORE, the condition of this obligation is such that if the Principal shall faithfully perform the terms and conditions of the contract in all respects and shall fully pay all obligations incurred in connection with the performance of such contract on account of labor and materials used in connection therewith, and all such other obligations of every form, nature and character, and shall save harmless the Owner from all and any liability of every nature, kind and character which may be incurred in connection with the performance or fulfillment of such contract or other such liability resulting from negligence or otherwise on the part of such Principal and further shall save harmless the Owner from all cost and damage which may be suffered by reason of the failure to fully and completely perform said contract and shall fully reimburse and repay the Owner for all expenditures of every kind, character and description which may be incurred by the Owner in making good any and every default which may exist on the part of the Principal in connection with the performance of the contract; and further that the Principal shall pay all lawful claims of all persons, firms, partnerships, or corporations for all labor performed and material furnished in connection with the performance of the contract, and that the failure so to do with such persons, firms, partnerships, or corporations shall give them a direct right of action against the Principal and Surety under this obligation; and provided further that if any alterations or additions which may be made under the contract, or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal shall not, in any way, release the Principal and Surety, or either of them, their heirs, executors, administrators, successors, or assigns from their liability hereunder, notice to the Surety of any such alterations, extensions or forbearance being expressly waived. This obligation shall remain in full force and effect until the performance of all covenants, terms and conditions herein stipulated and after such performance, it shall become null and void.

IN TESTIMONY WHEREOF witness the hands and seal of the parties hereto on this ____ day of _____, 2022.

Executed in two (2) counterparts.

_____	_____
(WITNESS)	(Contractor)
	BY:
	TITLE:
_____	_____
(WITNESS)	(NAME OF SURETY)
COUNTERSIGNED:	BY:
	TITLE:

_____
Resident Agent

LABOR AND MATERIAL BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____, as Principal, and _____ as Surety, are held and firmly bound unto **THE UTILITIES BOARD OF THE CITY OF GULF SHORES** (Hereinafter called the "Obligee") in the penal sum of: _____ **Dollars** _____ lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, personal representatives, successors and assigns jointly and severally, firmly by these presents.

WHEREAS, said Principal has entered into a certain contract with said Obligee dated (Hereinafter called the "Contract") for the construction of:

WASTEWATER RECLAMATION FACILITY HEADWORKS IMPROVEMENT

which contract and the specifications for said work shall be deemed a part hereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal and all subcontractors to whom any portion of work provided for in said Contract is sublet and all assignees of said Principal and of such subcontractors shall promptly make payments to all persons supplying him or them with labor, materials, feed-stuffs or supplies for or in the prosecution of the work provided for in such contract, or in any amendment or extension of or additions to said contract, and for the payment of reasonable attorney fees, incurred by the claimant or claimants in suits on said bond, the above obligation shall be void; otherwise to remain in full force and effect; PROVIDED, however, that this bond is subject to the following conditions and limitations:

(a) Any person, firm or corporation that has furnished labor, materials, feed-stuffs or supplies for or in the prosecution of the work provided for in said Contract shall have a direct right of action against the Principal and Surety on this bond, which right of action shall be asserted in a proceeding instituted in the county in which the work provided for in said contract is to be performed, or in any county in which said Principal or Surety does business. Such right of action shall be asserted in a proceeding instituted in the name of the claimant or claimants for his or their use and benefit against said Principal and Surety or either of them (but not later than one year after the final settlement of said contract) in which action such claim or claims shall be adjudicated and judgement rendered thereon.

(b) The Principal and Surety designate and appoint

(To be filled in by Surety Company)

as the agent of each of them to receive and accept service of process or other pleading issued or filed in any proceeding instituted on this bond and hereby consent that such service shall be the same as personal service on the Principal and/or Surety.

(c) The Surety shall not be liable hereunder for damage or compensation recoverable under any Workmen's Compensation or Employer's Liability Statute.

(d) In no event shall the Surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action or proceeding thereon that is instituted later than one year after the final settlement of said contract.

(e) This bond is given pursuant to the terms of Act No. 39, General Laws of Alabama, approved February 8, 1935, entitled "An Act to Further Provide for Bonds of Contractors on State and Other Public Works and Suits Thereon."

Executed in two (2) counterparts.

SIGNED, SEALED AND DELIVERED this _____ day of _____, **2022.**

WITNESS: _____ _____ _____

(CONTRACTOR)

BY:

TITLE:

WITNESS: _____ _____

NAME OF SURETY

BY:

TITLE:

CONTRACTOR'S ACKNOWLEDGEMENT FOR CHANGE ORDERS

THE UTILITIES BOARD OF THE CITY OF GULF SHORES

WASTEWATER RECLAMATION FACILITY HEADWORKS IMPROVEMENT

The Contractor agrees by signing this document that he acknowledges that the following are conditions for which Change Orders are allowed under the Bid Law.

1. Unusual and difficult circumstances which arose during the course of the execution of the contract which could not have been reasonably foreseen.

2. Where competitive bidding for the new work for new money will work to the serious detriment of the awarding authority.

3. Emergencies arising during the course of the work.

4. Change or alterations provided for in the original bid and original contract.

_____

CONTRACTOR

BY:_____

TITLE: _____

NOTICE OF AWARD

DATED: _____

TO: _____

You are notified that your Bid dated _____ for the Contract has been considered. You are the apparent successful bidder and have been awarded a Contract for:

THE UTILITIES BOARD OF THE CITY OF GULF SHORES

WASTEWATER RECLAMATION FACILITY HEADWORKS IMPROVEMENT

Within ten (10) days of the date of this Notice of Award, you must deliver to the OWNER the enclosed contract documents, fully executed, signed and witnessed, and a Certificate of Insurance as follows:

3 originals	Contract
1 original	Performance Bond
1 original	Labor and Material Bond
1 original	Certificate of Insurance certifying compliance with all insurance requirements specified in the General Conditions

Within ten (10) days after receipt of the above documents, OWNER will return to you one (1) fully signed original of the Contract. You may obtain two additional free copies of plans and specifications upon request. You will be notified of the time and place for a pre-construction conference; your proposed work schedule must be delivered to the OWNER at that time.

Failure to deliver the aforementioned contract documents and insurance certificate within the time specified will entitle OWNER to consider your bid abandoned, to annul this Notice of Award, and to declare your Bid Security forfeited.

CONTRACT Conditions:

THE UTILITIES BOARD OF THE CITY OF GULF SHORES
(OWNER)

BY: _____
(AUTHORIZED SIGNATURE)

NOTICE TO PROCEED

THE UTILITIES BOARD OF THE CITY OF GULF SHORES

WASTEWATER RECLAMATION FACILITY HEADWORKS IMPROVEMENT

In accordance with the contract dated _____, you are hereby notified to commence work within ten days of the date of this notice _____ Completion of all work shall be on or before _____.

THE UTILITIES BOARD OF THE CITY OF GULF SHORES
(OWNER)

(SIGNATURE) _____

(TITLE) _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged this the _____ day of _____, 2022.

_____**(Contractor)**

_____
(SIGNATURE)

_____
(TITLE)

DIVISION II

TECHNICAL SPECIFICATIONS & SPECIAL PROVISIONS

SECTION I

TRENCHING, BACKFILLING AND COMPACTING FOR UTILITY SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work included under this Section consists of clearing, excavating, grading and backfilling as required for the construction of the utility systems consisting of piping and appurtenances as shown on the Drawings and specified herein.

PART 2 - PRODUCTS

2.01 BEDDING MATERIAL

A. Bedding material for use below the water table or in wet trenches shall be pea rock, drain field lime rock or washed sand as approved by the Engineer. Pipe bedding material for use in dry trenches for water lines and force mains shall be lime rock screenings, sand or other fine inorganic material as approved by the Engineer. Bedding material for gravity sewer shall be angular rock or washed sand.

2.02 ADDITIONAL BACKFILL MATERIAL

A. Additional backfill material shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M 145 and shall be free from vegetation and organic material. No stones or rocks shall be larger than 6-inches in diameter, and when placed within 1-foot of piping and appurtenances stones or rocks shall be no larger than 2-inches in diameter (1-inch for PVC).

PART 3 - EXECUTION

3.01 CLEARING

A. The Contractor shall perform all clearing necessary for the proper installation of all piping and appurtenances in the locations shown on the Drawings.

Plantings, shrubbery, trees, utility poles or structures subject to damage resulting from the excavation shall be transplanted, relocated, braced, shored, or otherwise protected and preserved and prior to project completion restored to their original condition unless otherwise directed by the Engineer.

3.02 EXCAVATION

A. The Contractor shall perform all excavation of every description and of whatever substances encountered, to the dimensions and depth shown on the Drawings, or as directed. All existing utilities such as pipes, poles and structures shall be carefully supported and protected from injury, and in case of damage, they shall be restored at no cost to the Owner.

B. Trench walls shall be kept vertical, and, if required to protect the safety of workmen, the general public, this or other work or structures, or to maintain trench widths within the limits hereinafter specified, shall be properly sheeted and braced. Where wood sheeting or certain designs of steel sheeting are used, the sheeting shall be cut off at a level 2-feet above the top of the installed pipe and that portion below that level shall be left in place. If inter-locking steel sheeting is used, it may be removed providing removal can be accomplished without disturbing the bedding, pipe or alignment of the pipe. Any damage to the pipe

bedding, pipe or alignment of the constructed utility caused by removal of sheeting shall be cause for rejection of the affected portion of the work. Not more than 100-feet of trench shall be opened ahead of pipe laying operations at one time unless a greater length of open trench is approved by the Engineer.

C. In areas where trench widths are not limited by right-of-way, and/or easement widths, property line restrictions, existing adjacent improvements, including pavements, structures and other utilities, and maintenance of traffic, the trench sides may be sloped to a stable angle of repose of the excavated material. A substantially and safely constructed movable shield, “box” or “mole” may be used in place of sheeting when the trench is opened immediately ahead of the shield and closed immediately behind the shield as pipe laying proceeds inside the shield.

D. Ladders or steps shall be provided for and used by workmen to enter and leave trenches.

E. Pipe trenches for utility lines shall be excavated to a width within the limits of the top of the pipe and the trench bottom so as to provide a clearance on each side of the pipe barrel, measured to the face of the excavation or sheeting, if used, of 8-inches to 12-inches. Where the pipe size exceeds 12-inches, the clearance shall be from 12-inches to 18-inches.

F. Excavation for appurtenances shall be sufficient to provide a clearance between their outer surfaces and the face of the excavation or sheeting, if used, of not less than 12-inches. Manhole excavations shall be carried to sufficient depth to permit their construction on the undisturbed bottom of the excavation.

G. Materials removed from the trenches shall be stored and disposed of in such a manner that they will not interfere unduly with traffic on public streets and sidewalks and they shall not be placed on private property. In congested areas, such materials as cannot be stored adjacent to the trench or used immediately as backfill shall be removed to convenient places of storage.

H. All materials suitable for use as backfill shall be hauled to and used in areas where not enough suitable material is available from the excavation.

I. Excess suitable material and all unsuitable material shall remain the property of the Owner and shall be disposed of within the limits of the project as directed by the Engineer. The disposal area shall be finish graded upon completion of the work.

3.03 REMOVAL OF WATER

A. It is a basic requirement of these specifications that excavations shall be free from water before pipe or structures are installed.

B. Contractors will not be permitted to allow trench water to flow into the work. In order to accomplish this, the Con- tractor may install temporary dams or plugs within the pipe provided they are suitably removed and do not damage the lining of the pipe. Pipe joints must not be connected in water filled trenches.

C. The Contractor shall provide all necessary pumps, underdrains, well-point systems, and other means for removing water from trenches and other parts of the work. The Contractor shall continue dewatering operations until the backfill has progressed to a sufficient depth over the pipe to prevent flotation or movement of the pipe in the trench and so that it is above the natural water table.

D. Water from the trenches and excavation shall be disposed of in such a manner as will not cause injury to public health, to public or private property, to the work completed or in progress, to the surface of the streets, or cause any interference with the use of the same by the public. The Contractor shall submit his

proposed methods of handling trench water and locations at which the water will be disposed of to the Engineer for approval and shall receive approval before starting the excavation.

3.04 PIPE BEDDING

A. As described above, all pipe trenches shall be excavated to a level 6-inches below the outside bottom of the proposed pipe barrel. The resulting excavation shall be backfilled with approved pipe bedding material, up to the level of the lower one-third of the proposed pipe barrel. This backfill shall be tamped and compacted to provide a proper bedding for the pipe and shall then be shaped to receive the pipe. Bedding shall be provided under the branch of all fittings to furnish adequate support and bearing under the fitting. Bedding material for water lines and force mains may be composed of fine material from the excavation as approved by the Engineer. Bedding material for gravity sewer shall be pea rock, drainfield limerock, or similar materials as approved by the Engineer. Limerock screenings, or sand may also be used. (See detail on Page I - 9 hereof).

B. Any excavation below the levels required for installation of the pipe bedding, except for "Additional Excavation", as hereinafter specified, shall be backfilled with approved bedding material, tamped, compacted and shaped to provide proper support for the proposed pipe, at no additional cost to the Owner.

3.05 BACKFILL UNDER MANHOLES AND METER VAULTS

A. Any excavation below the levels required for the proper construction of manholes or meter vaults shall be filled with Class C concrete. (See Section III). The use of earth, rock, sand or other materials for this purpose will not be permitted. A 12" thick angular rock foundation is required under all manholes and meter vaults.

3.06 TRENCH STABILIZATION

A. No claim for extras, or additional payment will be considered for cost incurred in the stabilization of trench bottoms which are rendered soft or unstable as a result of construction methods, such as improper or inadequate sheeting, dewatering or other causes. In no event shall pipe be installed when such conditions exist and the Contractor shall correct such conditions so as to provide proper bedding or foundations for the proposed installation at no additional cost to the Owner.

3.07 BACKFILL

A. Backfilling of utility trenches will not be allowed until the work has been approved by the Engineer and the Engineer indicates that backfilling may proceed. Any work which is covered or concealed without the knowledge and consent of the Engineer shall be uncovered or exposed for inspection at no cost to the Owner. Partial backfill may be made to restrain the pipe during pressure testing.

B. Backfill material shall be non-cohesive, non-plastic material free of all debris, organic material, clods and broken paving. Backfill material placed within 1-foot of piping and appurtenances shall not contain any stones or rocks larger than 2-inches in diameter (1-inch for PVC) and no stones or rocks larger than 6-inches in diameter will be permitted in any backfill. (See Section 3.04A)

C. If a sufficient quantity of suitable backfill material is not available from the trench or other excavations within the site of the work, the Engineer will order the Contractor to provide additional material suitable for this purpose. The additional material shall be installed as specified herein. When the Engineer has determined that additional material is required, and has ordered the Contractor to furnish same, it shall be paid for at the unit price stated in the Proposal for "Additional Backfill Material". However, no payment will be made for additional backfill material used to replace non-plastic material (rock) over 6-inches in diameter.

D. Selected backfill material containing no stone or rocks larger than 2-inches (1" for PVC) shall be placed in 6-inch layers and thoroughly tamped to a depth of 12-inches over the top of the pipe. Particular attention and care shall be exercised in obtaining thorough support for the branch of all service connection fittings. Care shall be taken to preserve the alignment and gradient of the installed pipe.

E. After the backfill has been placed to a level 12-inches over the waterline or force main pipe, the remainder of the back-fill shall be placed in layers, not to exceed 9-inches, and compacted with mechanical vibrators or other suitable equipment to obtain a density of the backfilled material of not less than 95 percent of its maximum density as hereinafter defined. (See Sections IV, V, VI for locator tape specification).

F. After selected backfill has been placed to a depth of 12-inches over the sewer pipe, backfilling shall proceed to a depth of 30-inches over the pipe by placing the backfill material in 6-inch layers and thoroughly compacting it with mechanical vibrators. Backfill in this portion of the work shall be compacted to 90 percent of maximum density of the material as hereinafter defined.

G. After the backfill has been placed to a level 30-inches over the sewer pipe, the remainder of the backfill shall be placed in layers, not to exceed 9-inches, and compacted with mechanical vibrators or other suitable equipment to obtain a density of the backfilled material of not less than 95 percent of its maximum density as hereinafter defined.

H. Within paved areas of trench excavation, the base and surfacing shall be reconstructed.

I. No more than 800-feet of trench with pipe in place shall be partially backfilled at any time.

3.08 COMPACTION AND DENSITIES

A. Methods of control and testing of backfill construction to be employed in this work are:

1. Maximum density of the material in trenches shall be determined by AASHTO Designation T 180-74.

2. Field density of the backfill material in place shall be determined by AASHTO Designation T 238-79.

B. Laboratory and field density tests which, in the opinion of the Engineer, are necessary to establish compliance with the compaction requirements of these specifications, will be conducted at Contractor's expense. Tests will be made at depths and locations selected by the Engineer.

C. Trench backfill which does not comply with the specified densities, as indicated by such tests, shall be reworked and re-compacted until the required compaction is secured, at no additional cost to the Owner. The costs for retesting such work shall be paid for by the Contractor.

3.09 ADDITIONAL EXCAVATION AND BACKFILL

A. Where organic material, such as roots, muck, or other vegetation matter, or other material which, in the opinion of the Engineer, will result in unsatisfactory foundation conditions, is encountered below the level of the proposed pipe bedding material, it shall be wholly or partially removed as directed by the Engineer and wasted. Sheeting shall be installed if necessary to maintain pipe trenches within the specified limits. The resulting excavation shall be backfilled with suitable backfill material, placed in 6-inch layers, tamped and compacted up to the level of the bottom of the proposed pipe bedding material. Sufficient compaction of this material shall then proceed in accordance with the provisions of Article 3.04 Pipe Bedding.

B. Additional excavation shall be performed only when ordered by the Engineer. Where organic or other unsuitable material is encountered in the excavation, the Contractor shall bring the condition to the

attention of the Engineer and obtain his determination as to whether or not the material will require removal, prior to preparing the pipe bedding.

C. Additional backfill material, if required, shall be furnished in accordance with the provisions therefore in Article 3.07 Backfill.

3.10 RESTORATION OF EXISTING SURFACES

A. Paved and grassed areas disturbed by the operations required under this section shall be restored as indicated on the Drawings and/or specified herein.

SECTION V

SANITARY SEWER SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work included under this section consists of furnishing all Labor, equipment and materials necessary for the construction of sanitary sewers, sewer connections and appurtenances as shown on the Drawings or specified herein.

1.02 RELATED WORK

A. Section I - Trenching, Backfill and Compacting for Utility Systems

B. Section III - Concrete

1.03 QUALITY ASSURANCE

A. Design Requirements: Sewer mains and laterals shall have a minimum cover of thirty-six (36) inches below finished grade. Sewer lateral ends shall have a maximum cover of forty-eight (48) inches below finished grade, unless otherwise indicated.

B. Storage: Polyvinyl chloride pipe shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyvinyl chloride pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperatures conditions. Where necessary due to ground conditions the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

1.04 SUBMITTALS

A. Shop Drawings:

1. In general, six (6) copies of the following data or shop drawings shall be submitted to

the Engineer for approval prior to construction:

a. Precast manholes

b. Manhole frames, covers and other castings

c. Manufacturer's Certified Test Report on castings

d. Certified test records for polyvinyl chloride pipe

e. Pipe adapters

2. A copy of the approved shop drawings shall be submitted to the Owner prior to delivery of materials.

B. Record Information:

Record drawings shall be prepared and submitted to Gulf Shores Utilities. These record drawings shall specifically locate via discrete, manual measurements each and every component of the installed system, including: Manholes, main line service fittings, main line pipe material transitions, end of service laterals, depth of service lateral end, flow line of each line connected to each manhole, elevation of each manhole cover, and any other such items or project elements as may be required. Main line service fittings, main line pipe material transitions, and lateral information shall be stationed from the nearest downstream manhole. Lateral ends shall have left/right offsets measured from the centerline of the main sewer line. Manhole cover elevations shall be at the center of the cover.

PART 2 - GRAVITY SEWER MAINS

A.

APPROVED PRODUCT

PVC PIPE: SDR-35

PVC PIPE(LATERALS): SCHEDULE 40

PIPE ADAPTER: PVC OR POLYURETHANE FERNCO OR EQUAL

PRECAST MANHOLE: CEMENT TYPE II WITH 100% CALCAREOUS AGGREGATE, BASE 8" MINIMUM THICKNESS WITH 6" ANTI-FLOTATION COLLAR, WALL THICKNESS 5" MINIMUM, JOINT SEAL AND RAM-NEK OR EQUAL, GROUT TYPE II CEMENT OR NON-SHRINK HYDRAULIC CEMENT, PIPE SLEEVES SYNTHETIC RUBBER WITH STAINLESS STEEL BAND & amp; SCREWS, FRAME AND CAST IRON W/TYPE 2 PICK VULCAN FOUNDRY COVERHOLES AND APPROVED V-1418-1B CASTING PATERN

SEWER LATERAL MARKERS: STAMPED OR LABELED SEWER LATERAL

CURB STAMPING: SEWER LATERALS SHALL BE IDENTIFIED WITH AN "S" PLACED IN THE CONCRETE CURBING IDENTIFYING THE SEWER SERVICE

PIPE BEDDING MATERIAL: WET TRENCHES ANGULAR STONE NOT GREATER THAN 3/4" DRY TRENCHES ANGULAR STONE OR CLEAN SAND

B. Pipe and Fittings:

1. Polyvinyl Chloride Pipe For Gravity Sewers:

a. Plastic gravity sewer pipe and fittings shall be unplasticized polyvinylchloride (PVC), meeting or exceeding ASTM Specification D-3034, latest edition, Classification SDR 35.

b. Pipe lengths shall not exceed thirteen (13) feet and provisions shall be made at each joint to accommodate expansion and contraction.

c. All pipe and fittings shall be joined by means of an integral wall bell and spigot and sealed with a rubber gasket. This joint shall be capable of withstanding an internal hydrostatic pressure of 25 psi for one hour with no leakage.

d. Pipe shall be retained in shipping cradles when stored along the right-of-way until pipe is ready to be laid. In no case will removal of pipe from cradles be permitted more than 24 hours in advance of placing in trench.

e. PVC pipe shall be installed in accordance with ASTM D2321, latest edition and as modified herein. If there is a conflict between the provisions of ASTM D2321 and the Project Specifications, the Project Specifications shall govern.

2. Polyvinyl Chloride Pipe For Sewer Laterals:

a. Plastic sewer lateral pipe and fittings shall unplasticized polyvinylchloride (PVC) meeting or exceeding ASTM Specification D-2665 Schedule 40.

b. All pipe and fittings for PVC lateral pipe shall be joined by means of solvent-cement joints in conformance with ASTM D-2855. Joints shall be capable of withstanding an internal hydrostatic pressure of 25 psi for one hour without leakage.

3. Ductile Iron Fittings For Gravity Sewers And Laterals:

a. Ductile iron fittings shall be as specified in ASTM A746 for thickness Class 52.

b. A standard Tnemec or Permox coating shall be applied to the exterior of all ductile iron fittings.

c. Ductile iron fittings shall be designed for pressure rating of 350 psi and shall be in accordance with ANSI/AWWA C110/A21.10. Fittings shall be mechanical joint. Fittings shall be cement-mortar lined in accordance with ANSI/AWWA C151/A21.51.

d. Transitions from ductile iron pipe to other pipe material shall be made using approved adapters specifically designed for this purpose.

e. Polyethylene sheath shall be on ductile iron pipe where indicated on the Plans and where directed in the field. The exterior of ductile iron pipe shall be covered with a sealed polyethylene sheath in accordance with AWWA Specification C105. Polyethylene sheath

shall be "Polyetube" as manufactured by Polyetube Corporation, or an approved equal. Backfill shall be as specified elsewhere in these Specifications. Care shall be taken not to damage the polyethylene sheath during the backfill operation. Any polyethylene sheath which is damaged shall be replaced or repaired by the Contractor at no additional expense to the Owner.

B. Concrete and Reinforcing Steel: Concrete and reinforcing steel shall conform to the requirements of Section III. Concrete classes for the various purposes shall be as follows:

1. Manhole bottoms, Class A

2. Precast manholes, Class A

3. Pipe and riser encasement, Class B

4. Protective slabs, Class B

C. Castings: Gray iron castings for manhole frames, covers and other items shall conform to the ASTM Designation A 48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the drawings. The words "GULF SHORES SANITARY SEWER" shall be cast in all manhole covers. All manhole frames and covers shall be traffic bearing - Vulcan Foundry V-1418-1B, Type 2 Pick Hole or approved equal. A "Sailboat" pattern will be cast in lid.

D. Brick: Brick for manhole construction shall be dense, hard burned, shale or clay brick conforming to ASTM Designation C 32, Grade MM or C 62, Grade MW, except that brick absorption shall be between five and twenty-five grams of water absorbed in one minute by dried brick, set flat face down, in 1/8-inch of water. Brick used to construct manholes or adjust manhole rings to final grade must be laid in acceptable cementitious mortar - No dry stacking allowed.

E. Cement Mortar: Cement mortar for manhole construction shall be one part cement and three parts clean sharp sand to which may be added lime in the amount of not over ten percent volume of cement. It shall be mixed dry and then wetted to proper consistency for use. No mortars that have stood for more than one hour shall be used.

F. Pipe Adapter:

1. Donut pipe adapter shall be manufactured from virgin polyvinyl chloride (PVC) or polyurethane adaptable to similar or dissimilar pipes of the same or different sizes. Donuts shall be as manufactured by Fernco Joint Sealer Company or approved equal.

2. Flexible couplings shall be manufactured from virgin polyvinyl chloride (PVC) or polyurethane adaptable to dissimilar pipes of the same or different sizes. The flexible coupling shall be as manufactured by Fernco Joint Sealer Company or approved equal and supplied with #300 stainless steel bands and screws.

3. Flexible manhole sleeves for connecting sewer pipe to precast manholes shall be of a

synthetic rubber compound resistant to ozone, weather, acid and water. The sleeve shall either be cast-in-place with a water stop or shall be firmly affixed to the inner face of a smooth opening in the manhole wall by means of a stainless steel retainer band. The sleeve shall have a cast-in-place water stop and accommodate settlement up to 15 degrees. The binding of the sleeve to the pipe shall be a non-corrosive, non-magnetic type stainless steel strap and screws.

PART 3 - EXECUTION

3.01 PREPARATION

A. Bedding:

1. Pipe Cradle: Upon satisfactory installation of the pipe bedding, as specified in Section I, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous uniform support and no pressure shall be exerted on the pipe joints from the trench bottom.

2. Cleanliness: The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered in the trench and shall be kept clean during laying operations by means of plugs, or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe laid to prevent mud or other foreign material from entering the pipe.

3.02 INSTALLATION

A. Pipe:

1.Gravity sewer mains shall be installed upgrade with the spigot ends pointing in the direction of flow. All pipe will be installed straight and true to the specified grade using a laser or other devise specifically designed for pipeline installation. Pipe shall be bedded as trench conditions indicate. A GSU representative will determine if trench conditions allow the use of clean sand in lieu of angular stone. Contractor shall provide sufficient well points or pumps to control any water that may be present. **No laying of pipe in water filled trenches or on unstable bedding will be allowed.** A minimum of 6 inches of compacted bedding material shall be required below the pipe. Overcuts shall be filled with compacted bedding material. Pipe cradle shall be constructed in a manner that provides continuous, uniform support to the barrel of the pipe with no pressure exerted on the pipe joints from the trench bottom. Pipe cradle shall be constructed of compacted bedding material to the spring line of the pipe. From the spring line to 12 inches above the pipe, the trench shall be filled with compacted select material from excavation. In paved areas, backfilling of the trench above the pipe envelope shall be as required by the City of Gulf Shores. Whenever pipeline construction is stopped for the night or any other reason, the end of the pipe shall be plugged to prevent any trench water, mud, or foreign material from entering the pipe.

2. Any pipe which is disturbed or found to be defective after laying shall be taken up and relaid or replaced.

3. Polyvinyl Chloride Pipe:

a. Transportation: Care shall be taken during transportation of the pipe that is not cut,

kinked or otherwise damaged.

b. Handling Pipe Lengths: Ropes, fabric or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Pipe or fittings shall not be dropped onto rocky or unprepared ground.

c. Handling Pipeline: The handling of the joined pipe line shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Sections of the pipes with deep cuts and gouges shall be removed.

d. Lowering Pipe Into Trench: Care shall be exercised when lowering pipe into the trench to prevent damage to or twisting of the pipe.

e. Special Precautions: Polyvinyl chloride pipe connected to heavy fittings, manholes and rigid structures shall be supported in such a manner that no subsequent relative movement between the pipe and the joint with the rigid structures is possible.

B. Service Connections:

1. Service connections, of the type called for on the Drawings, shall be provided in accordance with the details therefore as shown or indicated on the Drawings.

2. Where called for on the Drawings, sewer pipe of the size and type noted shall be extended to the street right-of-way line with an approved cap. All connections and changes of direction shall be made using standard fittings designed for the purpose.

3. Where deep house connections or shallow connections are called for, but no service line is to be installed under this contract, all unused branches of such fittings shall be plugged watertight with a specified plug.

4. Without special approval all lateral ends shall have a minimum depth of thirty-six (36) inches and a maximum depth of forty-eight (48) inches.

5. Markers shall be installed on lateral ends. Markers shall be 66ï¿½ long fiberglass/plastic; Green)Curv-Flex Anchor (attached) with Decal (Caution: Sewer Pipeline)bearing the inscription "Gulf Shores Utilities Board 968-6323".

C. Precast Concrete Manholes:

1. Precast concrete manholes may be used when the following conditions are satisfied:

a. Details and shop drawings of the manholes, proposed to be furnished for this work, are submitted to and approved by the Engineer. prior to the manufacture of the units. Manholes which are not manufactured in strict compliance with the approved shop drawings and these specifications will be rejected.

b. The design and manufacture of the manholes and special pipe construction at manholes shall conform to these specifications.

c. Manhole excavation, bedding and pipe trench excavation and bedding at manhole junctions shall be performed in accordance with the provisions of Section I. A minimum of 12 inches of compacted angular stone shall be required below manholes or lift stations.

2. Precast manholes shall conform to the requirements of ASTM Designation C 478 with reinforcement of Grade 40 bars and the following modifications thereto:

a. The minimum shell thickness shall be 5-inches.

b. Cement to be used in precast manholes shall be Type II. All aggregate to be 100% calcareous rock.

c. Joints, regardless of position in the complete structure, shall be filled with Ram-Nek plastic joint sealing compound. Height of wall sections shall not be less than three feet.

d. Lifting holes through the structures are permitted.

e. The design of the structure shall include a base of not less than 8-inches in thickness and shall incorporate an integral anti-flotation collar.

The base of the precast manhole may be cast monolithically or be cast on the riser section the day following the casting of the riser section in the following manner:

The day following the casting of the riser section, four (4) 18 inch sections of the bell portion of the riser shall be removed leaving the remainder of the bell for support of the riser during the process of casting the base. The portions of the riser which will be cast into or contact the base slab shall be coated with an approved chemical bonding agent. The re-enforcing steel cage of the riser shall be exposed in the 18 inch openings from which the concrete has been removed, and the re-enforcing steel for the bottom slab shall be tied to this exposed riser re-enforcing cage. The bottom slab shall then be cast around the riser section, all in accordance with the approved shop drawings.

f. All grout used for sealing around pipe opening shall be Type II cement and designed for use in water. All openings and joints shall be sealed watertight.

g. Precast manhole tops, if used, shall

terminate at such elevations as will permit laying up brick courses (maximum of 4 courses) under the manhole frame to make allowance for future street grade adjustments.

h. Drop connections, where required on precast manholes, shall be manufactured with the manhole elements at the casting yard. The manufacturer shall submit for approval the method of drop manhole construction.

(Utilize 100% DI drop connection assemblies.)

3. Shallow manholes may substitute an eight-inch precast reinforced slab on the top in lieu of the cone section. slabs shall be laid in a full bed of mortar and pointed to form a dense joint.

4. Precast manholes shall utilize flexible wall sleeves for connection of sewer pipe. All openings and joints shall be watertight. The flexible wall sleeves shall be as specified in Paragraph 2.01.F.3. of this Section.

6. The invert channels shall be smooth and accurately shaped to a semicircular bottom

conforming to the inside of the adjacent sewer section. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practicable. Invert channels shall also be formed for pipe stub-outs.

D. Connections To Existing Structures And Sewers:

1. Various sewer lines shall be connected to existing manholes and structures. Provisions have been made in some of the existing structures for future connections and may require only the removal of a plug and the connection of the proposed line, while other connections will require cutting into the existing structure. Openings in existing manholes shall be created by core drilling the manhole at the proper grade. The use of jackhammers is prohibited. Any damage to existing manholes shall be repaired by the contractor in accordance with GSU requirements. In precast manholes, a properly sized flexible rubber connector with stainless steel bands shall be installed in the drilled hole. Connection to existing brick manholes requires a 3-foot ductile iron nipple through the manhole wall. The nipple shall be connected to the main line using an approved flexible connector (Fernco or equal). The ductile iron nipple shall be sealed to the opening in the manhole using approved non-shrink grout for a watertight seal. Invert of existing manhole shall be re-formed to accommodate flow from the new connection. The Contractor shall exercise care in cutting into the existing structure and any damage done to the structure shall be repaired as required by GSU and the Engineer, at the Contractor's expense. The contractor shall be responsible for the cleaning of any effected portion of the existing system if flow from new lines is not properly contained. Drop connections to existing manholes shall be installed as detailed on the Drawings for new construction.

2. New sewer lines connected to existing manholes must have Ductile Iron nipple (3'$\pm$) thru manhole wall then connect to main line via approved flexible connector. (Fernco).

3. The drop connection for existing Manhole shall be constructed of Class 51, Ductile Iron pipe. Anchor straps shall be not less than 3/16-inches by 1-1/2-inches and constructed of A1S1 304 stainless steel. Wall anchor bolts shall not be less than 5/8-inch and constructed of corrosion resistant metal. The Contractor shall provide an approved adapter for the connection between the DIP fitting and PVC pipe.

E. Additional Work: Additional items of construction such as cleanouts, terminal lamp holes, special manholes and other items necessary for the complete installation of the system shall conform to specific details on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

F. Where an existing manhole is not available for connection to the existing gravity sewer system, the contractor shall construct a "doghouse" manhole over the existing main. All requirements governing bedding and construction of standard manholes shall apply. Any damage to the existing main shall be repaired at the contractor's expense. The section of existing pipe inside the manhole shall be cut only after successful testing and inspection of the new lines are complete.

G. Location In Relation To Water Lines: Refer to Section IV, Paragraph 3.02.H.

3.03 FIELD QUALITY CONTROL

A. Tests, Inspections and Acceptance of Materials and Workmanship:

1. Workmanship: It is imperative that all sewers and appurtenances be built practically watertight and that the Contractor adhere rigidly to the specifications for materials and

workmanship. All of the sewage must be pumped for disposal and special care and attention must be paid to securing watertight construction. Upon completion, the sewers or sections thereof, will be tested and gauged and if leakage is above the allowable limits specified, the sewer will be rejected.

2. Inspection:

a. On completion of each block or section of sewer, or such other times as the Engineer may direct, the block or section of sewer shall be cleaned, tested and inspected. Each section of the sewer shall show, on examination from either end, a full circle of light between manholes.

b. Each manhole or other appurtenance to the system shall be of the specified size and form, be watertight, neatly and substantially constructed, with the top set permanently to exact position and grade. All repairs shown necessary by the inspection shall be made; broken or cracked pipe replaced; all deposits removed and the sewer left true to line and grade, entirely clean, and ready for use.

c. In paved areas, final inspection of manhole construction will be performed after all roadwork is complete.

3. Air Leakage Test of Sewers

a. General: On all sanitary sewer lines, the Contractor shall conduct a line acceptance test using low pressure air. The air test shall be conducted after the pipe has been backfilled and the cost of air testing shall be included in other items of work. Equipment to be used in making the test shall be specifically designed for this purpose and shall be Cherne Air-Loc Equipment or approved equal. The Engineer shall be advised at least 48 hours before tests are conducted.

b. Procedures: All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psi. The sealed pipe shall be pressurized to 5 psi. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedures, the plugs shall be placed in the line at each manhole and inflated to 25 psig.

Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize. After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected.

The test of that portion of line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that be over the pipe) shall not be less than the time shown for the given diameters in the following table:

Pipe Dia. In Inc. Minutes

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4” - 2.0

6” - 3.0

8” - 4.0

10”- 5.0

12” - 5.5

15” - 7.5

18” - 8.5

21” - 10.0

24” - 11.5

In areas where ground water is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one the sewer lines entering the manholes. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same.) Other methods for determining groundwater level may be used if approved in advance and if results are expected to be accurate in determining the groundwater level.

Should the line fail the pressure test, the Contractor shall, at his expense, determine the source of leakage and make repairs as necessary to eliminate leakage. Air testing shall be in addition to infiltration tests specified in Paragraph 3.03.A.4.

4. Mandrel Test of Sewers

All PVC sewer lines shall be tested by the Contractor at his expense for diametric deflection using a GO-NO-GO type mandrel or other approved method. The mandrel shall have an outside diameter of not less than 95 percent of the PVC pipe inside diameter. This testing shall be accomplished prior to final acceptance, but after the pipe has been backfilled completely.

5. Infiltration

Leakage into the sewer shall not exceed 100 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours to any section between successive manholes. The

amount of leakage shall be measured by a suitable weir or other device. All equipment and labor for measuring the infiltration shall be furnished by the Contractor.

If the infiltration exceeds the above specified amount, the Contractor shall make the necessary corrections to bring it within the acceptable limits. All visible leaks or points of infiltration shall be repaired even though the infiltration is below the maximum specified.

SEWAGE FORCE MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work under this Section includes providing pressure pipe and appurtenant items for sewage force mains.

B. Related Work Specified Elsewhere:

1. Section I - Trenching, Backfilling and Compacting for Utility System

2. Section III - Concrete

1.02 QUALITY ASSURANCE

A. Design Requirements:

1. Force mains shall be laid with a minimum cover of 30-inches and a maximum cover of 72-inches below finished grade, unless otherwise indicated.

2. Sewage force mains shall be constructed of the materials as set forth herein.

3. Force mains shall be constructed of Class 200 PVC pipe with Class 350 ductile iron fittings, unless otherwise indicated.

4. Changes in vertical and horizontal alignment of less than twenty-two (22) Degrees may be achieved through use of allowable pipe joint deflection in lieu of fittings at the Contractor's option, but subject to approval of the Engineer. Said deflection shall not exceed limits set forth in applicable AWWA Standards and/or the pipe manufacturer's recommendation.

B. Pipe Inspection: The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. All pipe and fittings shall be subjected to visual inspection at time of delivery by rail or truck, also just before they are lowered into the trench to be laid, and joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials

used are such as to produce inferior pipe or fittings.

C. Prevention of Electrolysis:

1. Where deemed necessary, electrolytic action through the contact of dissimilar metals, shall be prevented by either:

a. The separation of one material from the other by means of an insulating or dielectric coupling, or

b. The use of alternative materials, as directed by the Engineer.

1.03 SUBMITTALS

A. Shop Drawings:

1. In general, 6 copies of the following shop drawings shall be submitted to the Engineer for approval prior to construction:

a. Mill test certificates or certified test reports on pipe

b. Details of restrained and flexible joints

c. Valve vaults

d. Valves and valve boxes

e. Air release valves

f. Pipe laying schedule

g. Temporary plug and anchorage system for hydrostatic pressure test

2. A copy of the approved shop drawings shall be sub- mitted to the Owner prior to delivery of materials.

B. Record Information: Record drawings shall be prepared and submitted to Gulf Shores Utilities. These record drawings shall specifically locate via discrete, manual measurements of each and every component of the installed system, including: main line alignment and depth, transitions in main line pipe material, main line fittings, valves, air release valves, blow-offs, and any other such items or project elements as may be required. Location by triangulation measurements will be strictly enforced. Stationing of features from a remote initiation point will not be acceptable. Use of intangible features (e.g. Survey Lines, Property Lines, etc.) as a reference point will not be acceptable.

1.04 JOB CONDITIONS

A. Water in Excavation: Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines

being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned as directed by the Engineer so that the entire system will be left clean and unobstructed. (See Section IV-1.05).

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PART 2 - SEWER FORCE MAINS

A. MATERIALS

EFFECTIVE JANUARY 1, 2014, ALL MATERIALS SHALL MEET NSF/ANSI 61 STANDARDS (LEAD FREE MATERIALS)

APPROVED PRODUCT

PVC PIPE: SDR 21 CLASS 200

FITTINGS: CLASS 350 DUCTILE IRON

JOINT RESTRAINT: M.J. RETAINER GLANDS, EBBA IRON SERIES, 1100 MEGALUG

GATE VALVE: RESILIENT SEAT M.J. W/2" OPERATING NUT, MUELLER, CLOW OR AMERICAN DARLING

CHECK VALVE:

TAPPING SLEEVE(PVC): STAINLESS STEEL JCM 452, JCM 459, JCM 462 or Smith-Blair 665.

TAPPING SLEEVE(D.I.): JCM 452, JCM 459, JCM 462 or Smith-Blair 665

TRACING WIRE: 12 GAUGE, COATED GREEN

I.D. TAPE: NON-METALLIC GREEN LABELED "SEWER LINE"

VALVE BOXES: CAST IRON

VALVE MARKERS: FIBERGLASS/PLASTIC, 66"IN LENGTH MARKED "SEWER" VALVE

PIPELINE MARKERS: FIBERGLASS/PLASTIC, "66" IN LENGTH MARKED SEWER LINE

B. Ductile Iron Fittings:

1. Fittings:

a. All ductile iron fittings shall be Class 350 mechanical joint or single gasket, push on type with a minimum pressure rating of 150 psi and shall conform to the requirements of ANSI Standard A21.10.

b. Mechanical joint and/or single gasket, push on type fittings shall be polyethylene lined,

seal coated and outside coated with a Tnemec or Permox coating.

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PRESET LOW PRESSURE SEWER SERVICE/PRODUCT LINE

All new subdivisions shall be equipped with pre-set Low Pressure Sanitary Sewer Service for residential lots. Pre-set Low Pressure Sewer service installations shall consist of the following materials:

1" Low Pressure Sewer Pre-Set Service

Service saddle, Ex: JCM #406-IP, Smith-Blair 317-IP or Ford FC202-IP. Epoxy Coated w/Double Stainless Steel Bale's & Hardware. All service saddles are to be equipped with a 1" AWWA(IP) outlet thread. Sewer Service connections established on ductile iron piping are to direct tapped utilizing a 1" AWWA (IP) drill tap & installing a 1" ground key corporation stop style valve.

1" Ground Key Corporation Stop IPE, PE Mueller H-15029 or Ford F1101-4Q

1" Curb Ball Stop IPS, PE Quarter turn check w/lock wing, Mueller B-25196 or Ford B61-444-WQ

1-1/4" Check Valve, Bronze - Kitz #104, 1-1/4" Bronze single swing check valve, fip x fip.

Brass Service Materials ****Domestic Source Only****

1" x close Brass pipe nipple

1-1/4" x 1" Brass hex bushing reducer, mip x fip

1-1/4" Brass tee

1-1/4" Brass plug

1-1/4" x close Brass pipe nipple

Service Line - 1" IPS PET, 1" SDR 7 IPS Pet, Driscopipe 5100 ultraline or Orangebury equivalent

Service Line Color Black or Green, solid color

Tubing Insert - 1" IPS, stainless steel tubing liner - Ford #53-72 (1.049 ID) or Mueller Equivalency, #505142.

Service Valult PVC Carson Brooks Model 1220B Series

CB 1220-12B(Base)color green

CB 1220-5B(Lid) color green, solid, stamped Sewer

Security Locks Highfield firomatic #6 Barrel lock & cap, stainless steel w/dust cap #6

Firomatic lock #93180128 w/dust cap #9311016

Locater Wire 12AWG, Solid green (ATTACHED TO 1" IPS PET SERVICE LINE)

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3. Joints: Mechanical joints consisting of bell, socket, gland, gasket, bolts and nuts shall conform to ANSI Standard A21.11. Bolts shall be high strength, annealed, cast iron, or high strength low allow steel, T-head type having hexagonal nuts. Bolts and nuts shall be machined true and nuts shall be tapped at right angles to a smooth bearing surface. Single seal gasket push on type joints shall conform to the requirements of ANSI A21.11 and shall be "Tyton", "Fastite", "Super Bell Tite", "Altite", or approved equal.

4. Restrained Joints: Joint restraints shall be Series 1100 Megalug Ductile Iron retainer glands as manufactured by EBAA Iron.

5. Gaskets: Gaskets shall be of neoprene and shall have plain tips unless otherwise specified.

C. Polyvinyl Chloride Pipe And Fittings:

1. Pipe:

a. Polyvinyl chloride (PVC) pipe 2-inches and larger in diameter shall conform to the requirements of ASTM Designation D 2241, Class 1120 or 1220, SDR 21 for a minimum pressure rating of 200 psig at 73.4-1/4F and green in color for sewer. All PVC pipe shall bear the approval seal of the National Sanitation Foundation (NSF) for potable water pipe.

b. Polyvinyl chloride pipe smaller than 2-inches shall conform to the requirements of ASTM Designation D 1785, Class 1120 or 1220, Schedule 80 pipe with a minimum pressure rating of 400 psig. at 73.4-1/4F for unthreaded pipe.

c. All polyvinyl chloride (PVC) pipe shall be laid with 14 AWG THHN solid wire, green in color, buried one foot above and parallel to the pipe. The locator tape shall be at least two inches wide and shall be lettered, "CAUTION; SANITARY SEWER BURIED BELOW" and laid two feet above and parallel

to the pipe.

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2. Fittings:

a. PVC pipe fittings 2-inches and 3-inches shall be molded and shall be furnished by the manufacturer of the pipe with which they are used and conform to the requirements of ASTM Designation D 2467. All PVC pipe shall conform to requirements of ASTM Designation D 2467. All PVC pipe fittings shall bear the approval seal of the National Sanitation Foundation (NSF) for potable water pipe.

b. Fittings for PVC pipe smaller than 2-inches shall be Schedule 80 PVC with threaded joints and conform to the requirements of ASTM Designation D 2467 and D 2464 respectively.

c. Fittings for PVC pipe 4-inches to 12-inches shall be ductile iron fittings with transition gaskets. Ductile iron fittings shall be Class 350 mechanical joint with a minimum pressure

rating of 150 psi, and shall conform to the requirements of ANSI Standard A21.10.

d. All PVC pipe fittings shall bear the approval seal of the National Sanitation Foundation (NFS) for potable water pipe.

3. Joints:

a. PVC pipe 2-inches and larger shall have provision for expansion and contraction provided in the joints. All joints shall be designed for push on make up connection. A push on joint shall be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross section. Joints shall conform to the requirements of ASTM Designation D 3139 and provide for the pressure rating of the pipe.

b. Joints in PVC pipe smaller than 2-inches shall be threaded or push-on in accordance with the recommendations of the pipe manufacturer. Threaded joints shall be used only with Schedule 80 pipe or better. At threaded joints between PVC and metal pipes, the metal shall contain the socket end and the PVC side the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.

C. Gate Valves:

1. Gate valves 2-inches in diameter and larger shall be iron body, nonrising stem, bronze mounted resilient type gate valves, mechanical joint conforming to requirements of the AWWA Standard C509 and shall be provided with a 2-inch square operating nut. Valves shall turn to the left (counterclockwise) to open. All valves shall be provided with O-ring seals while in service without undue leakage. All valves shall be Mueller or Clow.

2. Gate valves for pipe less than 2-inches in diameter shall conform to the requirements of Federal Specifications WW-Y-54 for Class A, Type I, and shall be bronze, single wedge, nonrising stem, screwed bonnet, 125 pound S.P., 300 pound W.O.G. with stuffing box repackable under pressure and all parts renewable. Ends shall be as shown on the Drawings.

3. Valve Stem Extension: All Valves in which the operating nut is greater than 4 feet below finish grade shall be provided with extension stems to bring the operating nut to within 2 feet of the finished grade. The extension stem shall be provided with a 2-inch square operating nut on top and a coupling to connect the extension to the operating nut of the valve. A stem guide shall be provided to keep the valve stem extensions concentric with the valve box. Extension stems shall be of the same diameter as the valve stem unless otherwise specified.

D. Check Valves:

1. Swing check Valves 4-inches and larger shall have a cast iron or cast steel body with a bronze or stainless steel seat ring, non-corrosive shaft for attachment of weight and lever and a 300 psi hydrostatic test pressure rating. Check valves shall absolutely prevent the return of water back through the valve when the inlet pressure decreases below the delivery pressure. The valve must be full opening, tight seating and its seat ring shall be renewable and must be securely held in place by a threaded joint; the valve disc shall be of cast iron or cast steel and shall be suspended from a noncorrosive shaft which will pass through a stuffing box. A tapped boss with plug shall be provided on the check valve bonnet for future use with a pressure gauge. All check valves shall be Mueller or Clow with weight and lever.

2. Check valves smaller than 4-inches shall be bronze, bronze disc, swing check valves with lever and weight conforming to Federal Specification WW-V-51E, Type 4 Class A-125 pound. Ends shall be as shown or indicated on the Drawings.

E. Valve Vaults: Valve vaults shall be of precast concrete of the type shown on the Drawings and shall conform to the applicable requirements of Section III. The cover for the nontraffic bearing vault shall be constructed of 3/16-inch steel floor plate with reinforcement or 1/4-inch aluminum diamond plate rated at 150 psi. After fabrication, the steel covers shall be galvanized by the hot dip method in conformance with the requirements of ASTM Designation

A 123.

F. Valve Boxes: Cast iron valve boxes shall be provided for all valves installed underground. The valve boxes shall be adjustable to fit the designated depth of earth cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping.

Valve boxes shall be 3 piece type and have an interior diameter of not less than 5-inches. The valve boxes shall be provided with covers marked with the word "SEWER". The covers shall be so constructed as to prevent tipping or rattling. Boxes shall be equal to Clow Corporation No. F-2450, or Mueller Co. No. H-10357. Extension sections shall be ductile or cast iron. Each box shall have an at-grade 2' diameter by 4" thick protective ring constructed of Class B concrete. (See Section III)

G. Air Release Valves:

1. Automatic air release valves shall be APCO Model 400, or approved equal manufactured for sewage service. The valves shall be so designed that they will not stick shut or leak water under continued long

Operating conditions and to insure opening under high internal pressure. The design shall incorporate a solid settling chamber or trap and a flushing system by which the trap and the entire valve can be back flushed and cleaned.

H. Concrete: Concrete shall conform to the requirements of

Section III.

I. Castings: Gray iron castings for manhole frames, covers and other items shall conform to the ASTM Designation A48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown on the drawings. The words " GULF SHORES SANITARY SEWER" shall be cast in the manhole cover. The manhole frame and cover shall be traffic bearing - Vulcan Foundry V-1418-1B, Type 2 Pick Hole or approved equal.

J. Tie Rods: Steel for tie rods and tie bolts shall conform to the requirements of ASTM Designation A 242, and rods shall be galvanized in conformance with requirements of ASTM Designation A 123. Tie rods and tie bolts shall be Super Star Tierod Figure No.SS12

and Tiebolt Figure No.SST7 respectively as manufactured by Star National Products.

K. Coal Tar Epoxy: Coal tar epoxy shall be Kopper's Bitumastic 300M, Tnemec 46-413 Tneme-Tar or approved equal.

L. Tapping Sleeves: Tapping sleeves shall have full encirclement end gaskets so as to completely encapsulate the tap zone. Tapping sleeves shall be as manufactured by Mueller or Clow or JCM 452.

M. Additional Work: Additional items of construction, necessary for the complete installation of the systems, shall conform to specific details shown on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Bedding:

1. Pipe Cradle: Upon satisfactory installation of the pipe bedding material as specified in Section I, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

2. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

3.02 INSTALLATION

A. General

1. Sewer force mains shall be installed as generally located on the plans. **All fittings and valve assemblies shall be restrained to at least one full joint of PVC pipe in each direction.** Additional joint restraint may be required in poor soil conditions. Pipe shall not be laid in trenches that contain water. Approved means, shall be used by the Contractor to assure conformance to required grade. Pipe shall not be laid in trenches that contain water. Sewer force mains shall be located a minimum of five (5) feet from any paved areas or sidewalks to allow room for service taps. Sewer force mains shall be installed with a minimum of 30 inches of cover unless groundwater is encountered. In no case shall the sewer force main be installed with less than 24 inches of cover.

2. Pipe Joint Deflection: Pipe shall not be "bent" between joints to attain desired alignment. Deflection is allowable only at joints and in amounts in accordance with pipe manufacturer's recommendations. Required deflection shall be achieved by use of appropriate fittings.

3. Rejects: Any pipe found defective shall be immediately removed and replaced with

sound pipe at the Contractor's expense.

4. Anchors: Concrete thrust blocks shall be placed at all bends, tees, plugs and other fittings to provide lateral support, except when restrained joints are specified. Thrust blocks shall conform to the details shown on the Drawings.

5. PVC: Polyvinyl chloride pipe may be damaged by prolonged exposure to direct sunlight and the Contractor shall take necessary precautions during storage and installation to avoid this damage. Pipe shall be stored under cover and sufficient backfill to shield it from the sun shall be placed as the pipe is installed.

4. Restrained Joints: Joint restraints shall be Series 1100 Megalug Ductile Iron retainer glands as manufactured by EBAA Iron.

C. Polyvinyl Chloride Pipe Joints:

1. PVC pipe 2-inches and larger shall have provision for expansion and contraction provided in the joints. All joints shall be designed for push on make up connection. A push on joint shall be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross section. Joints shall conform to the requirements of ASTM Designation D 3139 and provide for the pressure rating of the pipe.

2. Joints in PVC pipe smaller than 2-inches shall be threaded or pushed on. Threaded joints shall be used only with Schedule 80 pipe, or better. At threaded joints between PVC and metal pipes, the metal shall contain the socket end and the PVC side the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.

D. Installing Valves And Boxes:

1. Valves: Valves shall be carefully inspected, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Valves, unless shown otherwise, shall be set with their stems vertically above the center line of the pipe. Any valve that does not operate correctly shall be removed and replaced.

2. Valve Boxes: Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve key to be fitted easily to the operating nut. Valve boxes shall be set to conform to the level of the finished surface and held in position by a ring of concrete placed under the support flange as shown on the Drawings. The valve box shall not transmit surface loads to the pipe or valve. Care shall be taken to prevent earth and other material from entering the valve box. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset. Before final acceptance of the work all valve boxes shall be adjusted to finish grade. Valve boxes shall be of

the appropriate length to extend from the valve to the surface when properly adjusted. No field-fabricated extensions shall be accepted. Valve box shall be centered on the operating nut of the valve and shall be held in place by a 2-foot square concrete collar or a pre-cast collar. Valve box lids shall be marked "SEWER". Valve markers shall be placed adjacent to each valve parallel with the pipe. Pipeline markers shall be placed parallel to the main at 500-foot intervals and each way from fittings to indicate any change in direction.

E. Backfilling:

1. After pipe has been laid, inspected, and found

satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place during the conduction of the preliminary hydrostatic test. Backfill material shall be dry and free from materials that may damage pipe(stumps, rocks, etc.) In wet conditions, select fill materials may be required. Dead end sewer force mains shall be terminated with an approve d flushing assembly. No backfill shall be placed over joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.

2. Upon satisfactory completion of the preliminary hydrostatic test, backfilling of the trench shall be completed. (See Section I)

F. Identification: All polyvinylchloride (PVC) pipe shall be laid with locator wire buried one foot above and parallel to the pipe. The locator wire shall be at least two inches wide and shall be lettered, "CAUTION: SANITARY SEWER BURIED BELOW." 14 AWG THHN solid green will be laid two feet above and parallel to the pipe. Where transitions from PVC to DI or DI to PVC occur, provision must be made to insure continuity of locator tape/wire. Also insure continuity at fittings and valves.

G. Location In Relation To Water Lines: Refer to Section IV,

Paragraph 3.02.H. Non metallic tape identifying the pipe as a sewer line shall be installed directly above the wire.

3.03 FIELD QUALITY CONTROL

A. Flushing: All force mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall be at least 4-feet per second.

Flushing shall be terminated at the direction of the Engineer. The Contractor shall dispose of the flushing water without causing a nuisance or property damage. No flushing shall be performed without approval from Gulf Shores Utilities (GSU).

B. Cleaning: Prior to pressure and leakage testing, the interior of each main shall be cleaned of accumulation of sand and other foreign matter by pressure or hand methods. Hand cleaning methods may consist of shoveling the material and pressure cleaning with a water hose. Care shall be exercised in cleaning to prevent damage to the pipe lining.

C. Hydrostatic Tests:

1. All components of the force main system, including fittings, connections and valves shall remain uncovered until tested and accepted; provided, however, that pipe trenches under traveled streets or roads or in unstable soil conditions may be backfilled with the permission of the Engineer. No testing shall be done until all concrete thrust blocking is in place and set. If high-early strength concrete is used, testing may be conducted 48 hours after the concrete is placed; otherwise thrust block concrete must cure 5 days before pressure testing commences. In testing, the part of the system under test shall be filled with water and subjected to a sustained pressure of 100 pounds per square inch. The piping may be tested in sections, thereby testing each valve for secure closure. While the system is being filled, air shall be carefully and completely exhausted. If permanent air vents are not located at all high points, the Contractor shall install corporation stops or fittings and valves at such points so the air can be expelled as the pipe system is slowly

filled with water.

2. Test pressure shall be maintained for 2 hours until all sections under test have been checked for evidence of leakage. Rate of loss shall not exceed that specified hereinafter. Visible leaks shall be corrected regardless of total leakage shown by test.

3. All pumps, gauges and measuring devices shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Engineer. Contractor shall provide a recording pressure gauge with minimum twelve inch (12") diameter chart and certification of calibration for same. All pressure and leakage testing shall be done in the presence of a representative of the Owner.

4. Water for testing and flushing shall be potable water provided by the Contractor from a source approved by the Engineer.

5. Preliminary pressure testing may be waived by the Engineer for pipe 24-inches in diameter and larger.

D. Allowable Limits For Leakage:

1. The hydrostatic pressure tests shall be performed as hereinabove specified and no installation, or section thereof, will be acceptable until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD\sqrt{P}}{133200}$$

in which,

L = Allowable leakage, in gallons per hour

S = Length of pipe being tested in feet

D = Nominal pipe diameter; in inches

P = Average test pressure during the test, in psi gauge.

Pressure must be maintained +/- 5 psi by pump-ups. Last step in test will be to add water to verify the final pressure of 100 psi.

2. For a 1000-foot segment of main with average test pressure of 100 psi the following table may be used.

Pipe Diameter(D)	Allowable Leakage(L)	Pipe Diameter(D)	Allowable Leakage(L)

Inches	Gal./Hr.	Inches	Gal./Hr.
3	0.23	14	1.05
4	0.30	16	1.20
6	0.45	18	1.35
8	0.60	20	1.50
10	0.75	24	1.80
12	0.90	30	2.25

3. Water shall be supplied to the main during the test period as required to maintain the test pressure as specified. The quantity used, which shall be compared to the above allowable quantity, shall be measured by pumping from a calibrated container. A 5/8-inch meter installed on the suction side of the pump may be used to measure the leakage for large mains when approved by the Engineer.

E. Correction Of Work: Where leakage exceeds the allowable limit, as specified hereinbefore, the defective pipe or joints shall be located and repaired. If the defective portions cannot be located, the Contractor shall remove and reconstruct as much of the work as is necessary in order to conform to the specified limits. Any visible leaks or any defective pipe or joint shall be repaired or replaced as directed by the Engineer even though the total leakage is within the specified allowable limits. No additional payment will be made for the correction of defective work, or to damage to other parts of the work resulting from such corrective work.

3.04 SCHEDULE

A. Connection To Existing System:

1. All connections to existing mains shall be made to conform with the requirements and under the direction of Gulf Shores Utilities (GSU). Valves separating the mains being installed from existing mains shall be operated by or under the direction of GSU. Some connections may require night work when peak flows are not anticipated. The cost of the work in making the connections shall be paid for by the Contractor.

2. In the event the proposed main is to be connected to a main which is in service, a temporary plug or cap shall be installed on the new main until the pressure tests are completed. Upon satisfactory completion, the cap or plug shall be removed from both mains and the connection made. The connection shall be made as swiftly as possible and any water in the ditch shall be kept below the level of the pipe. The pipeline shall then be placed in service by Gulf Shores Utilities personnel.

3. In the event any existing users will be without service while a connection is being made, the Contractor shall notify GSU of when the service will be turned off and when he estimates service will be resumed. In some instances, these connections may have to be made at night. No user shall be without service for more than two hours. In some cases, Gulf Shores Utilities may require the Contractor to provide temporary service to these

affected customers.

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SECTION VII

SUBMERSIBLE PUMP STATION

Part 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and install a submersible wastewater pumping station consisting of two submersible pumps, controls, hatch covers, fast-out assemblies, guide rails, liquid level controls, panel, electrical connections, meter base, main disconnect switch, emergency transfer switch, wet well, valve box, and all necessary appurtenances, as shown on the drawings and specified herein, complete and ready for operation.

B. RELATED WORK

1. Section II - Structure Excavation & Backfill For Pump Station

2. Section III - Concrete

1.02 QUALITY ASSURANCE

A. DESIGN REQUIREMENTS

1. Wet Well Dimensions and Pump Design Capacity shall be as detailed on the drawings.

B. SUBMITTALS

1. Shop Drawings

The Contractor shall provide six sets of shop drawings prepared by the manufacturer and submitted to the Design Engineer for review prior to the manufacture of the equipment. The shop drawings shall include outline dimensions and external connection diagrams.

A list of components, curves showing complete pump performance from shutoff to at least 15 percent below rated head conditions, brake horsepower and NPSH required, control panel one-line wiring diagram and specifications, and a copy of the manufacturer's warranty shall be included with each set of submitted ! data. One copy of the approved submittals shall be provided to the Owner prior to the delivery of equipment or materials.

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2. Manuals

Operating, maintenance, and repair manuals (4 copies) for all major equipment and items shall be submitted to the Owner's Engineer.

C. GUARANTEE

All equipment shall be guaranteed against defects in material and workmanship for a period of one year from the date of Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

Part 2 - PRODUCTS

2.01 MATERIALS

A. SUBMERSIBLE PUMPS

1. Pump Design

Each pump shall be designed with a close-coupled electric motor which permits continuous operation with the pump totally submerged or with the motor completely removed from the pumped media. Pumps shall be as manufactured by Flygt Corporation, Sulzer-ABS or Wilo Corporation.

2. Construction

All major parts, such as the pump casing, seal housing, motor housing, motor and cap, sliding bracket, and impeller, shall be of gray iron and shall be painted with a PVC epoxy primer with chloric rubber paint finish. All nuts, bolts, and miscellaneous hardware in the wet well or in contact with pumped material shall be stainless steel (Type 304).

Each pump shall be provided with a mechanical rotating shaft seal in an oil reservoir. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The impeller shall be capable of handling solids, fibrous material, heavy sludge and other matter found in normal sewage applications. The impeller shall be statically and dynamically balanced.

The electric motor shall be NEMA Design B with Class F insulation, and designed for continuous duty. The cable entry seal design shall be such to insure a watertight and submersible installation. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be sized to allow motor voltage conversion without replacing the cable.

Each motor shall incorporate an ambient temperature compensated overheated sensing device and a moisture sensing device wired in series. The protective devices shall be wired into the pump controls in such a way that if either device operates, the pump will shut down.

3. Mounting

The manufacturer shall provide cast iron fast-out fixtures to allow the pump to be installed or removed without requiring personnel to enter the wet well. The fixtures shall consist of a discharge elbow permanently mounted to the floor of the wet well, a sliding guide bracket which shall be an integral part of the pump unit, two stainless steel slide rails which will guide the pump into position, and stainless steel lifting cable, as shown on the plans.

B. PUMP CONTROL PANEL

1. Scope and Panel Operation: The control logic shall operate two electrical submersible pumps at the power characteristics as specified.

The control logic shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump will automatically start to handle the increased flow. As the liquid level decreases, the pumps will shut off at the elevations shown on the plans. In the event of a malfunction or a flow that exceeds the capacity of the pumps, a high level audible and light alarm will be excited to indicate alarm conditions. A silencer shall lock out the audible alarm; however, the alarm light shall release only with the correction of the high level condition or depression of the high-level reset button. Pumps shall alternate as lead and lag pumps on a continuous basis.

2. Construction and Materials: The control panel shall be NEMA 3R, Type 304 stainless steel with dead front aluminum inner door, and mounted as shown on the Drawings.

3. Panel Exterior: Mounted on the exterior enclosure shall be an alarm light and a high water level audible alarm with silencer button.

All exterior mounted accessories shall be constructed of corrosion proof materials such as stainless steel or aluminum.

Control wiring from the wet well shall enter the panel in a manner to prevent the possible entry of gases from the wet well.

4. Panel Inner Door: The inner aluminum door mounted on a continuous hinge, will be furnished for protection against exposed wiring and will have cutouts for access to the circuit breakers and pump resets mounted on the inner door will be pump run lights, level indication lights, hand-off-automatic switches, elapsed time meters, main circuit breaker, a fifteen (15) ampere ground fault duplex receptacle, motor resets, control circuit breaker, duplex receptacle breaker, motor circuit breakers, and lightning arrestor, motor high temperature lights, seal failure warning lights, high level light and reset buttons.

A permanently affixed 11" x 17" (minimum laminated panel wiring schematic and pump data sheet) shall be installed on the interior of the enclosure door.

5. Control Circuits: In order to ensure maximum personnel safety, all wet well (level sensor) circuits shall be run at 24 volts DC. The control circuit breakers shall be run at 115 volts.

6. Panel Components: The following power, control and alarm components shall be provided:

a. Circuit Breakers: All circuit breakers shall be heavy duty ER molded case breakers as manufactured by Siemens or equal. The main circuit breaker shall be provided with provisions for locking in an "on" or "off" position.

b. Duplex Service Receptacle: A duplex service receptacle supplying 15 amps at 115 volts shall be provided on the panel door. The duplex receptacle shall be provided with ground fault protection.

c. Lightning Arrestor and Surge Capacitor: A lightning arrestor and surge capacitor shall be installed and wired to protect motors and control equipment from lightning induced line surges and transient voltage surges.

d. Elapsed Time Meters: Elapsed time meters shall be 115 volt non-reset types and shall indicate pump running time in hours and tenths of hours to 99999.9 hours; total of three, one for each pump and one for simultaneous operation.

e. Motor Starters: The panel shall contain two NEMA (FVNR) starters. The motor starters shall be across the line magnetic starters with individual overload protection on each power leg with motor resets installed through the dead front door. Acceptable manufacturer is Allen-Bradley or equal, approved by GSU.

f. Phase Monitor (for 3-phase pump motors only): A phase monitor shall be installed and wired to disconnect control power from the motor starters in the event of loss of power, phase reversal, loss of any phase or phase balance, or low voltage. The phase monitor shall automatically reset upon removal of any and all of the preceding conditions and shall be RK electronics Model PV RO-200-AR.

g. Pump Run Lights: A 115 volt pump run lights shall be connected in parallel with each motor starter and indicate when a particular pump is running.

h. Control System: The control system shall consist of: 115 volt transformer; plug-in relays; automatic alternator Furnas 47AB10AF with test switch; plug-in three phase monitor (as required); and terminal strips for the installation of four level regulators. All control wiring shall be color coded (minimum of 18 colors) size 16, rated for 300 volts, 80 C stranded tinned copper, PVC insulated, and shall be installed in wiring duct with cover.

i. Audible Alarm: The audible alarm shall consist of a weatherproof high intensity electronic horn mounted on the side of the enclosure. The audible alarm shall be equipped with a control panel mounted push-button silencer. The alarm circuit will not automatically reset when the high liquid level condition is corrected, and can be canceled via panel mounted resets.

j. Liquid Level Indication Lights: A 115 volt level indication light shall be connected in parallel with each liquid level control sensor and indicate when a particular liquid level sensor is activated.

k. Alarm Light: The alarm light shall consist of a weatherproof light with lexan globe. The alarm circuit will not automatically reset when the high liquid level condition is corrected.

l. Moisture and Temperature Sensors: One moisture and one temperature sensing relay with associated red indicator lights for each pump shall be mounted in the dead front panel. These sensors shall operate on 115V and detect moisture in the casing of the submersible pump and excessive heat within the pump motor. If over-temp condition is noted, then the indication light shall light and the pump shall disconnect. If leak condition is noted, then indication light shall light but the pump shall not disconnect.

C. WET WELL AND VALVE VAULT

Wet Well and Valve Vault shall be of precast concrete as shown on the drawings and shall conform to the applicable requirements of Section III.

D. ACCESS COVERS

1. Wet Well: The Contractor shall furnish and install a single or double leaf aluminum access door. Door leaf shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 150 pounds per square foot. Access covers shall be hinged and hasp-equipped, including stainless steel guide rail bracket and holders with safety loops for lifting cable and motor cable. Access cover shall be provided with stainless steel hardware and shall have bituminous coating on all aluminum in contact with concrete. Minimum opening dimensions shall be in accordance with pump manufacturer's recommendations.

2. Valve Box: The Contractor shall furnish and install one double leaf aluminum access door. Door leaf shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 150 pounds per square foot. Access covers shall be hinged and hasp-equipped with stainless steel hardware and shall have bituminous coating on all aluminum in contact with concrete. Interior of valve box shall have a minimum of 24-inches clearance between inside wall and any pipe, valve or device.

3. Manual Lift Station By-Pass: The contractor shall install a manual bypass connection on the outside of the check valve vault. Connection shall be installed with a MJ or flanged tee, MJ or flanged gate valve w/cast iron valve box and top, MJ or flanged 90 degree elbow turned vertical, ductile spool piece with minimum 24ï¿½ above grade level and another 90 degree flanged elbow w/6ï¿½ mail cam lock fitting.

1. Materials

Pipe - Class 51 ductile

Gate Valve ï¿½ Resilient seat w/2ï¿½ operating nut

Fittings ï¿½ Tee 150# Class 350 ductile

90 degree elbows 150# Class 350 ductile

6ï¿½ 150# threaded RF flange X 6ï¿½ male cam

Lock aluminum

6ï¿½ cam lock dust cap aluminum

E. LIQUID LEVEL CONTROLS

Liquid level sensors with electrical cables (of the proper lengths) shall be provided to control the pumps based upon the control level elevations as shown on the Drawings.

The liquid level sensors shall be type 316 S.S., 5-1/2" diameter, #20 gauge floats, permanently assembled to the switch and cable. The cable shall be type S.O. with a nitrile PVC jacket, and 3-#14 AWG fine-stranded conductors. The switch shall be a mercury tilt type, with a less than 1" level differential. The AC resistive rating shall be 20 amps at 115, 10 amps at 230. The AC lamp load shall be 1000 watts. The mounting pipe, brackets, and U bolts shall be 316 S.S., and shall be capable of mounting to the slide rail system as detailed on the Drawings. The liquid level control shall be as manufactured by Consolidated Electric Company - Model 9G Direct Acting Float Switch.

F. MISCELLANEOUS METAL

All Miscellaneous Metal items located within the wet well shall be stainless steel (304)

Part 3 - EXECUTION

3.01 PREPARATION

A. All site preparation, excavation, and backfill shall be performed in accordance with Section II - STRUCTURE EXCAVATION AND BACKFILL FOR PUMP STATION.

3.02 INSTALLATION

A. WET WELL

Wet Well shall be installed in accordance with Drawings and applicable portions of Section III - CONCRETE.

B. PUMP SYSTEM

All pumping equipment and accessories shall be installed in accordance with Manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. MANUFACTURER'S REPRESENTATIVE

The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble-free operation, and instruct the operating personnel in the proper care and operation of the equipment, prior to the final acceptance of the station.

B. INSULATION TEST

Circuit insulation tests shall be performed to prove each circuit free of faults after all wiring is completed prior to equipment and fixture connections, and again after the installation is complete and ready for use.

Tests shall be made at the main electrical service connection between all conductors and between line conductors and ground. Tests shall be made with a minimum 500 Vdc instrument capable of accurately measuring the resistance involved. Readings shall be taken in the presence of the Design Engineer or his representative for each test and the written results of each test shall be submitted to the Engineer.

C. FIELD TEST

When the pumping facility is complete and ready for operation, then the station shall be inspected and tested for compliance to the contract documents. Test of the equipment shall be made by the Contractor in the presence of the Design Engineer, the Electrical Subcontractor (if used), the equipment manufacturer's representative, and the Owner's representative. The equipment tests shall include, but not be limited to, the following:

1. Pumps and Motors: Pumps shall be run and a determination made of the pumping capacity. Performance of the pumps shall meet the specified criteria when field tested. A pressure test shall be performed on each pump in the field.

2. Electrical: Recorded readings shall be made of voltage and amperage on all electrical components at start and operating conditions. Such readings shall be recorded on a form provided by the manufacturer and the results shall meet the manufacturer's prescribed limits. If a tested item fails to meet its requirements, then it shall be replaced. Results of the tests shall be given to the Design Engineer with the serial number of the accessory tested.

3. Controls: Controls shall be tested to determine satisfactory performance for starting and stopping at the proper liquid levels, pump sequence and alarm actuation.

4. Equipment: Equipment shall be operated to determine if the alignment is visually correct, that there is no overload or overheating or objectionable vibration and that all the operating features are in working order. Submersible pumps and level sensors shall be raised completely and reset to assure proper seating and operation.

5. Inspection: A thorough inspection of all mechanical and

electrical equipment and controls, piping, valves, fittings, brackets, mountings, seals, conduit, painting, sleeves, components, and features shall be made while the station is being tested to determine performance and compliance with design requirements and specifications.

6. Structure: The station shall be inspected for performance, structural soundness, and water tightness.

7. Repairs, Adjustment and Replacements: The Contractor shall make any and all necessary repairs, adjustments, and replacements until performance has been demonstrated to the satisfaction of the Owner's Engineer. The Contractor shall bear the cost of any repair, adjustment, and replacement.

D. SPARE PARTS

Spare parts for routine maintenance and repair as recommended by the equipment manufacturer shall be provided by the Contractor.

E. AS-BUILT DOCUMENTATION

As-Built documentation of the finished installation shall be made as a part of final acceptance and shall include certified record drawings, corrected submittals, operation and maintenance publications, and other data necessary to accurately define the final field installation.

SECTION 01401
STATEMENT OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

Project Name: Gulf Shores Utility Board - Wastewater Reclamation Facility Headworks Upgrade
Structural Engineering Firm: Dewberry Engineers Inc.

This Statement of Structural Tests and Special Inspections is being submitted as required by Chapter 17 of the **2021 International Building Code** (IBC-21). It includes the following:

1. Seismic requirements
2. Wind requirements
3. Qualification Requirements for Inspectors and Testing Technicians
4. Listing of Required Structural Tests and Special Inspections

The Construction Contractor's Quality Control Supervisor will provide copies of all special inspection reports and associated documentation to the Contracting Officer (CO). The Construction Contractor will be required to correct all deficiencies discovered in the Special Inspection and Structural Testing program.

Prepared By: Anthony D. Miller
(Type or print name)

Signature: _____ Date: 2/24/2022

Stamped by Professional Engineer (PE) or Structural Engineer (SE)

Seismic and Wind Requirements

Seismic Requirements, IBC-21 Section 1704.3

Description of seismic-force-resisting system and designated seismic systems subject to special inspections:

N/A

Wind Requirements, IBC-21 Section 1704.3

Description of wind-force-resisting system and designated wind systems subject to special inspections:

N/A

Instructions:

1. Under Listing of Required Structural Tests and Special Inspections:
    a. **Required?** - Place an **X** for all Special Inspections and Tests required for this project.
    b. **Required Qualifications** - Provide qualifications for the special inspector, using the Qualification Requirements for Inspector and Testing Technicians list below, for all required Structural Tests and Special Inspections.
    c. **Continuous** - If marked with an **X**, continuous special inspection shall be as defined in Chapter 2, IBC-21.
    d. **Periodic** - If marked with an **X**, provide the minimum number of tests, i.e. 20% of all field welds, or the amount of work to be inspected (e.g. 10% of all wall surfaces).
2. Attach completed Statement of Structural Tests and Special Inspections to the end of Division 1 Specifications **Section 01 40 00 Quality Requirements**.

Qualification Requirements for Inspectors and Testing Technicians

PE/SE	Structural Engineer – licensed PE or SE specializing in the design of buildings and structures
PE/GE	Geotechnical Engineer – licensed PE specializing in soil mechanics and foundations
EIT	Engineer-In-Training – graduate engineer who has passed the Fundamentals of engineering examination

American Concrete Institute (ACI) Certification

ACI-CCSI	Concrete Construction Special Inspector
ACI-LTT	Concrete Laboratory Testing Technician Level 1 or 2
ACI-STT	Concrete Strength Testing Technician
ACI-FTT	Concrete Field Testing Technician – Grade I

American Society of Non-Destructive Testing (ASNT) Certification

Non-Destructive Testing Technician – Level II or III

American Welding Society (AWS) Certification

AWS-CWI	Certified Welding Inspector

Exterior Design Institute (EDI) Certification

EDI-EIFS	Certified EIFS inspector

International Code Council (ICC) Certification

ICC-PCSI	Prestressed Concrete Special Inspector
ICC-RCSI	Reinforced Concrete Special Inspector
ICC-SSI	Soils Special Inspector
ICC-SFSI	Spray-applied Fireproofing Special Inspector
ICC-SMSI	Structural Masonry Special Inspector
ICC-SSBSI	Structural Steel and Bolting Special Inspector
ICC-SWSI	Structural Welding Special Inspector

National Institute for Certification in Engineering Technologies (NICET) Certification

NICET-CT	Concrete Technician – Levels I, II, III and IV
NICET-GET	Geotechnical Engineering Technician - Levels I, II, III and IV
NICET-ST	Soils Technician - Levels I, II, III and IV

Other

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Listing of Required Structural Tests and Special Inspections

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Steel Construction (IBC-21 Section 1705.2; American Institute of Steel Construction: AISC 360-16 Chapter N, AISC 341-16 Chapter J)				
	Prior to Welding (AISC 360-16 Table N5.4-1)				
	1. Welder qualification records and continuity records		X		
	2. Welding procedure specifications (WPS) available		X		
	3. Manufacturer certifications for welding consumables available		X		
	4. Material identification (type/grade)			X	
	5. Welder identification system			X	
	6. Fit-up of groove welds (including joint geometry)				
	a. Joint preparation			X	
	b. Dimensions (alignment, root opening, root face, bevel)			X	
	c. Cleanliness (condition of steel surfaces)			X	
	d. Tacking (tack weld quality and location)			X	
	e. Backing type and fit (if applicable)			X	
	7. Fit-up of CJP (complete joist penetration) groove welds of HSS (hollow structural sections) T-, Y- and K-joints without backing (including joint geometry)				
	a. Joint preparation				
	b. Dimensions (alignment, root opening, root face, bevel)				
	c. Cleanliness (condition of steel surfaces)				
	d. Tacking (tack weld quality and location)				
	8. Configuration and finish of access holes			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	9. Fit-up of fillet welds				
	a. Dimensions (alignment, gaps at root)			X	
	b. Cleanliness (condition of steel surfaces)			X	
	c. Tacking (tack weld quality and location)			X	
	10. Check welding equipment			X	
	During Welding (AISC 360-16 Table N5.4-2)				
	1. Control and handling of welding consumables				
	a. Packaging			X	
	b. Exposure control			X	
	2. No welding over cracked tack welds			X	
	3. Environmental conditions				
	a. Wind speed within limits			X	
	b. Precipitation and temperature			X	
	4. WPS followed				
	a. Settings on welding equipment			X	
	b. Travel speed			X	
	c. Selected welding materials			X	
	d. Shielding gas type/flow rate			X	
	e. Preheat applied			X	
	f. Interpass temperature maintained (minimum/maximum)			X	
	g. Proper position (F, V, H, OH)			X	
	h. Intermix of filler metals avoided unless approved (reference: AISC 341-10 Table J6.2)			X	
	5. Use of qualified welders		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	6. Welding techniques				
	a. Interpass and final cleaning			X	
	b. Each pass within profile limitations			X	
	c. Each pass meets quality requirements			X	
	7. Placement and installation of headed stud anchors		X		
	After Welding (AISC 360-16 Table N5.4-3)				
	1. Welds cleaned			X	
	2. Size, length and location of welds		X		
	3. Welds meet visual acceptance criteria				
	a. Crack prohibition		X		
	b. Weld/base-metal fusion		X		
	c. Crater cross section		X		
	d. Weld profiles		X		
	e. Weld size		X		
	f. Undercut		X		
	g. Porosity		X		
	4. Arc strikes		X		
	5. k-area		X		
	6. Weld access holes in rolled heavy shapes and built-up heavy shapes		X		
	7. Backing removed and weld tabs removed (if required)		X		
	8. Repair activities		X		
	9. Document acceptance or rejection of welded joint or member		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	10. No prohibited welds have been added without the approval of the EOR (Engineer of Record)		X		
	11. Placement of reinforcing or contouring fillet welds (if required) (reference: AISC 341-16)		X		
	Nondestructive Testing (AISC 360-16 Section N5 and AISC 341-16 Section J6)				
	1. Risk Category II Structures - Perform Ultrasonic Testing on 10% of CJP groove welds in butt, T- and corner joints subject to transversely applied tension loading, in materials 5/16 inch thick or greater.			X	
	2. Risk Category III or IV Structures - Perform Ultrasonic Testing on all CJP groove welds subject to transversely applied tension loading in butt, T- and corner joints, in materials 5/16 inch thick or greater.		X		
	3. Access Holes – Perform Magnetic Particle Testing or Liquid Penetrant Testing when the flange thickness exceeds 2 inches for rolled shapes, or when the web thickness exceeds 2 inches for built-up shapes.		X		
	4. Welded Joints Subject to Fatigue		X		
	Nondestructive Testing (AISC 341-16 Section J6)				
	Column Splice and Column to Base Plate PJP Groove Weld (AISC 341-16 Section J6 2b)				
	1. Perform Ultrasonic Testing on 100% of PJP (partial-joint-penetration) groove welds in column splices and column to base plate welds		X		
	2. CJP Groove weld		X		
	3. Lamellar tearing		X		
	4. Beam cope and access hole		X		
	5. Reduced beam section repair		X		
	6. Weld tab removal		X		
	Prior to Bolting (AISC 360-16 Table N5.6-1)				
	These inspections are not required for snug-tight joints.				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
X	1. Manufacturer's certifications available for fastener materials		X		
X	2. Fasteners marked in accordance with ASTM requirements			X	
X	3. Correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)			X	
X	4. Correct bolting procedure selected for joint detail			X	
X	5. Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements			X	
X	6. Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used			X	
X	7. Protected storage provided for bolts, nuts, washers and other fastener components			X	
	During Bolting (AISC 360-16 Table N5.6-2)				
	These inspections are not required for snug-tight joints.				
	These inspections are not required for pretensioned joints and slip-critical joints, when the installer is using the turn-of-nut method with matchmarking techniques, the direct-tension-indicator method, or the twist-off-type tension control bolt method.				
X	1. Fastener assemblies, of suitable condition, placed in all holes and washers (if required) are positioned as required			X	
X	2. Joint brought to the snug-tight condition prior to the pretensioning operation			X	
X	3. Fastener component not turned by the wrench prevented from rotating			X	
X	4. Fasteners are pretensioned in accordance with the RCSC (Resource Council on Structural Connections) Specification, progressing systematically from the most rigid point toward the free edges			X	
	After Bolting (AISC 360-16 Table N5.6-2)				
	Document acceptance or rejection of bolted connections.		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Other Inspection Tasks (AISC 360-16 Section N5.7)				
X	1. Verify compliance of fabricated steel with the details shown on the approved shop drawings.			X	
X	2. Verify compliance of the erected steel frame with the details shown on the approved erection drawings, including braces, stiffeners, member locations and joint details.			X	
	3. Anchor rods and other embedments support structural steel				
	a. Verify the diameter, grade, type and length of the anchor rod or embedded item.			X	
	b. Verify the extent or depth of embedment into the concrete.			X	
	4. RBS (reduce beam section) requirements, if applicable (AISC 341-16)				
	a. Contour and finish			X	
	b. Dimensional tolerances			X	
	5. Protected zone - no holes and unapproved attachments made by fabricator or erector, as applicable. (AISC 341-16)			X	
	6. H-piles - Protected zone - no holes and unapproved attachments made by the responsible contractor, as applicable. (AISC 341-16)			X	
	Cold-formed Steel Deck (IBC-21 1705.2.2)				
	1. Special inspections in accordance with QA/QC-2017 Standard for Quality control (QC) and Quality assurance (QA) for Installation of Steel Deck				
	Open-Web steel Joists and Joist Girders (IBC-21 Table 1705.2.3)				
	1. Installation of open-web steel joists and joist girders.				
	a. End connections - welding or bolted			X	
	b. Bridging - horizontal or diagonal				
	1. Standard bridging			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	2. Bridging that differs from the SJI (Steel Joist Institute) specifications listed in Section 2207.1.			X	
	Inspection of Composite Structures Prior to Concrete Placement (AISC 341-16 Table J9.1)				
	1. Material identification of reinforcing steel (Type/Grade)			X	
	2. Determination of carbon equivalent for reinforcing steel other than ASTM A706			X	
	3. Proper reinforcing steel size, spacing and orientation			X	
	4. Reinforcing steel has not been rebent in the field			X	
	5. Reinforcing steel has been tied and supported as required			X	
	6. Required reinforcing steel clearances have been provided			X	
	7. Composite member has required size			X	
	Inspection of Composite Structures During Concrete Placement (AISC 341-16 Table J9.2)				
	1. Concrete: Material identification (mix design, compressive strength, maximum large aggregate size, maximum slump)			X	
	2. Limits on water added at the truck or pump			X	
	3. Proper placement techniques to limit segregation			X	
	Inspection of Composite Structures During Concrete Placement (AISC 341-16 Table J9.2)				
	1. Achievement of minimum specified concrete compressive			X	
	Cold-formed Steel Trusses Spanning 60-feet or Greater (IBC-21 Section 1705.2.4)				
	1. Verify temporary installation restraint/bracing installed in accordance with the approved shop drawings.			X	
	2. Verify permanent individual truss member restraint/bracing installed in accordance with the approved shop drawings.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Concrete Construction (IBC-21 Section 1705.3)				
X	1. Inspect reinforcing steel, including prestressing tendons, and placement.			X	
	2. Inspection of reinforcing steel welding				
	a. Verify weldability of reinforcing bars other than ASTM A706.		X		
	b. Inspect single pass fillet welds, maximum 5/16 inch.			X	
	c. Inspect all other welds.			X	
X	3. Inspection of anchors cast in concrete.			X	
X	4. Inspection of anchors post-installed in hardened concrete members.				
X	a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension load		X		
X	b. Mechanical anchors and adhesive anchors not defined in 4 a			X	
X	5. Verify use of approved design mix.			X	
X	6. Prior to placement fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.		X		
X	7. Inspect concrete and shotcrete placement for proper application techniques.		X		
X	8. Inspect for maintenance of specified curing temperature and techniques.			X	
	9. Inspection of prestressed concrete:				
	a. Application of prestressing forces		X		
	b. Grouting of bonded prestressing tendons in the seismic-force-resisting system.		X		
	10. Erection of precast structural members			X	
	11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E, or F, inspect such connections and reinforcement in the field for:				
	a. Installation of the embedded parts		X		
	b. Completion of the continuity of reinforcement across joints		X		
	c. Completion of connections in the field		X		
	12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5 (American Concrete Institute).			X	
	13. Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.			X	
X	14. Inspection formwork for shape, location and dimensions of the concrete member being formed.			X	
	Masonry Construction (IBC-21 Section 1705.4)				
	1. Inspect masonry construction in accordance with IBC-21 Section 1705.4 and TMS 602-13 (The Masonry Society)/ACI 530.1-13 Article 1.6.				
	Level A Quality Assurance				
	Tests: None.				
	Inspection: Verify compliance with the approved submittal and project specifications.			X	
	Level B Quality Assurance				
	Tests:				
	1. Verify slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with TMS 602-13/ACI 530.1-13 Specification Article 1.5B.1.b.3 for self-consolidating grout.				
	2. Verify f'm and f'aac in accordance with TMS 602-13/ACI 530.1-13 Specification Article 1.4B prior to construction, except where specifically exempted.				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Inspection:				
	1. Verify compliance with the approved submittals and project specifications.			X	
	2. At the start of masonry construction, verify:				
	a. Proportions of site-prepared mortar.			X	
	b. Construction of mortar joints.			X	
	c. Grade and size of prestressing tendons and anchorages.				
	d. Location of reinforcement, connectors, prestressing tendons and anchorages.			X	
	e. Prestressing technique.			X	
	f. Properties of thin-bed mortar for AAC (autoclaved aerated concrete) masonry. (Continuous inspection is required for the first 5000 square feet of AAC masonry. Periodic inspection is required after the first 5000 square feet of AAC masonry.)		X	X	
	3. Prior to grouting, verify:				
	a. Grout space is clean.			X	
	b. Grade, type and size of reinforcement and anchor bolts, and prestressing tendons and anchorages.			X	
	c. Placement of reinforcing and connectors, and prestressing tendons and anchorages.			X	
	d. Proportions of site-prepared grout and prestressing grout for bonded tendons.			X	
	e. Construction of mortar joints.			X	
	4. During masonry construction, verify:				
	a. Size and location of structural members.			X	
	b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	c. Welding of reinforcement.		X		
	d. Preparation, construction and protection of masonry during cold weather (temperature below 40 degrees Fahrenheit) or hot weather (temperature above 90 degrees Fahrenheit).			X	
	e. Application and measurement of prestressing force.		X		
	f. Placement of grout and prestressing grout for bonded tendons is in compliance.		X		
	g. Placement of AAC masonry units and construction of thin-bed mortar joints. (Continuous inspection is required for the first 5000 square feet of AAC masonry. Periodic inspection is required after the first 5000 square feet of AAC masonry.)		X	X	
	5. Observe preparation of grout specimens, mortar specimens and/or prisms.			X	
	Level C Quality Assurance				
	Tests:				
	1. Verify f'm and f'aac in accordance with TMS 602-13/ACI 530.1-13/ASCE 6-13 Specification Article 1.4B prior to construction, and for every 5000 square feet during construction.				
	2. Verify proportions of materials in premixed or pre-blended mortar, prestressing grout, and grout other than self-consolidating grout as delivered to the project site.				
	3. Verify slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with TMS 602-13/ACI 530.1-13/ASCE 6-13 Specification Article 1.5B.1.b.3 for self-consolidating grout.				
	Inspection:				
	1. Verify compliance with the approved submittals and project specifications.			X	
	2. Verify:				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	a. Proportions of site-prepared mortar, grout and prestressing grout for bonded tendons.			X	
	b. Grade, type and size of reinforcement and anchor bolts, and prestressing tendons and anchorages.			X	
	c. Placement of masonry units and construction of mortar joints.			X	
	d. Placement of reinforcement, connectors and prestressing tendons and anchorages.		X		
	e. Grout space prior to grouting.		X		
	f. Placement of grout and prestressing grout for bonded tendons.		X		
	g. Size and location of structural elements.			X	
	h. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.		X		
	i. Welding of reinforcement.		X		
	j. Preparation, construction and protection of masonry during cold weather (temperature below 40 degrees Fahrenheit) or hot weather (temperature above 90 degrees Fahrenheit).			X	
	k. Application and measurement of prestressing force.		X		
	l. Placement of AAC masonry units and construction of thin-bed mortar joints.		X		
	m. Properties of thin-bed mortar for AAC masonry.		X		
	3. Observe preparation of grout specimens, mortar specimens and/or prisms.		X		
	Wood Construction (IBC-21 Section 1705.5)				
	1. Inspect prefabricated wood structural elements in accordance with Section 1704.2.5.			X	
	2. High load diaphragms:				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	a. Verify sheathing grade and thickness.			X	
	b. Verify nominal size of framing members at adjoining panel edges.			X	
	c. Verify nail or staple diameter and length.			X	
	d. Verify number of fastener lines.			X	
	e. Verify spacing between fasteners in each line and at panel edges.			X	
	3. Shearwalls:				
	a. Verify sheathing grade and thickness.			X	
	b. Verify nominal size of framing members at adjoining panel edges.			X	
	c. Verify nail or staple diameter and length.			X	
	d. Verify number of fastener lines.			X	
	e. Verify spacing between fasteners in each line and at panel edges.			X	
	f. Location and size of holdowns.			X	
	4. Verify nailing, bolting, anchoring and fastening of:				
	a. Drag struts and collectors.			X	
	b. Braces.			X	
	c. Hold-downs.			X	
	5. Metal-plate-connected wood trusses spanning 60 feet or greater:				
	a. Verify temporary installation restraint/bracing installed in accordance with the approved shop drawings.			X	
	b. Verify permanent individual truss member restraint/bracing installed in accordance with the approved shop drawings.			X	
	Soils (IBC-21 Section 1705.6)				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
X	1. Verify materials below shallow foundations are adequate to achieve the required bearing capacity.			X	
X	2. Verify excavations are extended to proper depth and have reached proper material.			X	
X	3. Perform classification and testing of compacted fill materials.			X	
X	4. During fill placement, verify use of proper materials and procedure in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.		X		
X	5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.			X	
	Driven Deep Foundation Elements (IBC-21 Section 1705.7)				
	1. Verify element materials, sizes and lengths.		X		
	2. Determine capacities of test elements and conduct additional load tests when required. Refer to project specifications.		X		
	3. Inspect driving operations and maintain complete and accurate records for each element.		X		
	4. Verify element locations and plumbness.		X		
	a. Verify type and size of hammer.		X		
	b. Record number of blows per foot of penetration.		X		
	c. Determine required penetration to achieve specified capacity.		X		
	d. Record pile tip and butt elevations.		X		
	e. Document any damage to any foundation element.		X		
	5. For steel piling, perform additional inspection in accordance with Section 1705.2 and AISC 341-16, Table J10.1.				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	6. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705.3.				
	7. For specialty elements, perform additional inspections as required in the project specifications.				
	Cast-in-Place Deep Foundation (IBC-21 Section 1705.8)				
	1. Inspect drilling operations and maintain complete and accurate records for each element.		X		
	2. Verify element locations and plumbness.		X		
	a. Verify element diameter.		X		
	b. Verify bell diameter (if applicable).		X		
	c. Verify element lengths.		X		
	d. Verify embedment depth into bedrock (if applicable).		X		
	e. Verify adequate end-bearing strata capacity.		X		
	f. Record concrete or grout volumes.		X		
	3. For concrete elements, perform additional inspections in accordance with Section 1705.3.				
	Helical Piles (IBC-21 Section 1705.10)				
	1. Verify pile locations.		X		
	a. Verify installation equipment used.		X		
	b. Verify pile dimensions.		X		
	c. Verify tip elevations.		X		
	d. Verify final depth.		X		
	e. Verify final installation torque.		X		
	f. Other data as required by the project specifications.		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Fabricated Items (IBC-21 Section 1705.11)				
X	1. Inspect fabricated items in accordance with Section 1704.2.5.		X		
	Wind Resistance (IBC-21 Section 1705.12)				
	1. Provide inspections when required by Section 1705.12.				
	Seismic Resistance (IBC-21 Section 1705.13)				
	1. Provide inspections when required by Section 1705.13.				
	Testing and Qualification for Seismic Resistance (IBC-21 Section 1705.14)				
	1. Test and qualify seismic resistance in accordance with IBC-21 Section 1705.14 and the project specifications.				
	Sprayed Fire-Resistant Materials (IBC-21 Section 1705.15)				
	1. Inspect sprayed fire-resistant materials in accordance with IBC-21 Section 1705.15 and the project specifications.				
	Mastic and Intumescent Fire-Resistant Coatings (IBC-21 Section 1705.16)				
	1. Perform inspections in accordance with AWCI 12-B (Association of the Wall and Ceiling Industry) and IBC-21 Section 1705.16.			X	
	Exterior Insulation and Finish Systems (EIFS) (IBC-21 Section 1705.17)				
	1. Perform inspections in accordance with project specifications and IBC-21 Section 1705.17.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Fire-Resistant Penetrations and Joints (IBC-21 Section 1705.18)				
	1. Perform inspections in accordance with project specifications and IBC-21 Section 1705.18.			X	
	Smoke Control (IBC-21 Section 1705.19)				
	1. Perform testing in accordance with project specifications and IBC-21 Section 1705.19.				
	Sealing of Mass Timber (IBC-21 Section 1705.20)				
	1. Perform testing in accordance with project specifications and IBC-21 Section 1705.20.				

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the CONTRACT, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Slabs-On-Grade
2. Below-Grade Foundation and Walls.
3. Suspended Slabs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, PROJECT conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at PROJECT site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Engineer.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Course and Fine Aggregate

3. Admixtures.
4. Form materials and form-release agents.
5. Steel reinforcement and accessories.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Joint fillers.
12. Repair materials.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

C. Minutes of pre-installation conference.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this PROJECT and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment. Manufacturer shall be certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities".

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Pre-installation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.
e. Special inspections agency.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the WORK include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the WORK include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Use plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

C. Joint Dowel Bars: ASTM A 615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice", of greater compressive strength than concrete and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout PROJECT:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.

C. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94 and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.7 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Available Manufacturers:

a. Bometals, Inc.
b. Greenstreak.
c. Meadows, W. R., Inc.
d. Tamms Industries, Inc.
e. Vinylex Corp.
f. Or approved equal.

2. Profile: Flat, dumbbell without center bulb.

3. Dimensions: 6 inches by 3/8 inch thick.

B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Available Products:

a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
b. Concrete Sealants Inc.; Conseal CS-231.
c. Greenstreak; Swellstop.
d. Henry Company, Sealants Division; Hydro-Flex.
e. JP Specialties, Inc.; Earthshield Type 20.
f. Progress Unlimited, Inc.; Superstop.
g. Carlisle Coatings & Waterproofing, Inc.

C. Extruded Bead Waterstop: Manufactured, high performance, extrudable swelling waterstop consisting of one-component, polyurethane-based waterstop meeting the following requirements:

a. Designed to swell up to 100% in potable water.
b. Product shall be capable of sealing joints with head pressures up to 50 psi (115 ft head).
c. Elastic to withstand wet/dry cycling
d. Temperature application rage: 50 degrees to 90 degrees
e. Packaged in 20 fl oz tube.
f. Tack free time of 2-3 hours at 73 degrees.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Available Products:

a. Axim Concrete Technologies: Cimfilm.
b. Burke by Edoco: BurkeFilm.
c. Euclid Chemical Company (The): Eucobar.
d. Meadows, W. R., Inc.: Sealtight Evapre.
e. Sika Corporation, Inc.: SikaFilm.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Available Products:

a. Burke by Edoco: Aqua Resin Cure.

b. ChemMasters: Safe-Cure Clear.
c. Euclid Chemical Company (The): Kurez DR VOX.
d. Lambert Corporation: Aqua Kure-Clear.
e. Meadows, W. R., Inc.: 1100 Clear.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:

a. Burke by Edoco: Cureseal 1315 WB.
b. ChemMasters: Polyseal WB.
c. Euclid Chemical Company (The): Super Diamond Clear VOX.
d. Kaufman Products, Inc.: Sure Cure 25 Emulsion.
e. Meadows, W. R., Inc.: Vocomp-30.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. High-Strength Epoxy Doweling System: Epoxy doweling system shall consist of an injectable two-part epoxy complying with the requirements of ASTM C881-90, Type IV, Grade 3, Class B and C except gel times. Epoxy doweling system shall be tested in accordance with ICC Acceptance Criteria 308 demonstrating compliance with the performance features of ACI 355.2. Epoxy doweling system shall have an ICC-ES Evaluation Report (ESR) indicating it is intended for use in both cracked and uncracked normal weight concrete in Seismic Design Categories A through F. The epoxy doweling system shall be installed according to manufacturer's instructions.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Hilti HIT-HY 200 Adhesive Anchoring System (ICC ESR-3187)
b. ITW Red Head EPCON G5 Adhesive Anchoring System (ICC ESR-1137)
c. Powers AC100+ Gold Adhesive Anchor System (ICC ESR-2582)
d. Simpson Strong-Tie SET-XP Epoxy Adhesive Anchors (ICC ESP-2508)

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4,000 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5,000 psi at 28 days when tested according to ASTM C 109.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a water-cementitious materials ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Slabs-on-Grade. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,500 psi at 28 days
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 4 inches, plus or minus 1 inch. 8 inches (plus or minus 1 inch) for concrete with verified slump of 1 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

B. Suspended Slabs, Walls, and Below-Grade Foundations. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40
3. Slump Limit: 4 inches, plus or minus 1 inch. 8 inches for concrete with verified slump of 1 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice".

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Not allowed.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.

2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the WORK. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges".
2. Install dovetail anchor slots in concrete structures as indicated.

B. Aluminum members embedded in concrete:
1. Where aluminum members are embedded in concrete, prime the aluminum with one coat of paint meeting Federal Specification TT-P-645.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of walls, piers, and similar parts of the WORK that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F

for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the WORK. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by ENGINEER.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by ENGINEER.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Where joint is permanently exposed, terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants", are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before test sampling and placing concrete, water may be added at PROJECT site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 305 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is CONTRACTOR's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to view or surfaces to be covered with a coating or covering material applied directly to concrete or surfaces as indicated.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to the base slabs of water-bearing structures. Coordinate which base slabs require trowel finish with ENGINEER before application.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, sidewalks, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with ENGINEER before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the WORK.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases as indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

b. Use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on the PROJECT.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on the PROJECT.

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by ENGINEER. Remove and replace concrete that cannot be repaired and patched to ENGINEER's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before

bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by ENGINEER.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to ENGINEER's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to ENGINEER's approval.

3.15 TESTING FOR WATER-TIGHTNESS

A. All concrete structures designed to hold or convey water, sewage, or sludge shall be tested for water-tightness by filling with water to levels approximating what will be attained during operation and measuring the drop in level due to leakage, if any. These tests shall be made under the direction of the Designer. Water supplied from the utility system shall be paid for by the Contractor. Concrete structures to be tested for water-tightness include wet well areas of pump stations and storage tanks.

B. The water shall be held under each condition long enough to satisfy the Engineer that the structures are watertight. The total loss of water level in any structure shall not exceed 1/2 inch depth in 24 hours. Leakage shall be located and stopped and the structure again tested until this requirement is met.

C. Regardless of the rate of leakage, there shall be no visible leakage from any concrete structure. The concrete structure shall be tested for leakage prior to placing backfill around the structure.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports per the requirements of the Statement of Special Inspections.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31. Cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days and two specimens at 28 days, and retain two specimens for later testing at 56 days if 28 day strength falls below the required specified strength. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

8. Test results shall be reported in writing to ENGINEER, concrete manufacturer, and CONTRACTOR within 48 hours of testing. Reports of compressive-strength tests shall contain PROJECT identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in WORK, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by ENGINEER but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by ENGINEER. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by ENGINEER.
11. Additional testing and inspecting, at CONTRACTOR's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the WORK that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION

SECTION 05510
ALUMINUM GRATING PLATFORMS AND STAIRS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.02 SUMMARY

A. Section includes industrial-type platforms, and straight-run stairs with aluminum-grating treads and railings attached to aluminum grating stairs.

1.03 COORDINATION

A. Coordinate installation of anchorages for platform and aluminum stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:

1. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments.

C. Delegated-Design Submittal: For platform and stairs, including analysis data signed and sealed by the qualified professional engineer, currently registered in the state where the project is located, responsible for their preparation.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, currently registered in the state where the project is located, to design platform, stairs, guards, and handrails.

B. The design criteria of the grating, stairs, and platforms, including connections, shall be in accordance with governing building codes and accepted standards.

C. Structural Performance of Platforms and Stairs: Aluminum platform and stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lb/sq. ft.
2. Concentrated Load: 300 lb applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
6. Stair Treads: Stair treads shall be designed for a uniform load of 100 psf or a concentrated load of 300 lbs on an area of 4 sq. inches located in the center of the tread, whichever produces greater stress and deflect less than 0.25". The two loads do not act concurrently.
7. Connections shall be designed to transfer the design loads.

D. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lb/ ft. applied in any direction.
   b. Concentrated load of 200 lb applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:
   a. Concentrated load of 50 lb applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Rolled and Extruded Members: Alloy and temper 6016-T6.

C. Aluminum Tubing: Alloy and temper 6016-T6.

D. Bolts, Nuts, and Washers:

1. Bolts and Nuts in Structural Connections: alloy 6061-T6.
2. Flat Washers: Alclad 2024-T4.

E. Rivetsin Structural Connections: Alloy 6061-T6.

F. Welding Materials:

1. Filler Metals: AWS D1.2.
2. Electrodes and Equipment Settings: As recommended by the filler metal manufacturer for the position, thickness and conditions of use.

3. Furnish written verification that filler metal is appropriate to the materials and welding process.

2.03 CONNECTIONS

A. Unless otherwise indicated on the Drawings, weld or rivet shop and field connections, except moment connections that shall be bolted. Weld in accordance with approved welding procedures.

B. Design connection components to resist the loads and moments indicated on the Drawings; if the reaction or load is not indicated on the Drawings, design connections as follows:

1. The minimum connection angle length will be half the depth of the beam depth.
2. Horizontal and vertical bracing connections shall have a minimum of two bolts.

C. Connect gusset plates connecting horizontal and vertical bracing to beams and/or columns to both adjacent members; where this is not practical, make provisions for the moment induced by the eccentricity of the load to the work point of the connection.

1. Locate gusset plates for horizontal bracing within the top two rows of bolts of beam connection angles, unless otherwise indicated on the Drawings.
2. The minimum thickness of gusset plates in single shear shall be 5/16-inch for bolts in single shear and 3/8-inch for bolts in double shear.

2.04 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.05 FABRICATION, GENERAL

A. Provide complete stair and platform assemblies, including aluminum framing, hangers, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

B. Form exposed work with accurate angles and surfaces and straight edges.

C. Fabricate joints that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

D. Fabricate aluminum members in accordance with the approved Shop Drawings. Where practical, fabricate and assemble in the shop.

E. Obtain field measurements necessary for fabrication.

F. Dimensional Tolerances:

1. Overall length of members with both ends milled shall vary by not more than 1/32-inch.

2. Overall length of members without milled ends shall vary by not more than 1/16-inch for lengths less than 30 feet and not more than 1/8-inch for lengths 30 feet and over.

G. Where structural joints are welded, the detail of the joints, welding technique, weld quality and appearance, and methods for correcting defective welds shall conform to the AWS D1.2.

1. Welding Process: Inert shielded gas or resistance welding process.

H. Where milling is indicated on the Shop Drawings, machine the contact surfaces true to obtain full and complete contact.

2.06 STAIR FRAMING

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of aluminum channels.
2. Construct platforms of aluminum channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Bolt stringers to headers; Bolt framing members to stringers and headers.

C. Aluminum Bar-Grating Stairs: Form treads and platforms to configurations shown from aluminum bar grating.

1. Fabricate platforms from McNichols GIA-200 2” depth rectangular bar grating.
2. Fabricate treads from McNichols GIA-150 1.5” depth stair tread grating.
3. Surface: Grooved.

2.07 STAIR RAILINGS

A. Comply with applicable requirements in Section 05520 "Pipe and Tube Railings."

2.08 FINISHES

A. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces as follows:

1. Where aluminum members are in contact with steel, prime both aluminum and steel members with one coat of paint meeting Federal Specification TT-P-645. Paint aluminum with an additional coat of varnish containing 2 pounds of aluminum pigment per gallon.
2. Where aluminum members are in contact with porous materials, masonry or concrete, apply to the contact surfaces of the aluminum members a heavy coat of alkali resistant bituminous paint.
3. Where aluminum members are embedded in concrete containing admixtures which are corrosive to aluminum, or in concrete subjected to highly corrosive environments, prime the aluminum with one coat of paint meeting Federal

Specification TT-P-645. Otherwise aluminum members embedded in concrete need not be painted.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction.

B. Coordinate delivery of such items to project site.

3.02 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing aluminum stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing aluminum stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

3.02 INSTALLING ALUMINUM STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set aluminum-stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, nonshrink grout unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

END OF SECTION

SECTION 05520
PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Aluminum pipe and tube railings.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Unless indicated otherwise, design railings, including comprehensive engineering analysis by a qualified professional engineer, currently registered in the State of Alabama, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.

C. Structural Performance: Railings, including attachment to the structure, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lb/ ft. applied in any direction.
b. Concentrated load of 200 lb applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lb applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout and anchoring cement.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of connecting and finishing members at intersections.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.09 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Aluminum Pipe and Tube Railings:

a. ATR Technologies, Inc.
b. Blum, Julius & Co., Inc.
c. Braun, J. G., Company; a division of the Wagner Companies.
d. CraneVeyor Corp.
e. Hollaender Manufacturing Company.
f. Kee Industrial Products, Inc.
g. Moultrie Manufacturing Company.
h. Pisor Industries, Inc.
i. Sterling Dula Architectural Products, Inc.; Div. of Kane Manufacturing.
j. Superior Aluminum Products, Inc.
k. Thompson Fabricating, LLC.
l. Tri Tech, Inc.
m. Tubular Specialties Manufacturing, Inc.
n. Tuttle Railing Systems; Div. of Tuttle Aluminum & Bronze, Inc.
o. Wagner, R & B, Inc.; a division of the Wagner Companies.
p. Or approved equal.

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.03 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Tubing: ASTM B 221, Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

G. Castings: ASTM B 26, Alloy A356.0-T6.

2.04 FASTENERS

A. General: Provide the following:

1. Aluminum Railings: Type 304 or Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical epoxy anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as

determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) or Group 2 (A4) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.06 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded or non-welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

K. Form changes in direction as follows:

1. By bending or by inserting prefabricated elbow fittings.

L. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

M. Close exposed ends of railing members with prefabricated end fittings.

N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide stainless-steel or galvanized steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

R. For removable railing posts, fabricate slip-fit sockets from galvanized steel or stainless-steel pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

S. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.08 ALUMINUM FINISHES

A. Mechanical Finish: AA-M12 (Mechanical Finish: nonspecular as fabricated).

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.02 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.03 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 6 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.04 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

C. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.05 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.06 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 16050
BASIC ELECTRICAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. General: This section specifies several categories of provisions for electrical work, including:

1. Certain adaptive expansions of requirements specified in Division 1.

2. General performance requirements within the electrical system as a whole.

3. General work to be performed as electrical work, because of its close association.

B. Drawings: Examine all drawings relating to the project. Include all work, materials, and equipment mentioned or shown as being provided under this division. Refer to all Drawings and details in coordinating and completing the work. Study all Drawings to determine any conflicts with ordinances and statutes. Report any discrepancies, conflicts, or omissions; accomplish work required for conformance and/or completion.

C. Specifications: Examine all specification divisions relating to the project. Include all work, materials, and equipment mentioned as being provided under this division. Study all specifications to determine any conflicts with ordinances and statutes. Report any discrepancies, conflicts, or omissions; accomplish work require for conformance and/or completion.

D. General Outline: The facilities and systems of the electrical work can be described (but not by way of limitation) as follows:

1. Coordination and installation of new electrical equipment to the existing electrical distribution.

2. Relocation of electrical service and power distribution system, including the electrical connecting of equipment not specified to be connected as work of another Division.

3. Motor starters/controllers and control/protection work as indicated.

4. Lighting systems.

5. Standby generator.

6. Controls and instrumentation systems as indicated.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 – SUBMITTALS

1.03 REFERENCES

ANSI Standards	American National Standards Institute
ASTM Standards	American Society of Testing Materials
IEEE Standards	Institute of Electrical and Electronic Engineers
ICEA Standards	Insulated Cable Engineers Association
NECA Standards	National Electrical Contractors Association
NEMA Standards	National Electrical Manufacturers Association
NFPA 70	National Electrical Code (NEC)
OSHA Standards	Occupational Safety and Health Act
UL Standards	Underwriters' Laboratories

1.04 ACTION SUBMITTALS

A. General: Electrical compliance submittals shall be prepared and submitted in accordance with the Conditions of Contract, Division 1 Specification Sections, and this specification section. The types of submittals required for electrical work are defined herein. Refer to each Division 16 specification section for detailed requirements for submittal content. Administrative submittals are specified elsewhere in the Contract Documents.

B. Content: Electrical compliance submittals shall include the following information.

1. Each specification section shall be submitted separately for approval. All equipment included in the submittal shall be listed. Combined section submittals are not acceptable.

2. Shop Drawings: Project shop drawings and other data prepared specifically for fulfillment of the project requirements. Shop drawings include fabrication, physical size, dimensioned layout, wiring diagrams, coordination and similar drawings and diagrams, and include performance data associated therewith, including weights, capacities, speeds, outputs, consumptions, efficiencies, voltages, amperages, cycles, phases, noise levels, operating ranges, and similar information.

3. Manufacturer's Data: Manufacturer's most current standard printed product information, including (as applicable) promotional brochures, product specifications, installation instructions and diagrams, statements of compliance with standards, performance charts or curves, and similar information concerning the standard portions of the manufacturer's products.

4. Certifications: Written statements, either standard printed forms or specifically prepared text, executed specifically for the project application by an authorized officer of the contracting firm, manufacturer, or other firm as designated, certifying (to the best of his knowledge) to compliance with the requirements as specified.

5. Specification Conformance: Each electrical submittal shall include a copy of the applicable specification section, with addendum updates included, and all

referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (in the margin adjacent to the beginning of the paragraph) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Submittal Presentation: Submittal data shall be assembled in folders or three-ring binders. Each folder or binder shall contain a cover sheet, indexed by item and cross-referenced to the appropriate specification paragraph. Catalog cuts shall be edited to show only the items, model numbers, and information that applies to the equipment being furnished.

D. Partial, incomplete or illegible submittals will be returned to the Contractor without review for re-submittal.

1.05 INFORMATION SUBMITTALS

A. Instruction Manuals:

1. General: Submittals shall be in accordance with Conditions of Contract and Division 1 Specification Sections and the requirements of this specification section. Instruction Manuals shall be submitted complete prior to commencing any training; partial or incomplete data shall not be accepted.

2. Original Literature: Two (2) copies of the Instruction Manuals shall be provided with manufacturer's original published literature; copies or reproductions of any kind shall not be accepted for these two manuals.

3. Electronic Copy: One (1) electronic copy of all Instruction Manuals shall be provided in portable document format (.PDF).

4. Content: Instruction Manuals shall include the following information:

a. Contact Information: Instruction Manuals shall include the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts.

b. Manufacturer's Product Warranties: Manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser

or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits.

c. User Manuals: The written instructions by the manufacturer, fabricator, or installer of equipment or systems, detailing the procedures to be followed by the Owner in configuration, operation, control, and shutdown of each operating item of the equipment and each electrical system.

d. Maintenance Manuals: The compiled information provided for the Owner's maintenance and troubleshooting of each system of operating equipment, including lubrication, emergency control, parts replacement, spare parts inventory recommendation, listing of tools and accessories needed for maintenance, and similar instructions.

e. Guarantees: The Contractor's specific signed commitment (sometimes requiring also that other countersign) to the Owner that certain acts of restitution will be performed when and if certain portions of electrical work fail within certain operational conditions and time limits.

f. Certifications: Written statements, either standard printed forms or specifically prepared text, executed specifically for the project application by an authorized officer of the contracting firm, manufacturer, or other firm as designated, certifying (to the best of his knowledge) the equipment installation, configuration, and startup is in compliance with the manufacturer's recommendations and the project requirements.

g. Test Reports: The results of all specified factory and field tests shall be included with the Instruction Manuals.

h. Startup Reports: Equipment manufacturer's field startup reports shall be included with the Instruction Manuals.

i. Configuration Data: A written record documenting the setup and configuration of each system that is software, hardware, or firmware configurable in the field shall be included in the Instruction Manual. All configuration parameters, jumpers, switch settings, etc., shall be recorded.

j. As-Built Control Wiring Diagrams and Assembly Drawings: As-built control diagrams and assembly drawings shall be provided in appropriately sized binders. Drawings shall not be folded or otherwise reduced in size for assembly in the instruction manual binder. As-built drawings shall be organized by facility or location.

B. Drawings

1. Where the Contractor is required to provide information on drawings as part of the specified work, such drawings shall be prepared on 11 inch by 17 inch paper complete with borders and title blocks clearly identifying project name,

equipment and the scope of the drawing. Drawings shall be prepared on a computer-aided drafting (CAD) system. All CAD drawing files shall be converted to .DWG file format and submitted on CD-ROM media. All CAD drawing files shall be updated to reflect final as-constructed conditions.

1.06 QUALITY ASSURANCE

A. General: Refer to Division 1 for general administrative/procedural requirements related to compliance with codes and standards. Materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards, and utility company regulations. In case of difference between codes, state laws, local ordinances, industry standards, utility company regulations, and the contract documents, the most stringent shall govern.

B. Definitions:

1. Elementary or Schematic Diagram: A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.

2. One-line Diagram: A one-line diagram shows by means of single lines and graphical symbols the course of an electrical circuit or system of circuits and the components, devices or parts used therein. Physical relationships are usually disregarded.

3. Block Diagram: A block diagram is a diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

4. Wiring or Connection Diagram: A wiring or connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly.

5. Interconnection Diagram: Interconnection diagrams shall show all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. References shall be shown to all connection diagrams that interface to the interconnection diagrams.
Interconnection diagrams shall be of the continuous line type. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable. Wire identification shall be shown as actually installed.
The wire identification for each end of the same wire shall be identical. All devices and equipment shall be identified. Terminal blocks shall be shown as actually installed and identified in the equipment complete with individual terminal identification.

6. Arrangement, Layout, or Outline Drawings: An arrangement, layout, or outline drawing is one that shows the physical space and mounting requirements of a

piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

C. Identification of Listed Products: Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. Three such organizations are Underwriters Laboratories (UL), Canadian Standards Association (CSA), and Electrical Testing Laboratories (ETL). Independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.

When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the product may be required by the inspection authority, to undergo a special inspection at the manufacturer's place of assembly. All costs and expenses incurred for such inspections shall be included in the original contract price.

D. Symbols: Except as otherwise indicated, refer to the symbols legend on the Drawings for definitions of symbols used on the Drawings to show electrical work.

E. Coordination Meetings: The Contractor shall include as Work of this section of the specifications the requirement for the following coordination meetings to be held at the project site. The primary function of the meetings shall be to insure compliance with the requirements of the construction documents and facilitate timely performance of the contract. The Contractor shall have in attendance at each meeting a representative of the Division 16 subcontractor who is responsible for the execution of the Work of this contract. The preliminary schedule and agenda for each of the meetings shall be as described below. The specific dates for each of the meetings shall be scheduled by the Contractor and approved by the Construction Manager. The Construction Manager shall be provided with two (2) weeks minimum advanced written notice of proposed scheduled meeting dates.

1.07 PROJECT/SITE CONDITIONS

A. Environmental Conditions: The following environmental conditions are typical for the project site. All electrical equipment and materials shall be sized and derated for the specified conditions:

1. Elevation: 1,000 feet above mean sea level

2. Outdoor Temperature:

a. Winter: -10 to 40 °F

b. Summer: 40 to 105 °F

3. Indoor Air Temperature: 40 to 104 °F

B. Area Classifications: For the purpose of delineating the basic electrical construction materials and installation requirements for this project, areas of the project have been classified on the Drawings as defined below. Electrical work within these areas shall conform to the requirements described below as well as the referenced code requirements.

1. Dry Non-Process Areas (NEMA 1): Areas requiring general purpose, NEMA 1, construction are indoor areas typically environmentally controlled non-process areas such as electrical rooms.

2. Wet Process Area (NEMA 4X): Areas requiring corrosion resistant, NEMA 4X, construction are all wet process areas. Wet process areas typically contain wastewater, chemicals, or sludge pumping or piping systems and are subject to spills and washdown. Wet process areas shall also include those areas containing chemicals.

3. Hazardous Location (NEMA 7): Areas requiring explosion proof, NEMA 7, construction are all hazardous locations. Hazardous Location areas typically contain exposed wastewater, chemicals, and/or sludge pumping or piping systems and are subject to spills, washdown, and combustible gas presence. Hazardous Location areas are prone to corrosion.

C. Construction Materials: Construction materials required for each area classification are listed in Table 16000-A appended to the end of this specification section. Refer to the individual specification section for each component for material composition and installation practices.

D. Seismic: Electrical equipment and supports shall be braced in accordance with the Uniform Building Code for Seismic Zone 1.

1.08 HANDLING AND STORAGE

A. Delivery: Deliver electrical materials and equipment properly packaged. Utilize factory fabricated containers or wrappings for materials and equipment which protect materials and equipment from damage. Inspect materials and equipment to ensure that no damage has occurred during shipment.

B. Storage: Store electrical materials and equipment indoors in original packaging in areas specifically designated for equipment storage. Protect equipment and materials from construction traffic and debris.

C. Handling: Handle electrical materials and equipment carefully to prevent physical damage to materials and equipment. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering and jarring which could damage the materials and equipment contained therein. Do not install damaged materials or equipment; remove from site and replace damaged materials and equipment with new.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Equipment and materials shall be new and free from defects. All material and equipment of the same or a similar type shall be of the same manufacturer throughout the work. Standard production materials shall be used wherever possible.

2.02 ELECTRICAL EQUIPMENT IDENTIFICATION

B. General: Nameplates shall be made from laminated phenolic plastic. The nominal size of the nameplates shall be 3/4 inch high by 2 inches long. Nameplates shall have white backgrounds with 3/16 inch black letters. Nameplate engraving shall minimally identify the equipment or equipment served by the labeled device and shall be in complete English terminology as indicated on the Drawings. Nameplates shall be attached with epoxy based adhesive.

C. Legends: Descriptions given on the one-line diagrams and panel schedules shall be used as the basis for nameplate engraving. In addition to the English description, each nameplate shall also indicate the equipment or device tag number. Additional engraving legend requirements shall be as defined below. If abbreviations are required because of space limitations, abbreviations shall be submitted to the Engineer for approval.

D. Equipment: Nameplates shall be provided for the following equipment. Additional engraving requirements shall be as indicated in parenthesis for each equipment type.

1. Panelboards, electrical cabinets, and enclosures

2. Electrical switchgear and switchboards

3. Control panels

4. Control stations (indicating equipment controlled)

5. Power transfer equipment

6. Transformers (indicating power source and equipment served)

7. Disconnect, transfer, and bypass switches (indicating power source and equipment controlled)

8. Local motor starters (indicating power source and equipment controlled)

2.03 CUTTING AND PATCHING

A. Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as individually authorized by the Construction Manager, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

2.04 EXCAVATING FOR ELECTRICAL WORK

A. General: The work of this article is defined to include whatever excavating and backfilling is necessary to install the electrical work. Coordinate the work with other excavating and backfilling in the same area, including dewatering, flood protection provisions, and other temporary facilities. Coordinate the work with other work in the same area, including other underground services (existing and new), landscape development, paving, and floor slabs on grade. Coordinate with weather conditions and provide temporary facilities needed for protection and proper performance of excavating and backfilling.

1. General Standards: Except as otherwise indicated, comply with the applicable provisions of Division 1 for electrical-work excavating and backfilling. Refer instances of uncertain applicability to the Construction Manager for resolution before proceeding.

2. Replacement of Other Work: Where it is necessary to remove and replace landscape work, pavement, flooring, and similar exposed finish work, engage the original installer to install the replacement work; except where work existed prior to the work of this Contract, engage only experienced and expert firms and tradespersons to replace the work.

2.05 CONCRETE FOR ELECTRICAL WORK

A. General: The work of this article is defined to include whatever concrete work is necessary or shown specifically to install the electrical work; but excluding equipment base grouting (see applicable Division 16 sections). Coordinate the work with other work, particularly other concrete work and accessories.

1. General Standards: Refer to specification section 3300 for all concrete standards.

2.06 HOUSEKEEPING

A. General: Electrical equipment shall be protected from dust, water and damage during the construction period. Electrical equipment including motor control centers, motor controllers, panelboards, switchgear, and buses shall be wiped free of dust and dirt on the outside and kept dry.

B. Upon completion of the work, remove all litter, waste material, unused materials, and Contractor's tools and equipment from the job site.

C. Remove all construction debris, packing materials, shipping labels, etc., from the interior and exterior of the equipment. Thoroughly clean and remove construction markings from interior surfaces.

D. Clean exterior surfaces of equipment of all construction debris and markings and leave the equipment in an unblemished condition.

E. Clean all equipment filters in accordance with the manufacturer's instructions.

F. Touch-up scratched or marred surfaces to match original finish.

2.07 TESTING

A. The tests specified in Section 16030 of these specifications shall be performed prior to energizing the electrical circuits.

2.08 CLOSEOUT

A. General: Refer to the Division 1 sections for general closeout requirements.

B. Lubrication: Clean and lubricate operational equipment.

C. Training: Instruct Owner's personnel thoroughly in the operation, sequencing, maintenance, and safety/emergency provisions of the electrical systems.

2.09 MAINTENANCE MATERIALS

A. Extra stock of spare parts, materials, replacement units, accessories, adjustment devices, and similar items as designated, for the Owner's initial use in maintaining the electrical equipment and systems in continued operation. Maintenance materials shall be furnished where specified in each equipment specification.

2.10 RECORD DOCUMENTS

A. Record documents refer to those documents maintained and annotated by the Contractor during construction, and include record drawings in accordance with Division 1 sections, and the following additional schedules, lists, and drawings:

1. Interconnection Diagrams (16000, Part 1).

2. Original Submittal Drawings (16000, Part 1).

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which equipment is to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 GENERAL

A. Coordinate equipment installation work with electrical raceway and wire/cable work, as necessary for proper interface.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

C. Cables larger than No. 6 AWG which hang from their vertical connections shall be supported from the structure within 2 feet of the connection.

3.03 INSTALLATION OF FREESTANDING EQUIPMENT

A. Install equipment at the locations indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. The floor or slab upon which the freestanding equipment is installed shall be smooth and level (within 1/8 inch per three feet in any direction). Four-inch (5.4 lb/ft) structural channel sills shall be embedded in the concrete along the entire length of the equipment, front and back. The front and rear channel sills shall be set and aligned with each other and shall be level (within 1/8 inch per three feet over the entire length of the sill). The finished floor or slab shall not be higher than the channel sills. The equipment structure shall be welded to the channel sills in accordance with the manufacturer's instructions.

3.04 INSTALLATION OF WALL-MOUNTED EQUIPMENT

A. Install equipment at the locations indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Equipment mounting height shall be 72 inches above finished floor to top of equipment enclosure.

C. Equipment enclosure shall be mounted on u-channel supports anchored to associated wall.

D. Conduits shall be terminated on the sides and bottom of enclosures. Conduits shall not be installed in the top of the enclosure without approval of the Construction Manager.

3.05 GROUNDING

A. Provide equipment grounding connections to equipment as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing of equipment shall be completed prior to energizing the equipment.

B. Prior to energization of electrical circuitry, check all accessible connections to manufacturer's tightening torque specifications.

3.07 ADJUSTING AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish

3.08 RUBBER MATS

A. A three foot wide rubber mat shall be furnished and installed on the floor and in front of each piece of electrical equipment located indoors. The mat shall be long enough to cover the full length of each enclosure. The mat shall be 1/4 inch thick with beveled edges, canvas back, solid type with corrugations running the entire length of the mat. The mat shall be guaranteed extra quality, free from cracks, blow holes or other defects detrimental to their mechanical or electrical strength. The mat shall meet OSHA

requirements and the requirements of ANSI/ASTM D 178 J6-7 for Type 2, Class 2 insulating matting.

TABLE 16000-A

Component	Area Classification			
	Dry Non Process Area (NEMA 1)	Wet Process Area (NEMA 4X)	Outdoors (NEMA 4X)	Hazardous Locations (NEMA 7)
Rigid Conduit (exposed)	GRS	PGRS	GRS	PGRS
Rigid Conduit (concealed)[4]	GRS	GRS	GRS	PGRS
Flexible Conduit[5]	FMC	LFMC	LFMC	LFMC
Support Systems	Galvanized Steel	Stainless Steel	Stainless Steel	Stainless Steel
Fastening Hardware and Hanger Rods[2,3]	Cadmium Plated Steel	Stainless Steel	Stainless Steel	Stainless Steel
Control Stations & Enclosures[2,3]	Steel	Stainless Steel	Stainless Steel	Stainless Steel or Cast Aluminum (Explosion Proof)
Receptacles[2]	General	WP, GFCI	WP, GFCI	WP, GFCI, Explosion Proof
Switches[2]	General	WP	WP	Stainless Steel or Cast Aluminum (Explosion Proof)

Table A Notes:

1. Enclosures, device boxes, control stations, and raceway systems shall be mounted with 1/4-inch (minimum) air space between the electrical system and supporting structure.

2. Conduit terminations to control stations, enclosures, and device boxes in NEMA 4X, 7, and 12 areas shall be made through threaded hubs. Threaded hubs on NEMA 7 enclosures shall be integral to the enclosure and not field-installed.

3. Control station and enclosure NEMA sealing ratings shall meet or exceed the rating designated by the area classification.

4. Conduit encased in concrete duct bank or beneath slab on grade shall be rigid nonmetallic

conduit, raceway type PVC8. Conduit concealed in concrete walls shall be raceway type GRS.

5. Flexible conduit shall be utilized for final connections to equipment.

6. Install per the NEC.

Legend:

GRS – Galvanized Steel Conduit

PGRS – PVC Coated Galvanized Steel Conduit

FMC – Flexible Metallic Conduit

LFMC – Liquid tight Flexible Metallic Conduit

PVC8 – Schedule 80 PVC

WP – Weatherproof

GFCI – Ground Fault Circuit Interrupter

REFER TO 16110 FOR ADDITIONAL REQUIREMENTS AND DETAILS ON CONDUIT TYPES AND REQUIREMENTS

END OF SECTION

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SECTION 16052
ELECTRICAL TESTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section. Should there be any conflict between provisions or requirements elsewhere indicated and the provisions of this division, request written clarification by addendum prior to submission of bid or abide by the interpretation of the Engineer.

1.02 SUMMARY

A. This section specifies the acceptance testing of electrical materials, equipment and systems. Contractor shall provide all labor, tools, material, power and other services necessary to provide the specified tests.

1.03 REFERENCES

A. General: This section contains references to the International Electrical Testing Association (NETA), ATS-2013: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, copyright 2013. It is a part of this section as specified and modified. In case of conflict between the requirements of this section and those of said document, the requirements of this section shall prevail.

B. Safety and Procedural Requirements:

1. Safety and Precautions: This specification does not include specific safety procedures. It is recognized that tests and inspections set forth by this specification may be potentially hazardous. Consequently, individuals performing these tests must be capable of conducting these tests in a safe manner and with complete knowledge of the hazards involved. Each person involved in this project must be provided with and use appropriate personal protective equipment.

2. Safety practices that shall be followed include, but are not limited to, the following:

a. Occupational Safety and Health Act.

b. Accident Prevention Manual for Industrial Operations, National Safety Council.

c. Applicable state and local safety operating procedures.

d. Owner’s safety practices.

3. Perform all testing work in accordance with the applicable codes and standards of the following agencies except as provided otherwise herein:

a. International Electrical Testing Association – NETA Acceptance Testing Specifications (ATS).

b. National Fire Protection Association.

c. National Electrical Code, ANSI/NFPA 70.

d. Recommended Practice for Electrical Equipment Maintenance, ANSI/NFPA 70B.

e. Electrical Safety Requirements for Employee Workplaces, NFPA 70E.

1.04 APPLICATION

A. General: Requirements for testing in accordance with this section are specified in this and other sections of Division 16. Where testing in accordance with this section is required, the required tests, including correction of defects where found, and subsequent retesting, shall be completed prior to energization of material, equipment or systems.

1.05 SUBMITTALS

A. General: Submit the following in accordance with the requirements of Specification 16050.

1. Description of all test procedures.

2. Examples of test report forms for all specified tests including deficiency report forms.

3. Final test report.

4. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (in the margin adjacent to the beginning of the paragraph) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

5. Submittal Presentation: Submittal data shall be assembled in folders or three-ring binders. Each folder or binder shall contain a cover sheet, indexed by item and cross-referenced to the appropriate specification paragraph. Catalog cuts shall be edited to show only the items, model numbers, and information that applies to the equipment being furnished.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT AND MATERIALS

A. General: Test instruments shall be calibrated to references traceable to the National Institute of Standards and Technology and shall have a current sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required.

B. NETA Compliance: Test equipment shall be in complete compliance with ATS-2013, Paragraphs 5.2 and 5.3.

PART 3 - EXECUTION

3.01 GENERAL

A. The test procedures to be conducted by the Installing Contractor are defined as those tests specified in paragraph 16052-3.4 B.

3.02 NOT USED

3.03 TEST DOCUMENTATION

A. Inspection and Test Procedures Documentation: Test procedure documentation shall be submitted in accordance with paragraph 16052-1.5.

B. Test Report Forms: The test report forms are appended to the end of this section.

C. Deficiency Reports: Deficiency reports shall be prepared for each item under test and submitted to the Engineer at the end of each day of testing. Deficiency reports shall identify the equipment under test by tag number and location and shall describe all deficiencies observed through the course of inspection and testing.

3.04 EQUIPMENT TESTING

A. General: The inspection and test procedures described by ATS-2013, Section 7 shall establish the minimum requirements for electrical equipment inspection and testing. Additional test procedures, beyond the scope of ATS-2013, Section 7, are defined herein and shall be conducted as specified.

B. Installing Contractor Tests: The following types of equipment and/or systems shall be inspected and tested by the installing contractor:

1. Insulation Resistance Tests: Insulation resistance tests shall be performed on the following types of equipment or systems:

a. Low Voltage (600 volt maximum) Power and Control Conductors and Cables: Insulation resistance tests shall be performed on all circuits 120 volts and above except interior lighting and 120 volt receptacle circuits.

Power and control conductor and cable insulation tests shall be performed in accordance with ATS-2013, Paragraph 7.3.2. Tests may be conducted with motors and other equipment connected, except that solid-state equipment shall be disconnected unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.

The ambient temperature at which insulation resistance is measured shall be recorded on the test form.

Test results shall be evaluated against the results for cables of same type and length. Test results of less than 50 mega-ohms shall be investigated.

b. Signal Cables: All analog signal cables shall be tested as specified herein.

The loop resistance of each signal pair or triad shall be measured. Any pair or triad exhibiting a loop resistance of less than or equal to 50 ohms shall be deemed satisfactory. For pairs with greater than 50 ohm loop resistance, the Contractor shall calculate the expected loop resistance considering loop length and intrinsic safety barriers if present. Loop resistance shall not exceed the calculated value by more than 5 percent.

Each shield drain conductor shall be tested for continuity. Shield drain conductor resistance shall not exceed the loop resistance of the pair or triad.

Each conductor (signal and shield drain) shall be tested for insulation resistance with all other conductors in the cable grounded.

Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500 volt megohmeter shall be used for insulation resistance measurements.

c. Test Records: Insulation resistance measurements shall be recorded on test report forms at end of this specification section.

2. Pre-functional Checkout: Functional testing shall be performed in accordance with the requirements of this specification. Prior to functional testing, all protective devices shall be adjusted and made operative. Prior to energization of equipment, all system component tests shall be completed and the Contractor shall perform a functional checkout of the control circuit. Checkout shall consist of energizing each control circuit and operating each control, alarm or malfunction device and each interlock in turn to verify that the specified action occurs. The Contractor shall submit a description of his proposed functional test procedures prior to the performance of functional checkout.

B. Witnessing:

1. The ENGINEER reserves the right to observe all CONTRACTOR testing. The ENGINEER shall be notified five (5) days prior to testing.

3.05 TEST RESULTS

A. General: Minimum acceptable test values shall be as specified in this specification and ATS-2013. Where acceptable test values are not specified, the equipment manufacturers recommended test values shall be used.

END OF SECTION

Form 16052-A
Wire and Cable Resistance Test Data Form

Wire or Cable Number: _____ Date of Test: _____

Temperature, Degrees F: _____

	Location of Test	Insulation Resistance, megohms
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
Owner's Representative

Form 16052-B
Signal Cable Resistance Test Data Form

Loop Number: _____

List all wiring associated with the loop in the table below. Make applicable measurements as indicated after disconnecting wiring.

			Continuity Resistance		Insulation Resistance			
Wire No.	Panel Tie	Field TB	Cond/ Cond	Cond/ Shield	Shield/ Cond	Shield/ GND	Cond/GND	Shield/Shield
A			--	(A/SH)				
B			(A/B)	--				
C			(A/C)	--				
D			(A/D)	--				

Continuity Test: Connect ohmmeter leads between wires A and B and jumper opposite ends together. Record resistance in table. Repeat procedure between A and C, A and D, etc. Any deviation of plus/minus 2 ohms between any reading and the average of a particular run indicates a poor conductor, and corrective action shall be taken before continuing with the loop test.

Insulation Test: Connect one end of a 500 volt megohmmeter to the panel ground bus and the other end sequentially to each completely disconnected wire and shield. Test the insulation resistance and record each reading.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
Owner's Representative

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SECTION 16060
GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install grounding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered a minimum requirement for compliance with this Specification.

B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100-92, Powering and Grounding of Sensitive Electronic Equipment. Conflicts shall be promptly brought to the attention of the Engineer.

C. In addition to the NEC requirements, building structural steel columns and metallic chemical/process storage tanks shall be permanently and effectively grounded.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 - SUBMITTALS

C. Section 16050 – Basic Electrical Requirements

D. Section 16110 – Raceways, Fittings, and Supports

1.03 REFERENCES

UL 467	Grounding and Bonding Equipment
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640 and as specified herein.

B. Shop Drawings - Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents

C. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

D. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Drawings and written description of how the Contractor intends to furnish and install the grounding system.

3. Results of certified field tests.

4. Manufacturer's Certification - Certify that products meet or exceed specified requirements.

5. Identified by applicable specification section.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer's operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer's equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

4. Contact information for local representative and supplier

1.06 HANDLING AND STORAGE

A. Equipment shall be carefully transported, stored, handled, and set in place in a manner that will prevent damage, misalignment, and distortion to the components.

B. Follow manufacturer's recommendations regarding handling and storage at all times prior to installation of the equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 GROUND RODS AND GRID

A. Ground rods shall be rolled to a commercially round shape from a welded copper-clad steel manufactured by the molten-welding process or by the electro-formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000 pounds per square inch (psi) and an elastic limit of 49,000 psi. The rods shall be not less than 3/4 inch in diameter by 10 feet in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of

0.010 inch at any point on the rod. Ground rods shall be UL 467 listed. The ground rods shall be manufactured by Erico Products, Blackburn, or equal.

B. Except where specifically indicated otherwise, all exposed non current carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in nonmetallic raceways and neutral conductors of wiring systems shall be grounded.

C. The ground connection shall be made at the main service equipment and shall be extended to the ground grid surrounding the structure. The ground grid shall also be connected to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection.

D. Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

2.03 FITTINGS

A. Grounding connections to equipment shall be bolted. Cable end connections shall be made by hydraulic crimp or exothermically welded. Split bolt type connectors are not acceptable. Fittings shall be UL 467 listed.

2.04 EQUIPMENT GROUNDING CONDUCTORS

A. An insulated equipment grounding conductor, which shall be separate from the electrical system neutral conductor, shall be furnished and installed for all circuits. Insulation shall be of the same type as the underground conductors in the raceway and shall be green in color. Equipment grounding conductors shall be furnished and installed in all conduits. Use of conduits as the NEC required equipment grounding conductor is not acceptable.

2.05 EQUIPMENT GROUNDS

A. Equipment grounds shall be solid and continuous from a connection at earth to all distribution panelboards. Ground connections at panelboards, outlets, equipment, and apparatus shall be made in an approved and permanent manner.

2.06 EXOTHERMIC WELDS

A. All exothermic welding shall be completed per welding kit manufacturer's instructions. Exothermic welds shall be CadWeld by Erico or ThermoWeld.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Metal surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.

B. Ground Grid

1. A main ground grid shall be provided for each structure and interconnecting structure grids consisting of driven ground rods as shown on the Drawings. The ground rods shall be interconnected by the use of copper cable exothermically welded to the rods. The grounding cables shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the ground grid and shall enter the buildings and structure from the outside and shall be connected to steel structures, and equipment as described in this Section and as required to provide a complete grounding system. The copper pigtails shall be exothermically welded to the ground grid, and connected to building reinforcement steel by hydraulic crimp.

2. Grounding conductors shall be continuous between points of connection; splices shall not be permitted.

3. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in metal raceway. The raceway shall be bonded to the grounding system.

4. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.

5. Buried exothermic welds and ground ring shall not be backfilled until inspected by Engineer.

C. Raceways

1. Conduit which enters equipment such as switchgear, motor control centers, transformers, panelboards, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus or ground lug, where provided, and as otherwise required by the NEC.

3.02 TESTING [AND STARTUP]

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests

a. None required.

2. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

b. Fall of potential tests shall be performed on the ground grid per IEEE81 recommendations by a third party, independent testing firm. A fall of potential plot shall be submitted at the conclusion of testing for Engineer review. Documentation indicating the location of the rod and grounding system as well as the resistance and soil conditions at the time the measurements were made shall be submitted. Testing shall show that the ground grid has 5 ohms resistance or less. Due to soil conditions and/or unforeseen field conditions, ground resistances greater than 5 ohms may be acceptable if specifically approved in writing by the Engineer. Ground resistance measurements shall be made in normally dry weather not less than 48 hours after rainfall and with the ground grid under test isolated from other grounds.

c. Continuity tests for the grounding electrode conductor shall also be performed. Test will be accepted when a resistance of less than 1 ohm is shown for this conductor.

END OF SECTION

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SECTION 16110
RACEWAYS, FITTINGS, AND SUPPORTS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Under this Section, the Contractor shall furnish and install all conduits and conduit fittings to complete the installation of all electrically operated equipment as specified herein and as required.

B. The Drawings indicate the general location of conduits both exposed and concealed; however, the Contractor shall install these conduits in such a manner to avoid all interferences.

C. Reference Section 16050 – Basic Electrical

D. All Contractor personnel installing PVC coated rigid conduit shall be trained as specified herein.

1.02 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable Specification section.

1.03 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Conduit identification methods and materials.

3. Evidence of training (e.g. Certificates of Completion) for all Contractor personnel that will install PVC coated rigid conduit. Training shall be as specified herein.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The material covered by this Specification is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings.

2.02 CONDUITS

A. Unless specified otherwise herein, or indicated on the Drawings, all conduits shall be rigid, aluminum. Minimum size conduit shall be 3/4 inch unless otherwise indicated on the Standard Details. Unless specified otherwise herein or indicated on the Drawings, all encased conduits shall be PVC Schedule 40, minimum size 1 inch. The Contractor, at his option, for ease of installation to accommodate saddle size, may increase the size of encased conduits to 2-inch. However, no combining of circuits/conductors will be permitted in these larger conduits.

All components (fittings, couplers, connectors, etc.) of the conduit system shall be of the same or compatible material of construction. Coated conduit systems shall include factory coated fittings couplings, connectors, and other components compatible with and approved for coated conduit systems.

Reference the "Conduit Uses" portion of this specification for additional information regarding conduit.

B. Rigid Aluminum Conduit

1. Aluminum conduits shall be rigid type, heavy walled as manufactured by Allied Tube and Conduit Corporation, Wheatland Tube Company, Jones & Laughlin Steel Company, or approved equal.

2. Rigid aluminum conduit shalt be manufactured of 6063 alloy in temper designation T1. Fittings shall be of the same alloy.

3. Rigid aluminum conduit shall be listed by Underwriters' Laboratories to U.L. Standard 6A shall be manufactured to ANSI Standard C80.5.

4. Each length of conduit shall be shipped with a coupling on one end and a color coded thread protector at the other end.

C. Flexible Metal Conduit

1. Flexible metal conduit (FMC) shall be galvanized steel, single strip. FMC shall be UL listed. FMC shall be used to connect all indoor vibrating equipment, installed in dry locations, above reflected ceilings to lighting fixtures, and other applications as accepted by the Engineer. FMC shall be Galflex Type RWS as manufactured by Southwire, Type BR as manufactured by Electri-Flex, or equal.

D. Liquid-Tight Flexible Metal Conduit

1. Liquid-tight flexible conduit (LFMC) shall be galvanized steel, single strip, with a copper strip interwoven and suitable as a grounding means. LFMC shall be UL listed. LFMC shall have an extruded moisture and oil-proof PVC jacket. LFMC shall be Titan Type UL as manufactured by Southwire, Liquatite Type "LA" as manufactured by Electri-Flex, Anaconda Type UA as manufactured by Anamet Electrical, Inc., or equal.

2. PVC coated or stainless steel watertight connectors shall be used with liquid-tight flexible metal conduit on both ends. LFMC shall be used to connect all vibrating equipment installed outdoors, in wet or damp areas, and other applications as directed by the Engineer.

E. Liquid-Tight Flexible Non-Metallic Conduit

1. Liquid-tight flexible non-metallic conduit (LFNC) shall be constructed of PVC. LFNC shall be UL listed. LFNC shall have an extruded moisture and oil-proof PVC jacket. LFNC shall be Ultratite Type NM as manufactured by Southwire, Type NM as manufactured by Electri-Flex, Anaconda Type NMUA by Anamet Electrical, Inc., or equal.

2. Watertight connectors shall be used with liquid-tight flexible non-metallic conduit on both ends. LFNC shall be used to connect all vibrating equipment installed in sodium hypochlorite storage and transfer areas as specified herein, and other applications as directed by the Engineer or as indicated on the drawings.

F. Rigid Nonmetallic Conduit

1. Rigid nonmetallic conduit shall be Schedule 40 polyvinyl chloride (PVC), 90□C, UL rated and shall conform to NEMA TC-2. Fittings and conduit bodies shall conform to NEMA TC3.

2. Rigid non-metallic conduit shall be as manufactured by Carlon, Triangle Conduit and Cable, Cantex, Inc., or equal.

G. PVC Coated Metallic Conduit

1. PVC coated rigid aluminum conduit shall be furnished and installed as specified herein and indicated on the Drawings. The product shall be rigid aluminum conduit covered with a bonded 40 mil (minimum) thickness PVC jacket and coated inside

with urethane. The conduit shall comply with NEMA RN-1 and shall be "Plasti-Bond Red" as manufactured by Robroy Industries, "OCAL-Blue" as manufactured by Thomas & Betts, Perma-Cote Supreme by Perma-Cote Industries, Kor Kap equivalent, or equal.

H. NOT USED

I. Conduit Fittings

1. Fittings for all conduit types shall conform to UL 467 and UL 514 as applicable.

2. Set screw or indentor type connectors shall not be used. Fittings for conduit installed in wet locations and underground shall provide a watertight joint. Fittings for rigid conduit shall be threaded.

3. Fittings or bushings shall be installed in easily accessible locations.

4. Where exposed conduits pass across structural expansion joints, approved weatherproof telescopic type expansion fittings shall be used. Fittings shall be OZ/GEDNEY Type AX, Crouse-Hinds Type XJG, or equal, watertight, and permit movement up to 4 inches. Each fitting shall be equipped with approved bonding jumpers around or through each fitting.

   Where embedded conduits pass through expansion joints, approved watertight, concrete-tight deflection/expansion fittings shall be used. Fittings shall compensate for movement of ¾-inch from the normal in all directions. Fittings shall be OZ/GEDNEY Type DX, Crouse-Hinds Type XD, or equal.

5. Conduit fittings ("condulets") shall be used on exposed conduit work for changes in direction of conduit runs and breaking around beams. "Condulets" shall be cast ferrous alloy, galvanized or cadmium plated, as manufactured by Crouse-Hinds, OZ/Gedney, Appleton Company, or equal. Coated fittings and boxes shall be used with coated conduit in all chemically aggressive areas or where called for on the Drawings. Covers shall be of a design suitable for the purpose intended. In damp areas, the outside condulets shall be made watertight. Install all condulets with the covers accessible. Use proper tools to assemble conduit system to prevent injury to the plastic covering. No damage to the covering shall be permitted.

6. Conduit fittings shall be cast type of non-ferrous metal or malleable iron thoroughly coated inside and outside with metallic zinc or cadmium after all machining has been completed. Cast fittings shall be provided with heavy threaded hubs to fit the conduit required. Covers shall be of the same material as the fittings to which they are attached and shall be screwed on with rubber or neoprene gaskets between the covers and fittings. Cast fittings 1-1/2 inches and above shall be of the "mogul" type.

7. PVC coated fittings shall be used with PVC coated conduit. All conduit nipples, elbows, couplings, boxes, fittings, unions, expansion joints, connectors, bushing, and other components of the raceway system shall be factory coated to maintain the corrosion-resistant integrity of the conduit system. The coated conduit and its

respective components shall all be provided by the same manufacturer. Coated conduit shall be used in all areas specified herein or indicated on the Drawings.

8. Conduit seals shall be Type EYS as manufactured by Crouse-Hinds, Appleton equivalent, OZ/Gedney equivalent, or equal.

   a. Conduit seal bodies shall match the material of the conduit eg. Aluminum conduit shall use aluminum seal offs, stainless steel seal off fittings for stainless steel conduits, etc.
   b. Sealing plugs shall use stainless steel hardware for the ports.

PART 3 - EXECUTION

3.01 CONDUIT AND FITTINGS

A. Unless otherwise specified herein or indicated on the Drawings, the minimum size conduit shall be 3/4 inch for exposed work and 1 inch for conduit encased in concrete or mortar. Multiple circuits may not be combined in the same conduit without the explicit written permission to do so by the Engineer.

B. Conduit home runs for lighting circuits are not necessarily indicated on the Drawings; however, the circuit numbers are shown. Conduit shall be furnished and installed for these lighting circuits and shall be installed as required to suit field conditions, subject to review and acceptance by the Engineer.

C. Conduit shall be installed concealed unless otherwise indicated or specified. Conduit may be run exposed on walls only where concealing is not practical, or at the direction of the Engineer.

D. Where exposed, maintain a minimum distance of 6 inches from parallel runs of flues or water pipes. Conduit runs shall be installed in such locations as to avoid steam or hot water pipes. A minimum separation of 12 inches shall be maintained where conduit crosses or parallels hot water or steam pipes.

E. A non-metallic raceway containing instrumentation cable (if specifically allowed herein) where installed exposed shall be installed to provide the following clearances:

   1. Raceway installed parallel to raceway conductors energized at 480 through 208 volts shall be 18 inches and 208/120 volts shall be 12 inches.

   2. Raceway installed at right angles to conductors energized at 480 volts or 120/208 volts shall be 6 inches.

F. Where practical, exposed raceways containing instrumentation cable shall cross raceway containing conductors of other systems at right angles.

G. For floor mounted equipment, conduit may be installed overhead and dropped down, where underfloor installation is not practical. Groups of conduits shall be uniformly spaced, where straight and at turns. Conduit shall be cut with a hacksaw or an approved conduit-cutting machine and reamed after threading to remove all burrs. Securely fasten conduit to outlets,

junction and pull boxes to effect firm electrical contact. Join conduit with approved couplings. Conduits shall be freed from all obstructions.

H. Empty conduit systems shall be furnished and installed as indicated on the Drawings and shall have pull ropes installed. The polyethylene pull ropes shall be ¼" diameter, minimum. Not less than 12 inches of slack shall be left at each end of the pull rope.

I. Each piece of conduit installed shall be free from blisters or other defects. Each piece installed shall be cut square, taper reamed, and a coat of galvanizing and conducting compound shall be applied to the threads. Galvanizing compound shall be CRC Zinc-It or equal. Threads on conduits shall be painted with a conducting compound prior to making up in a fitting. Conduit connections shall be made with standard coupling and the ends of the conduit shall butt tightly into the couplings. Where standard coupling cannot be used, Erickson three-piece couplings shall be used. Where conduits are installed in concrete, concrete-tight three-piece couplings shall be used.

J. Conduit threaded in the field shall be of standard sizes and lengths.

K. All bends shall be made with standard factory conduit elbows or field bent elbows. Field bending of conduit shall be done using tools approved for the purpose. Heating of conduit to facilitate bending is prohibited. Field bends shall be not less than the same radius than a standard factory conduit elbow. Bends with kinks shall not be acceptable.

The equivalent number of 90° bends in a single conduit run are limited to the following:

1. Runs in excess of 300 feet: 0

2. Runs of 300 feet to 201 feet: 1

3. Runs of 200 feet to 101 feet: 2

4. Runs of 100 feet and less: 3

All conduit for fiber optic cable shall have a minimum bending radius of 16 inches. Final bending radius shall be determined by the fiber optic cable manufacturer.

L. Unless otherwise specified herein, indicated on the Drawings, or required by the NEC, conduit shall be supported every 8 feet (minimum) and shall be installed parallel with or perpendicular to walls, structural members, or intersections of vertical planes and ceilings with right angle turns consisting of fittings or symmetrical bends. Conduits shall be supported within 1 foot of all changes in direction. Supports shall be approved pipe straps, wall brackets, hangers or ceiling trapeze.

M. NOT USED

N. In no case shall conduit be supported or fastened to another pipe or installed to prevent the removal of other pipe for repairs. Fastenings shall be by expansion bolts on concrete; by machine screws, welded threaded studs, or spring-tension clamps on steel work. Powder actuated fasteners may only be used to make connections where the use of this equipment complies with safety regulations and for structures in Seismic Design Categories A or B,

unless the fasteners are approved for seismic use. Wooden plugs inserted in masonry and the use of nails as fastening media are prohibited. Threaded C-clamps may be used on rigid aluminum conduit only. Coat the conduit to protect from dissimilar metals. Conduits or pipe straps shall not be welded to steel.

O. The load applied to fasteners shall not exceed 1/4 of the proof test load. Fasteners attached to concrete ceilings shall be vibration and shock resistant. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4 inch in concrete joints shall not cut the main reinforcing bars. Holes not used shall be filled. Spring steel fasteners are not permitted. Conduits shall be fastened to all sheet metal boxes and cabinets with two (2) locknuts where required by the National Electrical Code to ensure adequate bonding for grounding. Where insulated bushings are used, or where bushings cannot be secured firmly to the box or enclosure, a bonding jumper shall be installed to maintain suitable grounding continuity. Locknuts shall be the type with sharp edges for digging into the wall of metal enclosures. Bushings shall be installed on the ends of all conduits and shall be of the insulating type where required by the National Electrical Code.

P. Conduit installed in concrete floor slabs or walls shall be located so as not to affect the designed structural strength of the slabs. Conduit shall be installed within the middle one-third of the concrete slab except where necessary to not disturb the reinforcement. The outside diameter of conduit shall not exceed one-third of the slab thickness, and conduits shall be spaced no closer than three (3) diameters except at cabinet locations. Curved portions of bends shall not be visible above the finish slab. Where embedded conduits cross expansion joints, suitable expansion/deflection fittings and bonding jumpers shall be provided. Conduit larger than 1-inch trade size shall be parallel with or at right angles to the main reinforcement. When at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Conduits shall not be stacked more than two (2) diameters high in floor slabs. Embedded conduits shall be placed in accordance with the latest edition of ACI-318.

Q. Install polyvinyl chloride (PVC) coated aluminum conduits when entering or exiting concrete except under electrical equipment where the conduit is not subject to physical abuse. Also install PVC coated aluminum conduit when transitioning between grade and a structure or an equipment stand. Extend stub-ups at least 12 inches above and below grade or finish floor. Conduits extending through the concrete floor shall be installed using straight runs (for vertical penetrations) or factory elbows (for conduits installed within the slab) of PVC coated rigid aluminum conduit.

R. Aluminum conduits shall not be in contact with concrete surfaces. Where aluminum conduits are routed along concrete surfaces, they shall be installed with one hole cast straps with clamp-backs to space the conduit ¼" away from concrete surface. Where aluminum conduit passes through concrete, CMU or brick walls, the penetration shall be made such that the aluminum conduit does not come in contact with concrete, CMU, brick or mortar. All penetrations shall meet or exceed the UL design standards. Aluminum conduit shall transition to PVC coated aluminum conduit where entering a concrete encasement, floor or ductbank.

S. All conduit extending through the floor behind panels or into control centers or similar equipment may be PVC Schedule 40 and shall extend a minimum of 6 inches above the floor elevations, where practicable, with no couplings at floor elevations.

T. Unless specifically identified on the Drawings as "Direct Buried," all conduits in the earth, including conduits below slabs-on-grade, shall be concrete encased. Joints in conduit shall be staggered so as not to occur side by side. Rigid non-metallic (PVC) conduit shall be connected to PVC coated rigid aluminum conduit at the point where it leaves the ground, with the transition to metal conduit occurring inside the concrete encasement.

U. No more than three (3) 90 degree bends will be allowed in any one conduit run. Where more bends are necessary, a condulet or pull box shall be installed. All bends in 3/4-inch conduit shall be made with a conduit bender, and all larger sizes shall have machine bends. Joints in threaded conduit shall be made up watertight with the appropriate pipe thread sealant or compound applied to male threads only; and, all field joints shall be cut square, reamed smooth, and properly threaded to receive couplings. No running threads are permitted. All conduit ends at switch and outlet boxes shall be fitted with an approved locknut and bushing forming an approved tight bond with box when screwed up tightly in place.

V. Conduits stubbed up through concrete floors for connections to freestanding equipment and for future equipment shall be provided with an adjustable top or coupling threaded inside for plugs, set flush with the finished floor. Screwdriver operated threaded flush plugs shall be installed in conduits from which no equipment connections are made.

W. Where outlets are shown near identified equipment furnished by this or other Contractors, it is the intent of the Specifications and Drawings that the outlet be located at the equipment to be served. The Contractor shall coordinate the location of these outlets to be near the final location of the equipment served whether placed correctly or incorrectly on the Drawings. Changes in outlet locations required to serve the equipment furnished by other Contractors on the Project shall be brought to the attention of the Engineer.

X. Conduit shall be protected immediately after installation by installing flat non-corrosive metallic discs and steel bushings, designed for this purpose, at each end. Discs shall not be removed until it is necessary to clean the conduit and install the conductors. Before the conductors are installed, insulated bushings shall be installed at each end of the conduit.

Y. Where "all-thread" nipples are used between fittings and electrical equipment, they shall be so installed that no threads are exposed.

Z. Connections from rigid conduit to motors and other vibrating equipment, limit switches, solenoid valves, level controls, and similar equipment, shall be made with short lengths of liquid-tight flexible metal conduit. These conduits shall be installed in accordance with the NEC and shall be furnished and installed with appropriate connectors with devices which will provide an excellent electrical connection between the equipment and the rigid conduit for the flow of ground current. Flexible metal conduit and liquid-tight flexible metal conduit length shall be three (3) feet, maximum.

AA. Flexible metal conduit or liquid-tight flexible metal conduit installed between rigid metal conduit and motor terminal box and/or any other apparatus shall have a green insulated grounding conductor running through the flexible conduit. This conductor shall be terminated to the nearest pull box, motor terminal box, or any other apparatus ground terminal. Flexible metal conduit and liquid-tight flexible metal conduit shall be grounded and bonded per NEC Articles 348 and 350, respectively.

BB. Conduits installed within or underneath floor slabs, underground direct-buried or concrete encased conduits, and all conduits installed in areas subject to liquid inadvertently entering the conduit system shall be sealed or plugged at both ends in accordance with NEC Article 300-5(g). This requirement applies to both conduits containing conductors and "spare" conduits. Where practicable, the interior of the conduit shall be sealed as well as around the conductors by using conduit sealing bushings: Type CSB as manufactured by O/Z Gedney, or equal. Where the conduit fill does not allow the use of these bushings, the conduits shall be tightly caulked or plugged.

Conduit passing through the walls and floors of buildings below grade shall be installed with appropriate watertight fittings to prevent the entrance of ground water around the periphery of the conduits. For vertical conduit penetrations through openings in concrete floors, the fittings shall be Type FSK Floor Seals as manufactured by OZ/Gedney. For conduit penetrations through openings in concrete walls, the fittings shall be Type WSK Thruwall seals as manufactured by OZ Gedney. Conduits shall be sloped away from the buildings toward splice boxes, handholes and/or manholes to provide drainage away from the building wall.

Conduits passing through sleeves in interior walls and floors shall be tightly caulked.

CC. Weatherproof, insulated throat "Meyers" hubs shall be used on all conduit entries to boxes and devices without integral hubs in process areas to maintain NEMA 4X integrity. The Contractor shall furnish and install "Meyers" hubs on all conduit entries into non-cast enclosures such as metallic or non-metallic control panels, control component enclosures, wireways, pull boxes, junction boxes, control stations, and similar type equipment when this type of equipment is located in process areas requiring NEMA 4X integrity. This specified requirement for "Meyers" hubs does not apply to any area of the plant facilities where NEMA 4X integrity is not required.

DD. The use of two (2) locknuts, one on each side of the enclosure, and a grounding bushing shall be required at all conduit terminations where hub type fittings are not required; such as electrical rooms, control rooms, and office areas.

EE. Conduit installation shall be arranged to minimize cleaning. No horizontal runs of conduit will be permitted in brick or masonry walls.

FF. Install non-metallic conduits in accordance with manufacturer's instructions where specified herein or indicated on the Drawings.

GG. Join non-metallic conduit using cement as recommended by the manufacturer. Clean and wipe non-metallic conduit dry before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for twenty (20) minutes (minimum).

HH. All PVC coated conduit shall be installed in accordance with manufacturer’s instructions. The Contractor shall use tools that are specifically suited for coated conduit systems. The use of pipe wrenches and other such tools on PVC coated RGS conduit is prohibited. The Engineer and Owner reserve the right to reject any installation of coated conduit that does not meet the requirements of the Section or the manufacturer’s instructions. The Engineer and Owner also reserve the right to reject any installation that exhibits damage due to the improper use of tools. All rejected installations shall be replaced by the Contractor at no

additional cost to the Owner. The use of PVC coated conduit repair compounds to repair damages or improper installation is prohibited.

II. All Contractor personnel that install PVC coated RGS conduit shall be trained by the PVC coated RGS conduit manufacturer. Training shall include proper conduit system assembly techniques, use of tools appropriate for coated conduit systems, and field bending/cutting/threading of coated conduit. The Contractor shall furnish evidence of such training as specified herein. Training shall have been completed within the past 24 months prior to the Notice to Proceed on this Contract for all coated conduit installation personnel. Contractor personnel not trained within this timeframe shall not be allowed to install coated conduit, or shall be trained/re-trained as required prior to commencement of conduit installation.

JJ. Conduits shall not penetrate the floors or walls inside liquid containment areas unless specifically accepted by the Engineer.

KK. All conduits that are buried or encased in concrete that transition from the ground to any stationary structure or equipment shall be equipped with a longitudinal expansion coupling capable of at least four inches of expansion. Conduits with encasement that is rigidly tied to the stationary structure in accordance with the Standard Details shall not be required to have expansion couplings.

LL. Raceways shall not be installed concealed in water-bearing walls and floors.

3.02 CONDUIT USES AND APPLICATIONS

A. No PVC conduit shall be installed exposed unless specifically accepted in writing by the Engineer. Where PVC conduit is allowed to be installed exposed, the conduit shall be Schedule 80.

B. PVC Schedule 40 conduit shall be furnished and installed in concrete slabs (for slab-on-grade construction) and in walls when the conduit is shown to be encased. Rigid aluminum conduit shall be installed in all elevated slabs when the conduits are shown to be encased.

C. PVC Schedule 40 conduit shall be installed in reinforced concrete encasement. Conduit shall be "direct buried" only if specifically indicated on the Drawings.

D. All instrumentation wire and cable for analog signals shall be installed in rigid aluminum conduit or PVC coated rigid aluminum conduit to suit the application. This applies to all conduit installations including exposed, concealed in concrete encasement, and all other applications.

E. PVC coated rigid aluminum conduit shall be furnished and installed, where exposed, in the following areas:

1. All outdoor locations.

2. Pump rooms.

3. Wet-Process Areas

F. Liquid-tight flexible non-metallic conduit (LFNC) shall be furnished and installed, where required, in chemical storage and transfer areas.

G. Other conduit uses not specifically listed above shall be brought to the attention of Engineer for a decision.

H. Electric Metallic Tubing (EMT) style conduit is not permitted without special approval by the Engineer.

3.03 CONDUIT IDENTIFICATION

A. The identification system for the conduits furnished and installed under this Contract shall match the existing identification system used at the facility.

3.04 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and Section 16050, Basic Electrical.

b. All conduit installed below grade or concrete encased shall be tested to ensure continuity and the absence of obstructions by pulling through each conduit a swab followed by a mandrel 85% of the conduit inside diameter. After testing, all conduits shall be capped after installation of a suitable pulling tape.

END OF SECTION

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SECTION 16120
LOW VOLTAGE WIRE AND CABLE

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, all low voltage wire and cable indicated on the Drawings and as specified herein and/or required for proper operation. The work of connecting cables to equipment and devices shall be considered a part of this Section. All appurtenances required for the installation of cable and wire systems shall be furnished and installed by the Contractor.

B. The scope of this Section does not include internal wiring factory installed by electrical equipment manufacturers.

C. Reference Section 16050, Basic Electrical; Section 16110, Raceways, Fittings, and Supports

1.02 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the wire and cable manufacturer and submit the following:

1. Shop Drawings

2. Reports of Field Tests

3. Wiring Identification Methods

B. Each submittal shall be identified by the applicable specification section.

1.03 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.

B. Partial, incomplete, or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Cable pulling calculations (if required).

3. Wiring identification methods and materials.

1.04 IDENTIFICATION

A. Each cable shall be identified as specified in Part 3, Execution, of this Specification.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years. Wire and cable shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and indicated on the Drawings. Only one (1) manufacturer for each wire and cable type shall be permitted.

B. The wire and cable manufacturer shall be ISO 9000 registered.

2.02 POWER WIRE AND CABLE

A. Power cable and wire installed underground, in wet process areas, or between the output terminals of a VFD and the respective motor shall consist of stranded copper conductor with insulation type XHHW/XHHW-2, rated 90°C and 600V.

B. Power cable and wire for all other loads shall consist of stranded, copper conductor with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations.

C. Conductors shall be stranded copper per ASTM-B8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG.

D. Multi-conductor power cable assemblies shall be UL 1277 Listed, provided with a bonding conductor, and furnished with an overall PVC jacket.

E. Power wire and cable shall be as manufactured by the Okonite Company, the Southwire Company, General Cable, or equal.

2.03 CONTROL CABLE

A. Control cable and wire installed underground or in wet process areas shall consist of stranded copper conductor with insulation type XHHW/XHHW-2, rated 90°C and 600V.

B. Control cable for all other locations shall consist of stranded, copper conductor with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations, and 600V.

C. Conductors shall be stranded copper per ASTM B-8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be No. 14 AWG.

D. Multi-conductor control cable assemblies shall be UL 1277 Listed, provided with a bonding conductor, and furnished with an overall PVC jacket.

E. Control cable shall be as manufactured by the Okonite Company, the Southwire Company, General Cable, or equal.

2.04 LIGHTING AND RECEPTACLE WIRE

A. The lighting and receptacle branch circuit wire shall consist of solid, copper conductors with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations.

B. Conductors shall be solid copper per ASTM- B-3. Minimum size wire shall be No. 12 AWG.

C. Lighting and receptacle wire shall be as manufactured by the Okonite Company, the Southwire Company, General Cable, or equal.

2.05 INSTRUMENTATION CABLE

A. The instrumentation cable for analog signals shall be single, shielded, twisted pairs or triads with 600 volt insulation and shall have a 75°C (minimum) insulation rating.

B. Conductors shall be tin or alloy coated (if available), soft, annealed copper, stranded per ASTM-B8, Class B stranding unless otherwise specified. Minimum size wire shall be No. 16 AWG.

C. The instrumentation cable shall be Okoseal-N Type P-OS for single pair or triad applications and Okoseal-N Type SP-OS for multiple pair or triad applications as manufactured by the Okonite Company, Belden equivalent, Southwire Company equivalent, or equal.

2.06 SHIELDED VFD CABLE

A. Where indicated on the Drawings, shielded VFD cable shall be provided for motors controlled by VFDs. The cable shall be 600V/1000V rated, with stranded tinned copper conductors, shielded, suitable for use with variable frequency drives. Cable shall be suitable for use in wet/dry locations, indoors and outdoors, in cable trays, in conduits, trenches, and in underground ducts and direct burial. The conductor shall be annealed stranded tinned copper per ASTM B3, B8, and B33.

B. The conductor shall be annealed stranded tinned copper per ASTM B3, B8, and B33. The insulation shall be rated for 90 degrees Celsius Wet/Dry operating temperature. The insulation material shall be XLPE with a XHHW-2 listing per UL 44. The insulated conductors shall be cabled together with three (3) symmetrically placed ground wires. The ground wires shall have a minimum circular mil area equivalent to one circuit conductor. Fillers shall be included as necessary to make the cable round.

C. The cabled assembly shall be shielded by applying helically a 5 mil copper tape. The shield shall provide 100% coverage over the assembly. All cables shall have a continuous overall outer jacket of Polyvinyl Chloride (PVC), suitable for 90°C use. The jacket shall be resistant to abrasion, rated for direct burial, sunlight resistant and flame resistant in

accordance with UL 1277. Cable shall be as manufactured by Belden Wire and Cable, Okonite, General Cable, or AmerCable Inc.

2.07 CONDUCTOR IDENTIFICATION

A. Conductors shall be identified using a color coding method. Color coding for individual power, control, lighting, and receptacle conductors shall be as follows:

1. 480/277V AC Power

Phase A - BROWN
Phase B - ORANGE
Phase C - YELLOW
Neutral – GREY

2. 120/208V or 120/240V AC Power

Phase A - BLACK
Phase B - RED
Phase C - BLUE
Neutral - WHITE

3. DC Power

Positive Lead - RED
Negative Lead - BLACK

4. DC Control

All wiring - BLUE

5. 120VAC Control

120 VAC control wire shall be RED except for a wire entering a motor control center compartment or control panel which is an interlock. This interlock conductor shall be color coded YELLOW.

6. 24VAC Control

All wiring - ORANGE

7. Equipment Grounding Conductor

All wiring - GREEN

B. Individual conductors No. 2 AWG and smaller shall have factory color coded insulation. It is acceptable for individual conductors larger than No.2 AWG to be provided with factory color coded insulation as well, but it is not required. Individual conductors larger than No.2 AWG that are not provided with factory color coded insulation shall be identified by the use of colored tape in accordance with the requirements listed in Part 3 herein.

Insulation colors and tape colors shall be in accordance with the color coding requirements listed above.

C. Conductors that are a part of multi-conductor control cable assemblies shall have black insulation. The conductor number shall be printed on each conductor's insulation in accordance with ICEA S-58-679, Method 4. Each conductor within the cable assembly shall also be identified with a heat shrink tag with color coded background in accordance with the requirements listed in Part 3 herein. Background color shall be in accordance with the color coding requirements listed above.

D. Conductors that are a part of multi-conductor power cable assemblies shall have black insulation. The conductor number shall be printed on each conductor's insulation in accordance with ICEA S-58-679, Method 4. Each conductor No.2 AWG and smaller within the cable assembly shall also be identified with a heat shrink tag with color coded background. Each conductor larger than No.2 AWG within the cable assembly shall also be identified by the use of colored tape. Heat shrink tags and colored tape shall be in accordance with the requirements listed in Part 3 herein. Tape color and heat shrink tag background color shall be in accordance with the color coding requirements listed above.

2.08 CABLE PULLING LUBRICANTS

A. Cable pulling lubricants shall be non-hardening type and approved for use on the type of cable installed. Lubricant shall be Yellow #77 Plus by Ideal, Cable Gel by Greenlee, Poly-Gel by Gardner Bender, or equal.

PART 3 - EXECUTION

3.01 POWER, CONTROL, AND LIGHTING/RECEPTACLE WIRE AND CABLE INSTALLATION

A. The wire and cable shall be installed as specified herein and indicated on the Drawings.

B. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or equal.

D. Splices shall not be allowed in the underground manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing. Splicing materials shall be barrel type butt splice connectors and heat shrink tubing as manufactured by 3M, Ideal, or equal. No splicing of instrumentation cable is allowed. The use of screw-on wire connectors (wire nuts) shall only be permitted for lighting and receptacle circuits.

E. Wire and Cable Sizes

1. The sizes of wire and cable shall be as indicated on the Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors

and respective conduit shall be increased so that the voltage drop measured from source to load does not exceed 2-1/2%.

F. Additional Conductor Identification

1. In addition to the color coding identification requirements specified in Part 2 herein, individual conductors shall be provided with heat shrinkable identification tags. Identification tags for individual conductors shall have a white background where the conductor insulation is colored. Identification tags for individual conductors shall have a colored background where the conductor insulation is black. Background color shall match that of the taping provided on the individual black conductors.

2. Multi-conductor cables shall be provided with heat shrinkable identification tags in accordance with Part 2 herein.

3. All wiring shall be identified at each point of termination. This includes but is not limited to identification at the source, load, and in any intermediate junction boxes where a termination is made. The Contractor shall meet with the Owner and Engineer to come to an agreement regarding a wire identification system prior to installation of any wiring. Wire numbers shall not be duplicated.

4. Wire identification shall be by means of a heat shrinkable sleeve with appropriately colored background and black text. Wire sizes #14 AWG through #10 AWG shall have a minimum text size of 7 points. Wire sizes #8 AWG and larger shall have a minimum text size of 10 points. Sleeves shall be of appropriate length to fit the required text. The use of handwritten text for wire identification shall not be permitted.

5. Sleeves shall be suitable for the size of wire on which they are installed. Sleeves shall not be heat-shrunk onto control cables. Tags shall remain loose on cable to promote easier identification. For all other applications, sleeves shall be tightly affixed to the wire and shall not move. Sleeves shall be heat shrunk onto wiring with a heat gun approved for the application. Sleeves shall not be heated by any means which employs the use of an open flame. The Contractor shall take special care to ensure that the wiring insulation is not damaged during the heating process.

6. Sleeves shall be installed prior to the completion of the wiring terminations and shall be oriented so that they can be easily read.

7. Sleeves shall be polyolefin as manufactured by Brady, Seton, Panduit, or equal.

8. Wire identification in manholes, handholes, pull boxes, and other accessible components in the raceway system where the wiring is continuous (no terminations are made) shall be accomplished by means of a tag installed around the bundled group of individual conductors or around the outer conductor jacket of a multi-conductor cable. Identification shall utilize a FROM-TO system. Each group of conductors shall consist of all of the individual conductors in a single conduit or duct. The tag shall have text that identifies the bundle in accordance with the 'FROM' and 'TO' column for that particular conduit number in the conduit and wire schedule. Minimum text size shall be 10 point. The tag shall be affixed to

the wire bundle by the use of nylon wire ties, and shall be made of polyethylene as manufactured by Brady, Seton, Panduit, or equal.

9. Where colored tape is used to identify cables, it shall be wrapped around the cable with a 25% overlap and shall cover at least 2 inches of the cable.

G. Wiring Supplies

1. Only electrical wiring supplies manufactured under high standards of production and meeting the approval of the Engineer shall be used.

2. Rubber insulating tape shall be in accordance with ASTM Des. D119. Friction tape shall be in accordance with ASTM Des. D69.

H. Training of Cable

1. The Contractor shall furnish all labor and material required to train cables around cable vaults within buildings and in manholes and handholes in the outdoor underground duct system. Sufficient length of cable shall be provided in each handhole, manhole, and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. The training shall be done in such a manner as to minimize chaffing. Reference Section 16110.

2. Instrumentation cable shall be racked separate from other AC and DC wiring to maintain the required separation as follows:

a. 18 inches for 480/277VAC wiring

b. 12 inches for 208/120VAC wiring

c. 6 inches for 24VDC wiring

I. Conductor Terminations

1. Where wires are terminated at equipment which requires lugs, connections shall be made by solderless mechanical lug, crimp type ferrule, or irreversible compression type lugs. Reference individual equipment specification sections as applicable for additional termination requirements.

2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make terminations impractical due to the size of the field wiring, the Contractor shall terminate field wiring in an adjacent junction per the requirements of Section 16130, Boxes, complete with terminal strips. Contractor shall install the smaller wiring from the device to the junction box in a conduit, using the terminal strip as the means for joining the two different wire sizes. Splicing of wires in lieu of using terminal strips is not acceptable.

3. All spare conductors shall be terminated on terminal blocks mounted within equipment or junction boxes. Unless otherwise noted, coiling up of spare conductors within enclosure is not acceptable.

J. Pulling Temperature

1. Cable shall not be flexed or pulled when the temperature of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature of 40°F or less within a three (3) day period prior to pulling, the cable reels shall be stored three (3) days prior to pulling in a protected storage area with an ambient temperature of 55°F or more. Cable pulling shall be completed during the work day for which the cable is removed from the protected storage. Any remaining cable reels shall be returned to storage at the completion of the workday.

3.02 INSTRUMENTATION CABLE INSTALLATION

A. The Contractor shall install all cable or conductors used for instrumentation wiring (4-20 mA DC, etc.) in conduit as specified in Section 16110 – Raceways, Fittings, and Supports. Only instrumentation cable as specified herein shall exclusively occupy these conduits. No other wiring for AC or discrete DC circuits shall be installed in these conduits.

B. All shielding shall be continuous and shall be **grounded at one point only**.

C. Where instrumentation cables are installed in panels, manholes, handholes, and other locations, the Contractor shall arrange wiring to provide maximum clearance between these cables and other conductors. Instrumentation cables shall not be installed in same bundle with conductors of other circuits.

D. Special instrument cable shall be as specified or recommended by the manufacturer of the equipment or instruments requiring such wiring. Installation, storage, and terminations, shall be per manufacturer's recommendations.

3.03 SHIELDED VFD CABLE INSTALLATION

A. The Contractor shall install all cable or conductors used for shielded VFD cable in conduit as specified in Section 16110 – Raceways, Fittings, and Supports. Only shielded VFD cable as specified herein shall exclusively occupy these conduits. No other wiring shall be installed in these conduits.

3.04 FIBER OPTIC CABLE INSTALLATION

A. The Contractor shall install the fiber optic cable furnished by the General Contractor and/or the Instrumentation and Control Subcontractor. The cable shall be installed in its respective raceway system(s) as specified herein, indicated on the Drawings, and in accordance with the cable manufacturer's instructions. Reference Division 17 for additional information regarding the fiber optic cable.

3.05 TESTING

B. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Shop Test

a. Cable and wiring shall be tested in accordance with the applicable ICEA Standards. Wire and cable shall be physically and electrically tested in accordance with the manufacturer's standards.

2. Field Tests

a. After installation, all wires and cables shall be tested for continuity. Testing for continuity shall be "test light" or "buzzer" style.

b. After installation, some wires and cables shall be tested for insulation levels. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:

i. For #8 AWG and larger 600V power and control cable, apply 1,000 VDC from a Megaohmeter for one (1) minute for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits. Resistance shall be no less than 100 Megaohms. Insulation testing is not required for power and control cables smaller than #8 AWG.

ii. 600V instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a Simpson No. 260 volt-ohmmeter, or approved equal. The resistance value shall be 200 Megaohms or greater.

C. Wires and cables shall be tested before being connected to motors, devices or terminal blocks.

D. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

E. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment. Test reports shall be submitted to the Engineer.

END OF SECTION

(EXHIBIT A)
TEST DATA - MEGOHMS
TEST NO. _____

Date:			Company:				
Time:			Location:				
Circuit:	Circuit Length:	Aerial:	Duct:	Buried:	No. of Conductors	Size:	AMG MCM Shld:
Insulation Material:			Insulation Thickness:		Voltage Rating:		Age:
Type: _____Pothead _____Terminal					Location: Indoors_____ Outdoors_____		
Number and Type of Joints:							
Recent Operating History:							
Manufacturer:							
State if Potheads or Terminals were grounded during test:							
List associated equipment included in test:							
Miscellaneous Information:							

(EXHIBIT A)
TEST DATA - MEGOHMS
TEST NO. ____

Part Tested:Test Made:_____
Hours/Days:_____
After Shutdown:_____

Grounding Time:Dry Bulb Temperature:_____
Wet Bulb Temperature:_____

Test Voltage:

Equipment Temperature: _____
How Obtained: _____
Relative Humidity: _____
Absolute Humidity: _____
Dew Point: _____

Megohmmeter: Serial Number: _____ Range: _____
Voltage: _____ Calibration Date_____

Test Connections	To Line To Earth To Ground	To Line To Earth To Ground	To Line To Earth To Ground	Test Connections	To Line To Earth To Ground	To Line To Earth To Ground	To Line To Earth To Ground
1/4 Minute				5 Minutes			
1/2 Minute				6 Minutes			
3/4 Minute				7 Minutes			
1 Minute				8 Minutes			
2 Minutes				9 Minutes			
3 Minutes				10 Minutes			
4 Minutes				10/1 Minutes			
				Ratio			

Remarks:

SECTION 16130
BOXES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The scope of work under this Section includes furnishing and installing all pull boxes, junction boxes, and outlet boxes.

B. Requirements for other boxes and enclosures are not included in this Section. Reference each specific Division 16 equipment Section for requirements related to that equipment's respective enclosure.

1.02 RELATED SECTIONS

A. Section 01039 – COORDINATION AND MEETINGS

B. Section 01300 – SUBMITTALS

C. Section 16050 – BASIC ELECTRICAL

D. Section 16110 – RACEWAYS, FITTINGS, AND SUPPORTS

1.03 REFERENCES

UL 514A	Metallic Outlet Boxes
UL 514C	Standard for Non-metallic Outlet Boxes, Flush Device Boxes, and Covers
UL 50	Enclosures for Electrical Equipment, Non-environmental Considerations
UL 50E	Enclosures for Electrical Equipment, Environmental Considerations
UL 1203	Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations
NEMA 250	Enclosures for Electrical Equipment

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Product Datasheets

C. Layout Drawings for all boxes larger than standard receptacle boxes.

D. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every

paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer’s operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer’s equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

4. Contact information for local representative and supplier

1.06 HANDLING AND STORAGE

A. Follow manufacturer's recommendations regarding handling and storage at all times prior to placing the devices in service.

PART 2 - PRODUCTS

2.01 PULL AND JUNCTION BOXES

A. General

1. All pull and junction boxes shall be UL listed and labeled.

2. Pull and junction boxes shall not be provided with eccentric or concentric knockouts.

3. Pull and junction boxes mounted embedded in concrete shall be UL listed for embedment.

4. Where metallic boxes are used they shall be of all welded construction. Tack welded boxes are not acceptable.

B. Pull Boxes

1. All pull boxes shall be provided with a matching gasketed cover. For covers

with dimensions of 24 inches by 24 inches or less, the cover shall be held in place by machine screws. Other screw types are not acceptable. For covers with dimensions greater than 24 inches by 24 inches, the cover shall be hinged and held in place by screw-operated clamp mechanisms. Hinge pins shall be removable. Clamp mechanism material of construction shall match that of the associated box.

2. Pull boxes shall not have any wire terminations inside, other than those for grounding/bonding. A ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the pull box (minimum of two) shall be provided as spare terminations. Boxes requiring any other wire terminations shall be furnished and installed in accordance with the requirements for junction boxes herein.

3. Pull boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC.

4. Barriers shall be provided in pull boxes to isolate conductors of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:

   a. Power wiring

   b. AC Control wiring

   c. DC Control wiring

   d. Instrumentation wiring

C. Junction Boxes

1. Junction boxes used for lighting and receptacle circuits only shall be provided with a matching gasketed cover held in place by machine screws. Other screw types are not acceptable.

2. Junction boxes for all uses other than lighting and receptacle circuits shall be provided with a hinged, gasketed cover. Hinge pins shall be removable. Cover shall be held in place by screw-operated clamp mechanisms. Clamp mechanism material of construction shall match that of the associated box.

3. Barriers shall be provided in junction boxes to isolate conductors and terminal blocks of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:

   a. Power wiring

   b. AC control wiring

   c. DC control wiring

d. Instrumentation wiring

4. Junction boxes used for lighting and receptacle circuits only shall be allowed to have screw-on (wire nut) type connectors for wire terminations/junctions.

5. Junction boxes for all uses other than lighting and receptacle circuits shall be provided with terminal strips, consisting the necessary number of screw type terminals. Current carrying parts of the terminal blocks shall be of ample capacity to carry the full load current of the circuits connected, with a 10A minimum capacity. Terminal strips shall be rated for the voltage of the circuits connected. A separate ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the junction box (minimum of two) shall be provided as spare terminations. When barriers are provided within the box, separate terminal strips shall be provided in each barrier area. Terminals shall be lettered and/or numbered to conform to the wiring labeling scheme in place on the project.

6. Junction boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC. Terminal blocks (including spare terminals) shall be considered when sizing the junction box.

D. Enclosure Types and Materials

1. In non-hazardous locations, pull and junction boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	**ENCLOSURE TYPE AND MATERIAL**
Indoor Wet Process Area	NEMA 4X, Type 304 Stainless Steel
Indoor Dry Process Area	NEMA 12, Painted Steel
Indoor Dry Non-process Area	NEMA 1, Painted Steel
Indoor Type 1 Chemical Storage/Transfer Area	NEMA 4X, Fiberglass or PVC
Indoor Type 2 Chemical Storage/Transfer Area	NEMA 4X, Type 304 Stainless Steel
All Outdoor Areas	NEMA 4X, Type 304 Stainless Steel

2. In hazardous locations, pull and junction boxes shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

AREA CLASSIFICATION	**ENCLOSURE TYPE AND MATERIAL**

Class 1, Division 1, Group D	NEMA 7, Die Cast Aluminum
Class 1, Division 2, Group D	NEMA 4X, Type 304 Stainless Steel
Class 2, Division 1, Group F	NEMA 9, Die Cast Aluminum
Class 2, Division 2, Group F	NEMA 4X, Type 304 Stainless Steel

3. Non-metallic enclosures, NEMA 7 enclosures, and NEMA 9 enclosures shall be provided with threaded integral conduit hubs.

2.02 OUTLET BOXES

A. General

1. Outlet boxes shall be provided with a trim appropriate for the wiring device installed inside. Reference Section 16140, Wiring Devices, for outlet box trim requirements. An appropriate outlet box trim is required to achieve the NEMA rating of the outlet boxes as specified herein.

B. Surface Mount Outlet Boxes

1. Outlet boxes shall be the deep type, no less than 2.5 inches deep.

2. Outlet boxes shall be provided in single or multi-gang configuration as required, sized in accordance with the requirements of the NEC.

3. In non-hazardous locations, outlet boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	**ENCLOSURE TYPE AND MATERIAL**
Indoor Wet Process Area	NEMA 4X, Cast Aluminum
Indoor Dry Process Area	NEMA 1, Cast Iron
Indoor Dry Non-process Area	NEMA 1, Cast Iron
Indoor Type 1 Chemical Storage/Transfer Area	NEMA 4X, PVC
Indoor Type 2 Chemical Storage/Transfer Area	NEMA 4X, Cast Aluminum
All Outdoor Areas	NEMA 4X, Cast Aluminum

4. In hazardous locations, outlet boxes shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

AREA CLASSIFICATION	**ENCLOSURE TYPE AND MATERIAL**
Class 1, Division 1, Group D	NEMA 7, Die Cast Aluminum
Class 1, Division 2, Group D	NEMA 4X, Cast Aluminum

Class 2, Division 1, Group F	NEMA 9, Die Cast Aluminum
Class 2, Division 2, Group F	NEMA 4X, Cast Aluminum

5. Outlet boxes shall be provided with integral threaded conduit hubs mounted external to the box. Boxes with threaded conduit hubs mounted internal to the box or as a part of the box wall are not acceptable.

C. Flush Mount Outlet Boxes

1. Outlet boxes shall be no less than 2-1/8 inches deep, and 4-11/16 inches square. Boxes shall be UL listed and labeled. Pre-punched single diameter conduit knockouts are acceptable, however, concentric and eccentric knockouts are not acceptable.

2. Outlet boxes mounted flush in CMU walls shall be made of galvanized, tack welded steel, and suitable for installation in masonry walls. Sectional type boxes are not acceptable for this application.

3. Outlet boxes mounted flush in gypsum walls shall be made of galvanized pressed steel. Tack welded boxes are not acceptable for this application. Sectional type boxes are not acceptable for this application.

4. Outlet boxes mounted cast into concrete shall be concrete tight, and shall be made of galvanized steel or PVC.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Pull and Junction Boxes

1. Pull boxes and junction boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.

2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.

3. Box penetrations for conduits shall be made with a punch tool, and penetrations shall be of the size required for the conduit entry and/or hub. Oversized penetrations in boxes are not acceptable.

4. Watertight conduit hubs shall be provided for boxes where a NEMA 4X enclosure rating is specified. Reference Section 16110, Raceways, Fittings, and Supports for conduit hub requirements.

5. Pull and junction boxes may be installed flush mounted in gypsum, concrete or CMU walls where appropriate provided that covers are easily removed or opened.

6. Pull and junction boxes shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

B. Outlet Boxes

1. Outlet boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.

2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.

3. Flush mounted outlet boxes shall be arranged and located so that tile and grout lines fit closely around the boxes, and so placed that the cover or device plate shall fit flush to the finished wall surface.

4. Outlet boxes shall be flush mounted in finished areas and other areas where practical. Flush mounted outlet boxes shall not be installed in hazardous areas and type 1 or 2 chemical storage/transfer areas.

5. For the below-named items, mounting heights from finished floor, or finished grade to top is applicable, depending on the type of wiring device to be installed in the outlet box. Mounting heights for outlet boxes shall be as follows, unless otherwise specified herein, indicated on the Drawings, or required by the Americans with Disability Act (ADA):

   a. Light switches and wall mounted occupancy sensors, 48 inches

   b. Receptacles in indoor dry process/non-process areas, 16 inches

   c. Receptacles in indoor wet process areas and all indoor chemical storage/transfer areas, 48 inches

   d. Receptacles in outdoor locations, 24 inches

   e. Ceiling mounted occupancy sensors, as indicated on the Drawings

6. Outlet boxes shall be provided in the material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

END OF SECTION

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SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install all switches, occupancy sensors, and receptacles of the type and at the locations as shown on the Drawings.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 - SUBMITTALS

C. Section 16050 – BASIC ELECTRICAL

D. Section 16120 – LOW VOLTAGE WIRE AND CABLE

E. Section 16130 – BOXES

1.03 REFERENCES

UL 20	General Use Snap Switches
UL 498	Standard for Attachment Plugs and Receptacles
UL 943	Ground Fault Circuit Interruptors
UL 1203	Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations.

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Product Datasheets.

C. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer’s operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer’s equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

1.06 TOOLS AND SPARE PARTS

A. The Contractor shall furnish 10% (minimum of 1) spare of each receptacle, switch, and plug furnished and installed for this project.

B. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

C. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.07 HANDLING AND STORAGE

A. Follow manufacturer's recommendations regarding handling and storage at all times prior to placing the equipment in service.

1.08 GUARENTEES AND WARRANTY

A. All devices in this section shall be warrantied for a minimum of one (1) year after installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. The equipment covered by these Specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. The Contractor shall use the products of a single manufacturer for each type of wiring device.

C. The Contractor shall use the products of a single manufacturer for all device plates. Plate variations are allowed for the following devices:

1. Where the selected plate manufacturer does not manufacture a suitable finish plate.

2. For heavy duty receptacles rated at more than 30A.

3. Where non standard plates are required, specified, or shown.

D. The Contractor shall furnish and install all wiring devices and device plates.

2.02 WIRING DEVICES

A. Wall switches for non-hazardous areas shall be rated for the current required to suit the application, but not less than 20A. Double pole, three-way, and four-way switches shall be provided where indicated on the Drawings, and as required. Switches shall be rated for 120-277VAC, and shall be UL 20 Listed.

B. Convenience receptacles for non-hazardous areas shall be rated for 20A at 125VAC. Convenience receptacles shall be UL 498 Listed. Tamper resistant receptacles are not acceptable.

C. Special purpose receptacles (welders, lab equipment, etc.) shall be provided with the proper NEMA configuration and ampacity as indicated on the Drawings. The coordinating plug for each special purpose receptacle shall be provided with the equipment which it is serving.

D. Ground fault circuit interrupter receptacles shall be rated for 20A at 125VAC. Ground fault circuit interrupter receptacles shall be UL 943 Listed. Tamper resistant receptacles are not acceptable.

E. Wall switches for hazardous areas shall be the factory sealed type, UL 1203 Listed for use in the hazardous area. Wall switches shall be rated for 120-277VAC, and shall be rated for the current required to suit the application, but not less than 20A

F. Receptacles for hazardous areas shall be rated 20A at 120-240VAC. Receptacles shall be UL 1203 listed for use in the hazardous area, utilizing delayed-action construction.

G. All wiring devices shall be approved for use with stranded conductors, if stranded conductors are to be used with the device. Reference Section 16120, Low Voltage Wire and Cable for conductor requirements

2.03 DEVICE PLATES

A. Device plates for indoor flush mounted receptacles and switches shall be made of Type 304 stainless steel, not less than 0.032 of an inch thick, with beveled edges and milled on the rear so as to lie flat against the wall. Devices plates shall be provided with a gasket.

B. Device plates for outdoor installations, indoor wet process areas, and chemical storage/transfer areas shall be Appleton Type FSK, Crouse Hinds #DS185, or equal for

wall switches. Device plates for receptacles shall be “in-use” style. “In-use” weatherproof covers shall be rugged, minimum 3 ¼” depth, die-cast aluminum as manufactured by Thomas & Betts "Red Dot," Intermatic International, Inc., or equal.

C. Device plates for indoor dry process and non-process areas with surface mounted boxes shall be Crouse-Hinds DS32, or equal for switches, and Crouse-Hinds DS23 or equal for receptacles.

2.04 PLUGS

A. The Contractor shall furnish suitable plugs with equipment furnished under the respective specification Section. Plugs shall be black rubber or plastic. For waterproof receptacles, the plugs shall be similar in construction to the receptacles and shall be encased in corrosion resistant yellow housing provided with clamping nuts and stuffing gland cable outlets.

2.05 PROCESS INSTRUMENTS

A. The Contractor shall furnish and install a local disconnect switch at each process instrument (e.g., level transmitter, flow transmitter, analytical instrument etc.,) to disconnect the 120VAC power supply to the instrument. The device shall be a NSSC series manual motor starting switch without overload protection as manufactured by Crouse-Hinds, Appleton equivalent, or equal. For hazardous locations, the device shall be UL 1203 Listed.

B. Manufacturer shall be:

1. In non-hazardous areas, provide specification grade devices manufactured by Appleton, Crouse-Hinds, Leviton, Hubbell, Pass & Seymour, or Engineer approved equal.

2. In hazardous areas, provide devices manufactured by Appleton, Cooper Crouse-Hinds, Hubbell-Killark, or Engineer approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Where more than one (1) switch occurs at one (1) location, gang plates shall be used.

B. All device plates shall be set true and plumb, and shall fit tightly against the finished wall surfaces and outlet boxes.

C. Wiring device box (outlet box) mounting heights shall be as specified in Section 16130, Boxes.

D. When indicated height would place any of the equipment at an unsuitable location such as at a molding or break in wall finish, the Contractor shall bring it to the attention of the Engineer for a decision.

E. Receptacles installed in toilet, locker, and bathrooms, and within 6 feet of a sink, shall be

of ground fault interrupter type. Ground fault circuit interrupter receptacles shall also be furnished and installed in additional locations where indicated on the Drawings, and as required by the NEC.

F. All receptacles shall have a self-adhesive label installed on the top at the respective device plate that indicates which panel and which circuit number the receptacle is supplied from. Labels shall have a white background and black lettering in 14 point font.

3.02 CIRCUITING

A. Convenience receptacles shall be grouped on circuits separate from the lighting circuits. A maximum of eight (8) convenience receptacles are permitted per 20A, 120V circuit, unless otherwise indicated on the Drawings.

END OF SECTION

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SECTION 16150
ELECTRICAL CONTROLS AND RELAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish, install, test, and place in satisfactory operation all electric controls and relays as specified herein and indicated on the Drawings.

B. Electrical control and relay systems shall be assembled using NEMA rated components. Components designed and built to International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured and labeled in compliance with IEC standards is not acceptable.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 - SUBMITTALS

C. Section 16050 – BASIC ELECTRICAL

1.03 REFERENCES

NEMA 250	Enclosures for Electrical Equipment
UL 508A	Standard for Industrial Control Panels
UL-1203	Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations.
ANSI/ISA 12.12.01-2013	Nonincendive Electrical Equipment for use in Class I and II, Division II Hazardous (Classified) locations.

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Product Datasheets

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer’s operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer’s equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

4. Contact information for local representative and supplier

1.06 TOOLS AND SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor. In addition to the manufacturer recommended spare parts, the following spare parts shall be provided for the local control stations:

1. One (1) contact block of each type furnished on the project

2. One (1) indicating light lens of each color furnished on the project

3. One (1) LED lamp of each color furnished on the project

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same part number.

PART 2 - PRODUCTS

2.01 CONTROL COMPONENTS

A. Pilot Devices

1. General

a. All pilot devices shall be provided with a legend plate. Legend plates shall have a white background and black lettering and indicate the function of the respective pilot device. The text shown on the Drawings or indicated in the specifications shall be used as the basis for legend plate engraving (i.e. HAND-OFF-AUTO, RUN, EMERGENCY STOP, etc).

b. All pilot devices shall be selected and properly installed to maintain the

NEMA 250 rating of the enclosure in which they are installed. All pilot devices shall be UL 508 Listed.

c. All pilot devices shall be 30.5mm in diameter, unless otherwise indicated. 22mm devices are not acceptable.

d. Pilot devices for all electrical equipment under this Contract shall be of the same type and manufacturer unless otherwise specified herein or indicated on the Drawings.

e. In Class 1 Division 2 hazardous locations, pilot devices shall be the hermetically-sealed type, constructed in accordance with ANSI/ISA 12.12.01.

2. Pushbuttons

a. Pushbuttons shall be non-illuminated, black in color, and have momentary style operation unless otherwise indicated on the Drawings.

b. Pushbuttons shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each pushbutton. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.

c. Pushbuttons shall be provided with a full guard around the perimeter of the button. Where a lockout style pushbutton is specified or indicated on the Drawings, provide a padlockable guard.

3. Selector Switches

a. Selector switches shall be non-illuminated, black in color, and have the number of maintained positions as indicated on the Drawings and as required. Handles shall be the extended type that provide a greater surface area for operation.

b. Selector switches shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each selector switch. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.

c. Where indicated in the Drawings or Specifications, provide spring return positions.

d. Selector switches shall be provided with an indexing component that fits into the keyed portion of the cutout for the device and prevents the switch from spinning when operated.

4. Indicating Lights

a. Indicating lights shall LED type, with the proper voltage rating to suit the application, and push-to-test feature.

b. Indicating light lens colors shall be as required in equipment specifications and/or as indicated on the Drawings. If lens colors are not indicated, the following colors shall be used:

Red	"Run", "On", “Open”
Green	"Off", “Closed”
Amber	"Alarm", "Fail"
White	“Control Power On”
Blue	General Status

5. Emergency Stop and Tagline Switches

a. Emergency stop switches shall be non-illuminated, red in color, with a minimum 35mm diameter mushroom head. Once activated, switch shall maintain its position and require a manual pull to release/reset.

b. Tagline switches shall have a plunger that activates upon tension from the associated safety cable. Once activated, switch shall maintain its position and require a manual release/reset.

c. Emergency stop and tagline switches shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each switch. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.

B. Relays and Timers

1. General

a. Relays and timers shall be furnished with an integral pilot light for positive indication of coil energization.

b. Relays and timers shall have tubular pin style terminals with matching 11-pin DIN rail mount socket. Spade or blade style terminals are not acceptable.

c. Relays and timers for all electrical equipment under this Contract shall be of the same type and manufacturer unless otherwise specified herein or indicated on the Drawings.

2. Control and Pilot Relays

a. Miniature or “ice-cube” type relays are not acceptable.

b. Relays shall have coil voltage as required to suit the application and/or as indicated on the Drawings.

c. Relays shall be provided with contacts rated for 10A (resistive), minimum, at 120/240 VAC and 28 VDC. Relays shall have 3-pole, double-throw (3PDT) contact arrangement.

3. Time Delay Relays

a. Timers delay relays shall utilize electronic timing technology. Mechanical timing devices are not acceptable.

b. Relays shall have coil voltage as required to suit the application and/or as indicated on the Drawings.

c. Relays shall be provided with contacts rated for 10A (resistive), minimum, at 120/240 VAC and 28 VDC. Relays shall have double-pole double-throw (DPDT) contact arrangement.

d. Time delay ranges shall be as indicated on the Drawings and/or as required to suit the application. Timing range shall be adjustable from the front of the relay. On delay and off delay timer configurations shall be provided as indicated on the Drawings and/or as required to suit the application.

4. Elapsed Time Meters

a. Elapsed time meters shall be non-resettable type with no less than a 4 digit display. Coil voltage shall be as required to suit the application and/or as indicated on the Drawings

C. Control Terminal Blocks

1. Control terminal blocks shall be assembled on non-current carrying galvanized steel DIN mounting rails securely bolted to the enclosure or subpanel. Terminals shall be tubular screw type with pressure plate that will accommodate wire size range of #22 - #8 AWG.

2. Control terminal blocks shall be single tier with a minimum rating of 600 volts and 20A. Separate terminal strips shall be provided for each type of control used (i.e. 120VAC vs. 24VDC). Quantity of terminals shall be provided as required to suit the application. In addition, there shall be a sufficient quantity of terminals for the termination of all spare conductors.

3. Terminals shall be marked with a permanent, continuous marking strip, with each terminal numbered. One side of each terminal shall be reserved exclusively for incoming field conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal.

2.02 LOCAL CONTROL STATIONS

A. Local control stations shall be furnished and installed complete with pushbuttons, selector switches, indicating lights, and other devices as indicated on the Drawings.

B. Specific devices installed in local control stations shall be provided in accordance with the requirements specified elsewhere in this Section.

C. In non-hazardous locations, local control stations shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	**ENCLOSURE TYPE AND MATERIAL**
Indoor Wet Process Area	NEMA 4X, Type 304 Stainless Steel
Indoor Dry Process Area	NEMA 12, Die Cast Zinc
Indoor Dry Non-process Area	NEMA 12, Die Cast Zinc
Indoor Type 1 Chemical Storage/Transfer Area	NEMA 4X, Fiberglass or Thermoplastic Polyester
Indoor Type 2 Chemical Storage/Transfer Area	NEMA 4X, Type 304 Stainless Steel
All Outdoor Areas	NEMA 4X, Type 304 Stainless Steel

D. In hazardous locations, local control stations shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

AREA CLASSIFICATION	**ENCLOSURE TYPE AND MATERIAL**
Class 1, Division 1, Group D	NEMA 7, Die Cast Aluminum
Class 1, Division 2, Group D	NEMA 4X, Type 304 Stainless Steel
Class 2, Division 1, Group F	NEMA 9, Die Cast Aluminum
Class 2, Division 2, Group F	NEMA 9, Die Cast Aluminum

E. Non-metallic enclosures, NEMA 7 enclosures, and NEMA 9 enclosures shall be provided with threaded integral conduit hubs. Conduit hubs shall be external to the enclosure.

F. Local control stations for use in non-hazardous locations shall be UL-508 Listed. Local control stations for use in Class 1 Division 1 and Class 2 Divisions 1/2 hazardous locations shall be UL-1203 Listed. Local control stations for use in Class 1 Division 2 hazardous locations shall be in accordance with ANSI/ISA 12.12.01-2013.

G. Manufacturer shall be:

1. Siemens Energy and Automation

2. Eaton

3. Square D (Schneider Electric)

4. General Electric

5. Allen-Bradley

6. Or Engineer Approved Equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. Local control stations shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

B. All control components shall be mounted in a manner that will permit servicing, adjustment, testing, and removal without disconnecting, moving, or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component's mounting shall be oriented in accordance with the component manufacturer's and industries' standard practices.

C. Pilot devices shall be properly bonded to the equipment enclosure door where they are installed. If proper bonding cannot be achieved through the locknuts that affix the device in place, a green colored bonding screw shall be provided on the pilot device. The bonding screw shall be bonded to the equipment enclosure through the use of an insulated green bonding conductor.

D. Local control station covers shall be bonded to the local control station enclosure through the use of an insulated green bonding conductor.

E. Wiring to devices at each local control station shall be provided with enough slack to permit the local control station cover to be removed and pulled at least 6 inches away from the enclosure.

F. Terminal strips, relays, timers, and similar devices shall not be installed on the rear of the panel/cabinet doors. Terminal strips, relays, timers, and similar devices shall not be installed on the side walls of panel/cabinet interiors without written permission from the Engineer.

END OF SECTION

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SECTION 16289
TRANSIENT VOLTAGE SUPPRESSION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish, install, and place in satisfactory operation, the surge protective devices (SPD) as specified herein and indicated on the Drawings.

B. The surge protective devices specified under this Section shall be provided as a stand-alone unit, separate from the enclosure of the equipment to which they are connected. The requirements of this Section shall not apply to equipment where an integral SPD is specified.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 - SUBMITTALS

C. Section 16050 – BASIC ELECTRICAL

D. Section 16120 – LOW VOLTAGE WIRE AND CABLE

1.03 REFERENCES

UL 1449	Surge Protective Devices
UL 1283	Electromagnetic Interference Filters
IEEE C62.41.1	Guide for Surge Voltages in Low-Voltage AC Power Circuits
IEEE C62.41.2	Recommend Practice on Characterization of Surges in Low Voltage (100V and Less) AC Power Circuits.
IEEE C62.45	IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
IEEE C62.62	IEEE Standard Test Specifications for Surge Protective Devices for Low Voltage (1000V and Less) AC Power Circuits
NFPA 70	National Electric Code

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Product Datasheets.

C. Layout Drawings - Show complete layout, including materials, sizes, locations, and dimensions.

D. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are

submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

E. Proof that all products provided under this Section are UL listed and labeled by Underwriters Laboratories to UL1449, latest Edition. This proof shall be a copy of the data listed under the UL File Number for the manufacturer, which may be obtained from the UL Online Certification Directory. No other means of proving compliance (such as manufacturer data sheets, marketing material, etc) will be considered acceptable.

F. Proof of Short Circuit Current Ratings (SCCR), Voltage Protection Ratings (VPRs) for all modes, Maximum Continuous Operating Voltage rating (MCOV), Nominal Discharge Current (In), and device listing Type shall be submitted using the same means as described in the paragraph above.

G. Proof that all products provided under this Section are UL listed and labeled by Underwriters Laboratories to UL 1283, latest Edition. This proof shall be a copy of the data listed under the UL File Number for the manufacturer, which may be obtained from the UL Online Certification Directory. No other means of proving compliance (such as manufacturer data sheets, marketing material, etc) will be considered acceptable.

H. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "Soft Cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are to provide are acceptable and shall be submitted.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer’s operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer’s equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

4. Contact information for local representative and supplier

1.06 FACTORY TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Factory Shop Tests

a. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA, ANSI, and UL standards.

b. All surge protective devices, subassemblies, and components shall be 100% tested and certified by the manufacturer to meet their published performance parameters.

1.07 TOOLS AND SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished by the Contractor to the Owner.

B. The Contractor shall furnish one (1) spare field replacement module of each rating provided under this Contract.

C. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

D. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the Work, at which time they shall be delivered to the Owner.

E. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

F. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same part number.

1.08 HANDLING AND STORAGE

A. Equipment shall be carefully transported, stored, handled, and set in place in a manner that will prevent damage, misalignment, and distortion to the equipment.

B. Follow manufacturer's recommendations regarding handling and storage at all times prior to placing the equipment in service.

1.09 GUARENTEES AND WARRANTY

A. All SPDs, associated hardware, and supporting components shall be warranted to be free from defects in materials and workmanship, under normal use and in accordance with the instructions provided, for a period of five (5) years after acceptance of the equipment by the Owner.

B. Any component or subassembly contained within the surge protection system that shows evidence of failure or incorrect operation during the five (5) year warranty period, shall be replaced by the manufacturer at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. The SPD units shall be UL 1449 Listed and must bear the UL mark. Units that are "manufactured in accordance with" UL 1449 or tested by other testing agencies "in accordance with" UL 1449 are not acceptable and will be rejected.

B. Type II SPD units shall be UL 1283 Listed and must bear the UL mark. Units that are "manufactured in accordance with" UL 1283 or tested by other testing agencies "in accordance with" UL 1283 are not acceptable and will be rejected. Further, SPD units using UL 1283 capacitors but not tested to UL 1283 will be rejected.

C. SPDs shall be provided as a stand-alone unit, separate from the equipment to which they are connected.

D. All SPDs furnished and installed under this Contract shall be from the same manufacturer.

2.02 PRODUCTS

A. Type I surge protective devices (SPD) shall be furnished and installed when shown without upstream overcurrent protection on the Drawings. Type II SPDs shall be provided in all other locations. Type II SPDs shall not require the use of a specific upstream overcurrent device. SPDs shall be provided in the location and quantity as shown on the Drawings.

B. Each SPD shall be rated for the voltage and configuration of the equipment to which it is connected.

C. Each Type II SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.

D. The short circuit current rating of each SPD shall match or exceed the rating of the equipment to which it is connected. The Contractor shall reference the Drawings for short circuit current rating of each piece of equipment.

E. Each SPD system shall provide surge protection in all possible modes. Surge protection shall be as follows:

SYSTEM CONFIGURATION	MODES OF PROTECTION	NUMBER OF MODES
3-Phase Wye	L-N, L-G, N-G	7
3-Phase Delta	L-L, L-G	6
3-Phase Impedence Grounded	L-L, L-G	6
Single-Phase	L-N, L-G, N-G	3

F. Each SPD shall have a Maximum Continuous Operating Voltage (MCOV) of at least 115% of the nominal voltage of the equipment to which it is connected.

G. The Nominal Discharge Current (In) of each SPD shall be 20kA. Peak surge current ratings shall not be used as a basis for applying the SPD to the system.

H. The Voltage Protection Rating (VPR) of each SPD shall not exceed the following:

SYSTEM VOLTAGE	L-N	L-G	L-L	N-G
208Y/120	800V	800V	1200V	800V
480Y/277	1200V	1200V	2000V	1200V
480 DELTA	N/A	1800V	2000V	N/A
240 DELTA	N/A	1200V	1200V	N/A
120/240	800V	800V	1200V	800V

I. The surge current rating for each SPD shall be as indicated on the Drawings. Surge current ratings are indicated on single line diagrams and in panel schedules. Surge current rating indicated is on a per phase basis.

J. Each SPD shall be provided in an enclosure to match or exceed the NEMA rating of the equipment enclosure that it is serving (i.e. NEMA1, NEMA 12, NEMA 4X, etc).

K. Each SPD shall be provided with the following accessories:

1. Each individual module shall feature an LED indicating the individual module has all surge protection devices active. If any single component is taken off-line, the LED shall turn off and another LED shall illuminate, providing individual module as well as total system status indication.

2. Surge counter and audible alarm with reset/silence switch.

3. One set of Form C (SPDT) dry contacts rated for at least 5A at 120VAC.

L. Manufacturer shall be:

1. Eaton

2. Thor Systems

3. ASCO/Emerson Network Power

4. Schneider (Square D)

5. Or Engineer Approved Equivalent

PART 3 - EXECUTION

3.01 INSTALLATION

A. The SPD units shall be furnished and installed as shown on the Drawings and in accordance with the manufacturer's installation instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. The SPD units shall be mounted such that the conductor lengths are as short as possible, but no greater than 36 inches. Any installation resulting in a conductor length of greater than 36 inches shall be reviewed with the Engineer as a special type of cable may need to be installed. For equipment such as panelboards, the Contractor shall relocate the circuit breaker that is to be connected to the SPD as needed to achieve the shortest conductor length possible.

C. The Contractor shall use a close nipple to enclose the conductors between the SPD and the equipment served. However, if due to field conditions a 90 degree conduit bend is required to connect the SPD to the equipment that it serves, the bend shall have a minimum radius of 36 inches to eliminate any potential for sharp bends in the conductors.

D. Conductors between the equipment served and the SPD shall be 600V power wire and cable as specified in Section 16120 – Low Voltage Wire and Cable. The individual conductors shall be gently twisted and shall be sized as indicated on the Drawings.

3.02 TESTING [AND STARTUP]

A. Prior to energizing, the Contractor shall verify that the SPD unit voltage and configuration is suitable for the system to which it is connected.

B. Prior to energizing, the Contractor shall also verify that any Neutral to Ground bonding jumpers are installed as required.

C. Prior to energizing, the Contractor shall also verify that the impedance of the equipment grounding conductor between the SPD and the grounding electrode system is less than 1 ohm.

END OF SECTION

SECTION 16410
ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install enclosed circuit breakers of voltage and current ratings as specified herein and indicated on the Drawings.

B. This specification is intended to apply to circuit breakers separately-mounted from other equipment in an individual enclosure. This Section does not apply to circuit breakers as part of an equipment assembly such as motor control centers, panelboards, switchboards, etc.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 - SUBMITTALS

C. Section 16050 – BASIC ELECTRICAL

1.03 REFERENCES

UL 489	Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures
NEMA 250	Enclosures for Electrical Equipment
NFPA 70	National Electric Code

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Layout Drawings - Show complete layout, including materials, sizes, and dimensions.

C. Product Data Sheets.

D. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the

deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer's operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer's equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

4. Contact information for local representative and supplier

1.06 TOOLS AND SPARE PARTS

A. For each enclosed circuit breaker, the Contractor shall furnish to the Owner all spare parts as recommended by the equipment manufacturer.

1.07 HANDLING AND STORAGE

A. The Contractor shall follow manufacturer's recommendations regarding handling and storage at all times prior to placing the device in service.

1.08 GUARENTEES AND WARRANTY

A. The enclosed circuit breaker shall be warrantied for at least one (1) year of operation after installation.

PART 2 - PRODUCTS

2.01 ENCLOSED CIRCUIT BREAKERS

A. Circuit breakers shall be molded case type with trip and frame ratings as indicated on the Drawings. Provide electronic trip unit where indicated on the Drawings, with adjustable functions as indicated on the Drawings.

B. The Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

C. Circuit breakers shall have an interrupting rating of 65,000 amperes symmetrical at 480 VAC, unless otherwise indicated on the Drawings.

D. Enclosed circuit breakers in non-hazardous locations shall be UL 489 Listed. Circuit

breakers in hazardous locations shall be UL 1203 Listed.

E. In non-hazardous locations, enclosed circuit breakers shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	ENCLOSURE TYPE AND MATERIAL
Indoor Wet Process Area	NEMA 4X, Type 304 Stainless Steel
Indoor Dry Process Area	NEMA 12, Painted Steel
Indoor Dry Non-process Area	NEMA 1, Painted Steel
Indoor Type 1 Chemical Storage/Transfer Area	NEMA 4X, Fiberglass
Indoor Type 2 Chemical Storage/Transfer Area	NEMA 4X, Type 304 Stainless Steel
All Outdoor Areas	NEMA 4X, Type 304 Stainless Steel

F. In hazardous locations, enclosed circuit breakers shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

AREA CLASSIFICATION	ENCLOSURE TYPE AND MATERIAL
Class 1, Division 1, Group D	NEMA 7, Die Cast Aluminum
Class 1, Division 2, Group D	NEMA 7, Die Cast Aluminum
Class 2, Division 1, Group F	NEMA 9, Die Cast Aluminum
Class 2, Division 2, Group F	NEMA 9, Die Cast Aluminum

G. Enclosed circuit breakers shall be quick-make, quick-break and with an interlocked cover which cannot be opened when the breaker is in the “ON” position and capable of being locked in the “OPEN” position.

H. An Underwriter's Laboratories, Inc. inspection label shall appear on the interior of the enclosure.

I. Enclosed circuit breakers shall be suitable for use as service entrance equipment where indicated on the Drawings and so labeled to suit the application.

J. Where indicated on the Drawings, enclosed circuit breakers shall be 100% rated.

K. Circuit breakers shall be NEMA style construction, IEC style circuit breakers are not acceptable.

L. Manufacturer shall be:

1. Eaton

2. General Electric Company

3. Square D Company (Schneider Electric)

4. Siemens Energy and Automation

5. Or Engineer Approved Equivalent

PART 3 - EXECUTION

3.01 GENERAL

A. The enclosed circuit breaker shall be furnished and installed as shown on the Drawings and as recommended by the equipment manufacturer.

B. Enclosed circuit breakers shall be set true and plumb in locations as shown on the Drawings. The top of enclosure shall not exceed six (6) feet above finished floor elevation.

C. Enclosed circuit breakers shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

3.02 TESTING [AND STARTUP]

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests

a. None required

2. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

END OF SECTION

SECTION 16440
DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install separately mounted, individual disconnect switches as specified herein and indicated on the Drawings.

B. Disconnect switches for process instruments are not included in the scope of this Section and shall be as specified in Section 16140 – Wiring Devices.

1.02 CODES AND STANDARDS

A. Disconnect switches shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 98 – Enclosed and Dead-Front Switches

2. UL 1203 – Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations.

3. NEMA 250 – Enclosures for Electrical Equipment

4. NEMA KS 1 – Heavy Duty Enclosed and Dead-Front Switches

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Spare Parts List

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Complete layout and installation drawings with clearly marked dimensions for each type/size/rating of disconnect switch.

3. Assembled weight of each unit.

D. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items that the Contractor intends to provide are acceptable and shall be submitted.

1.05 SPARE PARTS

A. The equipment shall be furnished with all spare parts as recommended by the equipment manufacturer.

B. One (1) complete set of spare fuses for each ampere rating installed shall be furnished and delivered to the Owner at the time of final inspection.

C. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

D. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. Switches shall be manufactured by the Square D Company, Eaton, the General Electric Company, or Siemens Energy and Automation, Inc.

2.02 DISCONNECT SWITCHES

A. Disconnect switches shall be heavy-duty type and/or as specified in these Specifications. Switches shall be furnished and installed as shown on the Drawings and as required by the NEC. Handles shall be lockable.

B. Disconnect switches shall be UL 98 Listed.

C. Switches shall meet NEMA Standard KS 1 type HD requirements, be externally operated, and be fused or non-fused as indicated on the Drawings. Switches shall have the number of the poles, voltage, and ampere ratings as shown on the Drawings.

D. In non-hazardous locations, disconnect switches shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Unless otherwise indicated on the Drawings. Area designations are indicated on the Drawings.

AREA DESIGNATION	**ENCLOSURE TYPE AND MATERIAL**
Indoor Wet Process Area	NEMA 4X, Type 304 Stainless Steel
Indoor Dry Process Area	NEMA 12, Painted Steel
Indoor Dry Non-process Area	NEMA 1, Painted Steel
Indoor Type 1 Chemical Storage/Transfer Area	NEMA 4X, Fiberglass
Indoor Type 2 Chemical Storage/Transfer Area	NEMA 4X, Type 304 Stainless Steel
All Outdoor Areas	NEMA 4X, Type 304 Stainless Steel

E. NOT USED

F. Disconnect switches shall be quick-make, quick-break and with an interlocked cover which cannot be opened when switch is in the "ON" position and capable of being locked in the "OPEN" position.

G. A complete set of fuses for all switches shall be furnished and installed as required. Time-current characteristic curves of fuses serving motors or connected in series with circuit breakers shall be coordinated for proper operation. Fuses shall have voltage rating not less than the circuit voltage.

H. Disconnect switches shall be furnished with a factory installed internal barrier kit that helps prevent accidental contact with live parts and provides “finger-safe” protection when the door of the enclosed switch is open.

I. Disconnect switches shall be furnished with a manufacturer-supplied ground lug kit for termination of equipment grounding conductors. Where a grounded (neutral) conductor is shown on the Drawings in the conduits connected to the disconnect switch, a manufacturer-supplied neutral bar shall be furnished for termination of the grounded conductors. Third party ground lug and neutral lug kits not supplied by the disconnect switch manufacturer are not acceptable.

J. Disconnect switches for all motors connected to variable frequency drives (VFDs) shall be furnished with a factory installed electrical interlock kit that includes one (1) early-break auxiliary contact rated for 5A (minimum) at 120 VAC to be used to open the control circuit before the main switch blades break.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All disconnect switches shall be mounted five (5) feet above the floor or finished grade, at the equipment height where appropriate, or where shown otherwise.

B. Disconnect switches shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

3.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

END OF SECTION

SECTION 16442
PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install panelboards of voltage and current ratings as specified herein and indicated on the Drawings. Panelboards shall be furnished with circuit breaker ratings, number of breakers, number of poles and locations conforming to the panelboard schedules on the Drawings.

B. All power distribution equipment shall be UL Listed.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 - SUBMITTALS

C. Section 16050 – BASIC ELECTRICAL

1.03 REFERENCES

UL 67	Panelboards
UL 50	Cabinets and Boxes
NEMA PB1	NEMA Standard for Panelboards
NECA 407	NECA Standard for Installing and Maintaining Panelboards
NFPA 70	National Electric Code
UL 489	UL Standard for Circuit Breakers

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Product Datasheets

C. Layout Drawings - Show complete panel layout layout, including materials, sizes, classes, locations, and dimensions.

D. Results of shop tests, if required.

E. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall

be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer’s operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer’s equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

4. Contact information for local representative and supplier

1.06 TOOLS AND SPARE PARTS

A. For each panelboard, the Contractor shall furnish to the Owner all spare parts as recommended by the equipment manufacturer. All spaces in the panelboards shall be furnished with a spare breaker as indicated in the panelboard schedules shown on the Drawings.

B. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

C. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.07 HANDLING AND STORAGE

A. Equipment shall be carefully transported, stored, handled, and set in place in a manner that will prevent damage, misalignment, and distortion to the equipment.

B. Follow manufacturer's recommendations regarding handling and storage at all times prior to placing the equipment in service.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. All main bus shall be tin plated copper sized in accordance with UL standards to limit the temperature rise on any current carrying part to a maximum of 50 degrees C above a maximum ambient temperature of 40 degrees C.

C. All circuit breakers shall be fully rated for the full short circuit rating shown on the drawings. Series ratings are not acceptable.

2.02 LIGHTING PANELBOARDS

A. General

1. Lighting panelboards shall be dead-front type with automatic trip-free, non-adjustable, thermal-overload, branch circuit breakers. Panelboards shall be of the configuration and rating as specified herein and indicated on the Drawings. Panelboards shall be service entrance rated where indicated on the Drawings.

2. Lighting panelboards shall be equipped with a main breaker or main lugs complete with branch circuit breakers, as indicated on the Drawings. The panelboards shall be suitable for flush or surface mounting.

3. Lighting panelboards shall be fully rated and shall have a minimum short circuit rating of 22,000 amperes symmetrical, unless otherwise indicated on the Drawings.

4. Lighting panelboards shall be Eaton Pow-R-Line Series, the Square D Company equivalent, the General Electric Company equivalent, or Siemens Energy and Automation, Inc. equivalent.

B. Enclosures

1. Enclosures shall have a NEMA rating as indicated on the Drawings, and be constructed of No. 12 U.S.S. code gauge galvanized steel. The door shall be fastened to the enclosure with concealed hinges and shall be equipped with flush-type catches and locks. The Contractor shall equip cabinet doors exceeding 40 inches in height with vertical bolt three point locking mechanism. All locks shall be keyed alike. The panelboard trim shall have a removable hinge assembly, in addition to the door hinge, that allows work inside the enclosure without the need to remove the trim. The enclosure shall have wiring gutters on sides and shall be at least 5-3/4 inches deep. The panelboard shall be provided with an information label. The information label shall include the panelboard designation, voltage, phase, wires, and bus rating.

2. All metal surfaces of the panelboard enclosures shall be thoroughly cleaned and

given one prime of zinc chromate primer. All interior surfaces shall then be given one shop finishing coat of a lacquer of the nitro cellulose enamel variety. All exterior surfaces shall be given three coats of the same lacquer. The color of finishing coats shall be manufacturer's standard light gray.

3. An Underwriter's Laboratories, Inc. inspection label shall appear on the interior of the cabinet.

C. Bus Work

1. Main bus bars shall be of ample size so that a current density of not more than 1000 amperes per square inch of cross section will be attained. This current density shall be based on the application of the full load connected to the panel plus approximately 25% of the full load for spare capacity. The main bus shall be full capacity as based on the preceding for the entire length of the panel so as to provide full flexibility of circuit arrangement.

2. Solid neutral bus bars are required and neutral bus ampacity shall be the same as the main bus bars unless otherwise noted. Ratings shall be in accordance with applicable standards.

3. A separate ground bus shall be provided with lugs for termination of equipment grounding conductors.

4. Branch bus work shall be rated to match the maximum branch circuit breaker which may be installed in the standard space.

5. All bus shall be tin plated copper and shall extend the entire useable length of the panelboard, including spaces. Silver plated busswork is not an acceptable alternative.

D. Circuit Breakers

1. Circuit breakers shall be bolt-on, molded-case type conforming to UL 489. All circuit breakers shall have quick-make, quick-break, toggle mechanism for manual as well as automatic operation. Tandem or half-size circuit breakers are not acceptable

2. Where indicated on the Drawings, or where required by Code, circuit breakers shall be equipped with integrally mounted ground fault interrupters complete with "TEST" push button and shall be of a type which fit standard panelboard spaces for the breaker continuous current rating required. Circuit breakers used for lighting circuit switching shall be approved for the purpose and shall be marked "SWD". Where required by Article 440 of the NEC, circuit breakers installed for air conditioning units shall be HACR type.

3. Circuit breaker voltage ratings shall meet or exceed the panelboard voltage indicated on the Drawings. Trip elements of circuit breakers shall be 20A unless otherwise indicated on the Drawings. Circuit breakers shall have an interrupting rating at 240 VAC that matches the panelboard short circuit rating.

4. Where indicated on the Drawings, branch circuit breakers shall be provided with a padlockable hasp or handle padlock attachment for padlocking in the off position as required to meet the NEC requirement for disconnecting means and/or OSHA lock-out/tagout standard. Locking hardware shall remain in place even when the padlock is removed. Branch circuit breakers used for control, instrumentation, telephone, fire alarm, or auxiliary equipment circuits requiring continuous operation shall be provided with a similar lock on device where indicated on the Drawings.

E. Directories

1. Approved directories with noncombustible plastic cover, and with typewritten designations of each branch circuit, shall be furnished and installed in each panelboard. The Contractor shall maintain in each panel, during the duration of the Contract, a handwritten directory clearly indicating the circuit breakers in service. This directory shall be updated as work progresses, and final, typewritten directories, as specified above, shall be installed at the end of the project. Designations and circuit locations shall conform to the panelboard schedules on the Drawings, except as otherwise authorized by the Engineer.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Power distribution panelboards shall be of the configuration and rating as specified herein and as indicated on the Drawings. The panelboards shall be dead front type with automatic trip-free, non adjustable, thermal overload branch circuit breakers. Panelboards shall be service entrance rated where indicated on the Drawings.

B. Power panelboards shall be equipped with a main breaker or main lugs complete with branch circuit breakers as indicated on the Drawings. The panelboards shall be suitable for flush or surface mounting.

C. Power distribution panelboards shall be fully rated and shall have a minimum short circuit rating of 65,000 amperes symmetrical unless otherwise indicated on the Drawings.

D. Power distribution panelboards shall be Eaton Pow-R-Line Series, the Square D Company equivalent, the General Electric Company equivalent, or Siemens Energy and Automation, Inc. equivalent.

E. Enclosures

1. Enclosures shall have a NEMA rating as indicated on the Drawings, and be constructed of No. 12 U.S.S. code gauge galvanized steel. The door shall be fastened to the enclosure with concealed hinges and shall be equipped with flush type catches and locks. The Contractor shall equip cabinet doors exceeding 40 inches in height with vertical bolt three point locking mechanism. All locks shall be keyed alike. The panelboard trim shall have a removable hinge assembly, in addition to the door hinge, that allows work inside the enclosure without the need to remove the trim. The enclosure shall have wiring gutters on sides and shall be at least 5 3/4 inches deep. The panel shall be provided with an information label. The information label shall include the panelboard designation, voltage, phase, wires, and bus rating.

2. All metal surfaces of the panelboard enclosures shall be thoroughly cleaned and given one prime of zinc chromate primer. All interior surfaces shall then be given one shop finishing coat of a lacquer of the nitro cellulose enamel variety. All exterior surfaces shall be given three coats of the same lacquer. The color of finishing coats shall be manufacturer's standard gray.

3. An Underwriter's Laboratories, Inc. inspection label shall appear on the interior of the cabinet.

F. Bus work

1. Main bus bars shall be of ample size so that a current density of not more than 1,000 amperes per square inch of cross section will be attained. This current density shall be based on the application of the full load connected to the panel plus approximately 25% of the full load for spare capacity. The main bus shall be full capacity as based on the preceding for the entire length of the panel so as to provide full flexibility of circuit arrangement.

2. Solid neutral bus bars, where required, shall be provided. Neutral bus shall have the same ampacity as the main bus, unless otherwise indicated. Ratings shall be in accordance with applicable standards.

3. A separate ground bus shall be provided with lugs for termination of equipment grounding conductors.

4. Branch bus work shall be rated to match the maximum branch circuit breaker which may be installed in the standard space.

5. All bus shall be tin plated copper and shall extend the entire useable length of the panelboard, including spaces. Panelboards Listed and Labeled as a four-wire panel shall not be used in place of a three-wire panel where a neutral conductor does not exist in the supply conductors to that panel. Silver plated busswork is not an acceptable alternative.

G. Circuit Breakers

1. Circuit breakers shall be bolt-on, molded-case type conforming to UL 489. All circuit breakers shall have quick-make, quick-break, toggle mechanism for manual as well as automatic operation.

2. Circuit breakers used for lighting circuit switching shall be approved for the purpose and shall be marked "SWD" where required by Article 440 by the NEC. Circuit breakers installed for air conditioning units shall be HACR type.

3. Circuit breaker voltage rating shall meet or exceed the panelboard voltage indicated on the Drawings. Trip elements of circuit breakers shall be 20A, unless otherwise indicated on the Drawings. Circuit breakers shall have an interrupting rating at 480 VAC that matches the panelboard short circuit rating.

4. Where indicated on the Drawings, branch circuit breakers shall be provided with a padlockable hasp or handle padlock attachment for padlocking in the off

position as required to meet the NEC requirement for disconnecting means and/or OSHA lock-out/tagout standard. Locking hardware shall remain in place even when the padlock is removed. Branch circuit breakers used for control, instrumentation, telephone, fire alarm, or auxiliary equipment circuits requiring continuous operation shall be provided with a similar lock on device where indicated on the Drawings.

H. Directories

1. Approved directories with noncombustible plastic cover, and with typewritten designations of each branch circuit, shall be provided in each panel. The Contractor shall maintain in each panel, during the duration of the Contract, a handwritten directory clearly indicating the circuit breakers in service. This directory shall be updated as work progresses, and final, typewritten directories, as specified above, shall be installed at the end of the project. Designations and circuit locations shall conform to the panelboard schedules on the Drawings, except as otherwise authorized by the Engineer.

2.04 SURGE PROTECTIVE DEVICES

A. Surge protective devices shall be provided in a separate enclosure external to the panelboard enclosure. See Section 16289 – Transient Voltage Suppression for panelboard SPD requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Panelboards shall be furnished and installed as shown on the Drawings and as recommended by the equipment manufacturer, and as required by NECA 407.

B. Panelboards shall be set true and plumb in locations as shown on the Drawings. The top of panelboard enclosure shall not exceed six (6) feet above finished floor elevation.

C. Enclosures shall not be fastened to concrete or masonry surfaces with wooden plugs. Appropriate cadmium plated or galvanized steel bolts shall be used with expansion shields or other metallic type concrete insert for mounting on concrete or solid masonry walls. Cadmium plated or galvanized steel toggle bolts shall be used for mounting on concrete block or other hollow masonry walls. Bolt diameter shall be as required considering the size and weight of the completed panelboard and enclosure to provide adequate structural support.

D. The Contractor shall not use factory furnished knockouts with surface mounted back boxes. The Contractor shall punch or drill required openings during installation and shall equip flush mounted back boxes with manufacturer's standard pattern of knockouts.

E. The Contractor shall install cabinets (and other enclosure products) in plumb with the building construction. Flush mounted enclosures shall be installed so that the trim will rest against the surrounding surface material and around the entire perimeter of the enclosure.

F. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same lacquer as used for shop finishing coats.

3.02 TESTING [AND STARTUP]

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Prior to termination of any conductors to the circuit breakers, all bus work and circuit breakers shall be tested from phase to phase and phase to ground with a 1000 VDC megaohmeter for 1 minute in accordance with NECA 407. Resistance values shall be recorded and shall not be less than 100 megohms.

2. Prior to terminating any wires to the circuit breakers, the resistance of the connection between the bus work and each circuit breaker shall be tested through the use of a low-resistance ohmmeter. Record the resistance values for each circuit breaker.

END OF SECTION

SECTION 16444
INDIVIDUAL MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install separately mounted, individual motor controllers for 120 volt single phase, and 208 and 480 volt three phase motors as specified herein and indicated on the Drawings. Individual motor controllers specified in this Section include magnetic motor starter and manual motor starters

B. Reference Section 16050, Basic Electrical Requirements; Section 16120, Low Voltage Wire and Cable; and Section 16150, Electric Controls and Relays.

1.02 CODES AND STANDARDS

A. Individual motor controllers shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 508 – Standard for Industrial Control Panels

2. NEMA 250 – Enclosures for Electrical Equipment

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings.

2. Spare Parts.

3. Reports of Certified Shop and Field Tests.

4. Operation and Maintenance Manuals.

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

2. Product data sheets.

3. Complete layout and installation drawings with clearly marked dimensions for each type/size/rating of individual motor controller.

4. Custom wiring diagrams for each individual motor controller. Standard wiring diagrams that are not custom created by the manufacturer for the individual motor controllers for this project are not acceptable. One wiring diagram which is typical for an equipment group (e.g. reuse water pump) is not acceptable. Each wiring diagram shall include wire identification and terminal numbers. Indicate all devices, regardless of their physical location, on the diagrams. Identify on each respective wiring diagram specific equipment names and equipment numbers consistent with those indicated on the Drawings.

5. Bill of material list for each individual motor controller.

6. Nameplate schedule for each individual motor controller.

7. Manufacturer’s installation instructions.

8. Time-current curves for each type and size protective device if requested by the Engineer.

D. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items that the Contractor intends to provide are acceptable and shall be submitted.

E. Prior to completion and final acceptance of the project, the Contractor shall furnish and install "as-built" wiring diagrams for individual motor controller. These final drawings shall be plastic laminated and securely placed inside each individual motor controller unit door and included in the O&M manuals.

1.05 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1.

1.06 SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor.

B. The Contractor shall furnish the following additional spare parts:

1. One (1) solid state overload relay for each type, size, and rating used.

2. One (1) motor circuit protector & motor contactor for each type, size, and rating used.

3. One (1) spare control power transformer for each type and size used.

4. Two (2) spare fuses for each size and type used.

C. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

D. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.

E. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

F. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 INDIVIDUAL MAGNETIC MOTOR STARTERS

A. Individual magnetic motor starters shall be combination type complete with motor circuit protectors (MCP's). Starters shall be rated 480 VAC, 3-pole, sized for the intended load unless otherwise indicated. In no case shall a starter smaller than a NEMA Size 1 be used. Each starter shall be furnished with a minimum of two spare auxiliary contacts.

B. Only NEMA starters with replaceable contacts and coils are permitted. NEMA-rated IEC starters are not acceptable.

C. In non-hazardous locations, motor starters shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	**ENCLOSURE TYPE AND MATERIAL**
Indoor Wet Process Area	NEMA 4X, Type 304 Stainless Steel
Indoor Dry Process Area	NEMA 12, Painted Steel
Indoor Dry Non-process Area	NEMA 1, Painted Steel
Chemical Storage/Transfer Area	NEMA 4X, Fiberglass
All Outdoor Areas	NEMA 4X, Type 304 Stainless Steel

D. NOT USED

E. Starters shall be provided with all coils and controls for 120 VAC operation, unless otherwise indicated on the Drawings.

F. The minimum control power transformer VA requirements are as shown below. Control power transformers shall be sized as required for the connected loads, plus 25% spare capacity.

Size 1	150 VA
Size 2	150 VA
Size 3	200 VA
Size 4	300 VA
Size 5	500 VA

The motor controller manufacturer is advised to review the total Contract Documents for additional requirements for space heaters, power factor correction capacitors, and similar equipment which may not be specified in this Division or shown on the Drawings. Control power transformers shall be fused on both the primary and secondary sides.

G. Each starter shall be supplied with a manual reset overload relay. Manual reset shall be accomplished by a door mounted overload reset pushbutton. The relays shall be solid state type, with at least one isolated normally open and one isolated normally closed auxiliary contact that operates when a trip condition has occurred. Relays shall be self-powered, have a visible trip indicator, have a trip test function, and have selectable Class 10 or 20 operation. Overload relays shall be set for Class 10 operation unless otherwise directed by the Engineer. Overload relay shall have phase loss protection built in to trip the unit and protect the motor against single phasing. The Contractor shall provide the overload relay model with the correct current range for each application. Overload relay shall have adjustable current range dial. Eutectic alloy and bi-metallic type overload relays are not acceptable.

H. Control Devices

1. Furnish and install control devices as required and/or shown on the Drawings. The following control devices shall be provided as specified in Section 16150, Electric Controls and Relays:

   a. Pilot devices (switches, indicating lights, etc)

   b. Relays and timers

   c. Control Terminal blocks

I. All control wiring shall be No. 14 AWG (minimum) labeled at each end in accordance with the wiring numbers shown on the accepted shop drawings. Power wiring shall be sized to suit the maximum horsepower rating of unit; No. 12 AWG (minimum). Wiring shall be type MTW rated for 105ºC. Wire color coding shall be as specified in Section 16120, Low Voltage Wire and Cable.

J. Each motor starter coil shall be equipped with a surge-suppression device for protection of the solid state equipment (e.g. programmable logic controller) wired as part of the control circuit.

K. Individual magnetic motor starters shall be as manufactured by Eaton using NEMA rated Freedom Series starters and contactors, the General Electric Company equivalent, the Square D Company equivalent, or Siemens Energy & Automation, Inc. equivalent.

2.03 INDIVIDUAL MANUAL MOTOR STARTERS

A. Individual manual motor starters in enclosures as specified above shall be furnished and installed for outdoor and indoor exposed work. Furnish and install manual motor starters in outlet boxes with flush wall plates as required for concealed work.

B. Furnish and install manual motor starters with pilot lights and overload heater elements of correct rating based on motor nameplate data.

C. Manual motor starters shall be equipped with either a push button or toggle operator with reset device or mechanism accessible without opening the enclosure.

D. Individual manual motor starters for motors one (1) horsepower and less shall be Eaton Type MS, the General Electric Company equivalent, the Square D Company equivalent, Allen-Bradley equivalent, or Siemens Energy & Automation, Inc. equivalent.

E. Individual manual motor starters for integral horsepower motors shall be Eaton Type B100 or B101, the General Electric Company equivalents, the Square D Company equivalents, Allen-Bradley equivalent, or Siemens Energy and Automation, Inc. equivalents.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All individual motor starters shall be installed as indicated on the Drawings and as recommended by the equipment manufacturer.

B. Individual motor starters shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

3.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests

a. None required.

2. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA acceptance testing specifications, latest edition.

END OF SECTION

SECTION 16461
LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish, install, and test transformers for power and lighting distribution systems as specified herein, as indicated on the Drawings, and as required to complete the electrical installations.

B. All equipment specified in this Section shall be furnished by the transformer manufacturer who shall be responsible for the suitability and compatibility of all included equipment.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 - SUBMITTALS

C. Section 16050 – BASIC ELECTRICAL

1.03 REFERENCES

UL 1561	Dry Type General Purpose and Power Transformers
	U.S. Department of Energy 2016 Efficiency
NFPA 70	National Electric Code
NEMA ST-20	Dry Type Transformers for General Applications
ANSI C57	Standard General Requirements for Dry Type Distribution and Power Transformers

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Product Datasheets.

C. Layout Drawings - Show complete transformer layout, including materials, sizes, locations, and dimensions.

D. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from

the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer’s operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer’s equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

4. Contact information for local representative and supplier

1.06 TOOLS AND SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor.

B. Spare parts lists, included with the Shop Drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

C. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 HANDLING AND STORAGE

A. Equipment shall be carefully transported, stored, handled, and set in place in a manner that will prevent damage, misalignment, and distortion to the equipment.

B. Follow manufacturer's recommendations regarding handling and storage at all times prior to placing the equipment in service.

1.08 GUARENTEES AND WARRANTY

A. The equipment manufacturer shall guarantee for a period of five (5) years starting at the time of Substantial Completion, that the equipment supplied is free from defects in materials or workmanship and will meet the specified performance requirements when operated in accordance with the manufacturer’s recommendations. The manufacturer shall correct any breach in this warranty at their expense.

PART 2 - PRODUCTS

2.01 DRY TYPE TRANSFORMERS

A. Furnish and install single-phase and three-phase general purpose, dry-type transformers, as specified herein and indicated on the Drawings. The transformers shall be 60 Hz, self-cooled, quiet design insulated of the two-winding type.

B. The transformers shall be UL 1561 Listed.

C. The primary windings shall be rated 480 VAC for use on 3 phase systems and connected delta unless indicated otherwise on the Drawings. KVA ratings shall be as shown on the Drawings. Furnish transformers with two 2 1/2% primary taps above, and four 2 1/2% primary taps below rated voltage for transformers 15 KVA and above, and two 2 1/2% primary taps above, and two 2 1/2% primary taps below rated voltage for transformers less than 15 kVA. All taps shall be full capacity rated.

D. The ratings of the secondary windings shall be as indicated on the Drawings.

E. Transformers shall be designed for continuous operation at rated KVA, 24 hours a day, 365 days a year, with normal life expectancy as defined in IEEE 65 and ANSI C57.96. This performance shall be obtainable without exceeding 150 degrees Celsius average temperature rise by resistance or 180 degrees Celsius hot spot temperature rise in a 40 degrees Celsius maximum ambient and 30 degrees Celsius average ambient. The maximum coil hot spot temperature shall not exceed 220 degrees Celsius. All insulating materials shall be flame retardant and shall not support combustion as defined in ASTM Standard Test Method D 635. All insulating materials shall be in accordance with NEMA ST 20 Standard for a 220 degrees Celsius UL component recognized insulation system.

F. Transformers shall meet Department of Energy 2016 Efficiency standards and be Energy-Star compliant.

G. Transformer coils shall be of the continuous wound copper construction and shall be impregnated with nonhygroscopic, thermosetting varnish.

H. All cores are to be constructed of high grade, nonaging, grain-oriented silicon steel with high magnetic permeability and low hysteresis and eddy current loses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be tightly clamped and compressed with structural steel angles. The completed core and coil shall then be bolted to the base by means of vibration absorbing mounts to minimize sound transmission. There shall be no metal to metal contact between the core and coil assembly and the enclosure.

I. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees Celsius. Transformers shall be furnished with lugs of the size and quantity required and suitable for termination of the field wiring.

J. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and

ANSI standards.

K. Transformers shall have core and coil assemblies mounted on rubber isolation pads to minimize the sound levels. Transformers shall not exceed the sound levels listed in NEMA ST-20.

L. Transformers shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	ENCLOSURE TYPE AND MATERIAL
Indoor Wet Process Area	NEMA 3R, Painted Steel
Indoor Dry Process Area	NEMA 2, Painted Steel
Indoor Dry Non-process Area	NEMA 2, Painted Steel
All Outdoor Areas	NEMA 3R, Painted Steel

M. The enclosure shall be made of heavy gauge steel and shall be degreased, cleaned, primed, and finished with a baked weather-resistant enamel using the manufacturer's standard painting process.

N. Manufacturer shall be:

1. Square D (Schneider Electric)

2. General Electric

3. Eaton

4. Siemens Energy and Automation

5. Or Engineer Approved Equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. The transformers shall be furnished and installed as shown on the Drawings and as recommended by the equipment manufacturer.

B. Conduit routed to and from the transformer shall be arranged for easy removal of the transformer access covers.

C. Where transformers 50 kVA and smaller are shown to be wall mounted, a transformer manufacturer supplied wall mounting kit shall be used. The lowest point of the wall mounting bracket shall be no lower than 7'-0" above the finished floor. Field fabricated mounting hardware is not acceptable unless reviewed and approved in writing by the Engineer.

D. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same lacquer as used for shop finishing coats.

3.02 TESTING [AND STARTUP]

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Factory Shop Tests

a. The transformers shall be given routine factory tests in accordance with the requirements of the ANSI and NEMA standards. Temperature rises may be certified from basic design.

b. As a minimum, the following tests shall be made on all transformers:

i. Ratio tests on the rated voltage connection and on all tap connections.

ii. Polarity and phase-relation tests on the rated voltage connection.

iii. Applied potential tests.

iv. Induced potential tests.

v. No-load and excitation current at rated voltage on the rated voltage connection.

2. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

b. Insulation between windings shall be tested by 1000 VDC Megaohmeter for one (1) minute. Resistance value shall be no less than 100 Megaohms.

END OF SECTION

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SECTION 16500
LIGHTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install all lighting fixtures, labor, and material, in accordance with the preceding Specifications, the requirements of this Section, and as shown on the Drawings.

B. Lighting shall be in accordance with the latest requirements of the Illuminating Engineering Society, and all lighting fixtures shall have the Underwriters Laboratories, Inc. label of approval.

C. All wiring shall be placed in conduit and shall comply with the Specifications for conduit, outlet boxes, pull and junction boxes, wires and cables, grounding, and other Sections as set forth in these Specifications and as noted herein.

1.02 RELATED SECTIONS

A. Section 01039 - COORDINATION AND MEETINGS

B. Section 01300 - SUBMITTALS

C. Section 16050 – BASIC ELECTRICAL

D. Section 16060 – GROUNDING AND BONDING

1.03 REFERENCES

UL 924	Emergency Lighting and Power Equipment
UL 844	Luminaries for Use in Hazardous (Classified) Locations
UL 1598	Luminaries
ANSI C62.41	Guide for Surge Voltages in Low-Voltage AC Power Circuits
IESNA LM-80-08	IES Approved Method for Measuring Lumen Maintenance of LED Light Sources
IESNA TM-21	IESNA Projecting Long Term Lumen Maintenance of LED Light Sources
NFPA 70	National Electric Code

1.04 ACTION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Shop Drawings shall include but not be limited to:

1. Product Datasheets

2. Layout Drawings - Show complete layout, including materials, sizes, classes, locations, and dimensions.

3. Results of shop tests, if required.

4. Catalog cuts for each fixture type showing performance and construction details of standard fixtures, and complete working drawings showing all proposed construction details of special or modified standard fixtures.

5. Photometric curves.

6. Catalog data including applicable coefficients of utilization tables, isolux chart of illumination on a horizontal plane, beam efficiency, horizontal and vertical beam spread, and beam lumens.

7. Custom wiring diagrams for each individual lighting contactor. Standard wiring diagrams that are not custom created by the manufacturer for the individual lighting contactors for this project are not acceptable. One wiring diagram which is typical for all lighting contactors is not acceptable. Each wiring diagram shall include wire identification and terminal numbers. Indicate all devices, regardless of their physical location, on the diagrams. Identify on each respective wiring diagram specific equipment names and equipment numbers consistent with those indicated on the Drawings.

8. System (entire fixture assembly) efficiency data.

C. Shop drawings shall be submitted to the Engineer for review and acceptance for all fixtures before fixtures and poles are manufactured. Substitutions will be permitted only if acceptable to the Engineer.

D. Manufacturer's catalog number and description in the fixture schedule on the Contract Documents establishes a level of quality, style, finish, etc. The use of a catalog number describing the various types of fixtures shall be used as a guide only, and does not exclude all the required accessories or hardware that may be required for a complete installation.

E. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

F. If a fixture is submitted as an “Equal” the Engineer may request a copy of the regulatory file be provided by the contractor to verify compliance with the UL Listing requirement.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 01640, and as specified herein.

B. Prior to start-up, submit manufacturer's operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer's equipment warranty.

2. Copies of Submittals

3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety

4. Contact information for local representative and supplier

1.06 FACTORY TESTING

A. The lighting fixtures shall be given routine factory tests in accordance with the requirement of ANSI, NEMA and Underwriters Laboratories standards.

1.07 TOOLS AND SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor. The following minimum spare parts shall be furnished:

1. A minimum of one (1) LED driver for every type of fixture installed.

2. A minimum of one (1) set of LED arrays for every type of LED fixture with replaceable LED arrays.

3. If either the arrays or the driver are not replaceable, a minimum of one (1) spare fixture of each type must be provided.

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.08 HANDLING AND STORAGE

A. Equipment shall be carefully transported, stored, handled, and set in place in a manner that will prevent damage, misalignment, and distortion to the equipment.

B. Follow manufacturer's recommendations regarding handling and storage at all times prior to placing the equipment in service.

1.09 GUARENTEES AND WARRANTY

A. Fixtures shall carry a minimum one (1) year warranty from the date of Substantial Completion, that the equipment supplied is free from defects in materials or workmanship and will meet the specified performance requirements when operated in accordance with the manufacturer's recommendations. The manufacturer shall correct any breach in this warranty at their expense.

B. LED fixtures shall carry a minimum 50,000 hour warranty on the LEDs and the ballast.

PART 2 - PRODUCTS

2.01 FIXTURES

A. Each fixture shall bear the Underwriters Laboratories, Inc. label. All lighting fixtures shall be furnished complete with lamps of the size and type as indicated on the Drawings and all fittings and hardware necessary for a complete installation. Lighting fixtures shall have all parts and fittings necessary to completely and properly install the fixtures.

B. Fixture leads shall be as required by NEC and shall be grounded by the equipment grounding conductor in the conduit.

C. All glassware shall be high quality, homogeneous in texture, uniform in quality, free from defects, of uniform thickness throughout, and properly annealed. Edges shall be well rounded and free from chips or rough edges.

D. HID fixture housings shall be finished with a seven-stage phosphate pretreatment and thermal-set, electrostatically applied polyester paint. Color shall be as indicated in the fixture schedule or as selected by the Engineer.

E. Indoor metal halide fixtures shown in non-hazardous locations shall be furnished with a tungsten/halogen lamp and time delay relay as specified in the fixture schedule or indicated on the Drawings. For hazardous locations where this feature is not available, emergency fixtures shall be provided with a time delay feature.

F. Emergency fixtures shall be UL 924 listed and have a minimum 90 minutes battery back-up.

G. Fixtures for use in hazardous locations shall be UL 844 Listed.

H. Fixtures specified to be damp or wet locations rated shall be UL 1598 listed.

I. Fluorescent fixtures shall be complete with housing, louvers (if required), and accessories

of the types and quantities specified herein and indicated on the Drawings.

J. Fixtures shall be as specified in the fixture schedule on the Drawings.

2.02 LED DRIVERS

A. Drivers shall have a voltage range of (120-277) +/- 10% at a frequency 60Hz.

B. All drivers shall be designed to a power factor >90% with a total harmonic distortion THD <20% at full load.

C. Case temperature shall be rated for -40°C through +80°C.

D. Drivers shall have overheat protection, self-limited short circuit protection and overload protected.

E. Drivers shall be furnished with a fused primary. Fixtures operating on 208V, 240V, or 480V shall have double-fusing with fuses present on all line connections.

F. Drivers shall have an output current ripple <30%

G. Drivers shall have a five year (50,000 hour) warranty.

H. Drivers shall be manufactured by Advance, Universal or equal.

I. Drivers shall be UL Listed for damp location, UL1012, UL935, ROHS.

J. Drivers shall meet FCC 47 Sub Part 15.

K. All drivers shall be provided with ANSI/IEEE C62.41 Category C (10kV/5kA) surge protection.

2.03 LEDs

L. Luminaires provided with LED technology shall utilize high brightness LEDs.

M. Color Temperature: as specified in fixture schedule.

N. Junction point shall be designed and manufactured to allow adequate heat dissipation.

O. LEDs shall be rated for 50,000 hours of life, minimum (based on IESNA L70). The 50,000 hour life guarantee shall be based on in-fixture tests. LED L70 lifetime values that are collected with the LED not installed in the submitted fixture are not acceptable.

P. Manufacturer shall be:

1. As shown on the fixture schedule in the Drawings. Equivalent fixtures are only acceptable or permitted if “or Equal” is called out on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lighting fixtures shall be located symmetrically with building lines as shown on the Drawings. The Contractor shall furnish and install the lighting fixtures to allow "convenient" access for maintenance such as cleaning, relamping, and other activities. The fixtures shall be installed to be accessed by a 12 ft. (max.) ladder. Where fixtures are shown in locations on the Drawings where maintenance would be difficult, the Contractor shall notify the Engineer for direction.

B. The Contractor shall provide and install all inserts, conduit, structural supports as required, lamps, ballasts, poles, wiring, and any other items required for a complete system. Contractor shall properly adjust and test, to the satisfaction of the Engineer, the entire lighting system. The Contractor shall provide pigtails and flexible conduit connected to an outlet box where necessary or required resulting in a neat and complete installation.

C. The Contractor shall protect all fixtures at all times from damage, dirt, dust, and the like. Before final acceptance, all fixtures and devices shall be cleaned of all dust, dirt or other material, be fully re-lamped (except LED fixtures) and in operating condition to the satisfaction of the Engineer.

D. The Contractor shall furnish and install all pendant trapezes and pendant stem hangers with durable swivel or equivalent trapeze hanger permitting normal fixture motion and self alignment. Fixture pendants shall be Appleton Type UNJ ball type flexible hanger at the fixture and supports from an Appleton JBLX junction box with JBLX hub cover, or equal. Pendant lengths shall be adequate and adjusted to provide uniformity of installation heights above the reference datum. Stems shall be one piece, with matching canopies and fittings.

E. Fixtures located on the exterior of the building shall be provided with neoprene gasket and non ferrous metal screws finished to match the fixtures.

F. The finish or exposed metal parts of lighting fixtures and finish trims of all recessed lighting fixtures shall be as directed by the Engineer.

G. The Contractor shall furnish and install recessed fixtures with a separate junction box concealed and located as to be accessible when fixture is removed.

H. The Contractor shall furnish and install all boxes for lighting fixtures such that the box is not the sole support of the fixture. The boxes shall be offset to allow maintenance such that access to wiring within the box can be attained without having to consider supporting (holding) the fixture.

I. All lighting units, when installed, shall be set true and be free of light leaks, warps, dents, and other irregularities. All hangers, cables, supports, channels, and brackets of all kinds for safely erecting this equipment in place, shall be furnished and erected in place by the Contractor.

J. The Contractor shall install fixtures at mounting heights indicated on the Drawings or if

not indicated on the Drawings they shall be located as shown below. In areas with exposed ducts and/or piping, installation of lighting fixtures shall be adapted to field conditions as determined by the Engineer.

1. Fixtures located on the exterior of the building shall be located a minimum of 10 Feet above grade.

2. Ceiling mounted fixtures shall be mounted directly to the ceiling.

K. The Contractor shall support each fixture securely. Each fluorescent or LED fixture shall be secured to the building structure. The Contractor shall not secure fixtures to the work of other trades, unless specified or noted otherwise, and shall not support fixtures from plaster. The Contractor shall furnish and install all steel members and supports as required to fasten and suspend fixtures from the structure.

L. In all mechanical equipment areas, the Contractor shall install lighting fixtures on the ceiling after all piping and equipment therein has been installed. Exact locations for such fixtures may be determined by the Engineer on the site during the course of the work.

M. Upon completion of work, and after the building area is broom clean, all fixtures shall be made clean and free of dust and all other foreign matter both on visible surfaces, and on surfaces that affect the lighting performance of the fixture including diffusers, lenses, louvers, reflectors, and lamps.

N. All fixtures that require physical adjustment shall be so adjusted in accordance with the directions of the Engineer. The Contractor shall also adjust angular direction of fixtures and/or lamps, as directed.

O. Relamping access of fixtures including LED fixtures shall require no special tools. All optical control surfaces such as lenses and reflectors shall be safely and securely attached to fixtures and shall be easily and quickly removed and replaced for cleaning without the use of special tools. No fixture part that may be removed, for maintenance, shall be held in place by metal tabs that must be bent to remove said part.

P. The Contractor shall furnish and install time switches and photocells as specified herein or indicated on the Drawings. Time switches shall be provided with a manual bypass switch controlling the lights locally and remotely. Time switches shall control contactors, relays, or direct controlling of one, two, or three lighting circuits, as indicated. The Contractor shall furnish and install photocells as specified herein or indicated on the Drawings for automatic "ON/OFF" switching of outdoor lighting.

Q. Lighting contactors shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

3.02 TESTING [AND STARTUP]

A. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

END OF SECTION

DIVISION III

GENERAL CONDITIONS

DIVISION III - GENERAL CONDITIONS

SECTION 1

DEFINITION OF TERMS

1.01 DEFINITION.

Whenever the following terms, or abbreviations, or pronouns in place of them are used in these specifications, or any documents or instruments in construction operations where these specifications govern, the intent and meaning shall be interpreted as follows:

1.02 ABBREVIATIONS.

A.S.T.M. The American Society for Testing Materials
A.I.S.C. The American Institute of Steel Construction
A.W.W.A. The American Water Work Association
A.A.S.H.T.O. American Association of State Highway & Transportation Officials

1.03 TERMS.

Bidder. Any individual, firm or corporation submitting a proposal for the work contemplated, acting directly or through a duly authorized representative.

Calendar Day Is every day shown on the calendar including Sundays and Holidays.

Change Order. A written order issued by the Engineer, that has been signed by both the Owner and Contractor, covering changes in the plans or quantities or both, within the scope of the contract and establishing the basis of payment and time adjustments for the Work affected by the changes.

Contract. The written agreement between the Owner and the Contractor, covering the performance of the Work and the furnishing of the labor and materials in the construction thereof. The Contract shall include, but shall not be limited to, the "Invitation for Bids," "Proposal," "Plans," "Standard Specifications," "Supplemental Specifications," "Special Provisions" (if any), "Contract Agreement," and "Contract Bonds," together with all the "Supplemental Agreements" and "Extra Work Orders" that are required to complete the Work in a substantial and acceptable manner.

Contract Bid Price. The sum of the products of the approximate quantities of the items of the Work listed in the Proposal, multiplied by the respective unit prices bid in the Proposal, plus any lump sum items.

Contract Bonds. The approved bonds furnished by the Contractor and his surety to guarantee both completion of the Contract in accordance with its terms, and prompt payment to all persons supplying him or them with labor, materials, supplies, equipment, etc.

Contractor. The individual, firm or corporation, the Party of the First Part to the Contract, that has entered into a Contract awarded him by the Owner for any work covered by these Plans and Specifications, acting directly or through his agents or employees.

Engineer. The engineering firm, or their authorized representative, acting as the Owner's agent within the scope of the authority and/or the particular duties entrusted to them.

Equipment. All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the Work.

Extra Work. Work or material, the performance or furnishing of which, is found necessary for proper completion of the improvements, and which, though in principle is an obligation of the Contractor, is not covered by any item in the proposal, and for which no means of payment, direct or indirect, has been provided in the Contract, and accordingly is an obligation for which special remuneration, by an "Extra" price or by other consideration in any case to be duly negotiated, or by "Force Account," shall be paid to the Contractor.

Extra Work Orders. Written order issued by the Engineer, at the Owner's request, to the Contractor concerning the performance of work or furnishing of Materials involving Extra Work as defined in these specifications.

Force Account. The term used to describe a method of accounting, which may be employed as a basis of payment to the Contractor for Extra Work, as described in detail in the General Agreement Section of the Specifications.

Inspector. An authorized representative of the Engineer, assigned to make general reviews of any or all portions of materials furnished and work completed by the Contractor.

Laboratory. The Testing Laboratory approved by the Owner to test materials and work involved in the Contract.

Material. Any substance proposed to be used in connection with the construction of any of the Work.

Notice to Proceed. Written notice, or the equivalent thereof, from the Engineer to the Contractor, of the date on which he is to begin the prosecution of the Work for which he has contracted.

Plans. All officially approved drawings, which are on file in the office of the Owner, or exact reproductions thereof, showing the alignment, layout, and design of structures, profiles, accessory features, the particular location, character, dimensions, and details of the Work covered by the Contract. Plans shall prevail over Standard and Supplemental Specifications whenever in conflict therewith.

Proposal. The written offer for the Work contemplated, when submitted by the Bidder in the required manner on the prescribed Proposal Form, properly signed and guaranteed.

Proposal Form. The approved, prepared form on which the Owner requires that the formal bids be submitted for the Work contemplated.

Proposal Guaranty. The certified check or bid bond designated in the Invitation for Bids, or in the Proposal Form, to be furnished by the Bidder to insure execution of the Contract and furnishing of the Bonds of the Work contemplated, if it be awarded to him.

Specifications. All work will be performed in accordance with the technical specifications prepared and adopted by the UTILITIES BOARD OF THE CITY OF GULF SHORES. All work not covered by the UTILITIES BOARD OF THE CITY OF GULF SHORES technical specifications will be performed in accordance with the provisions and requirements contained within the ALABAMA DEPARTMENT OF TRANSPORTATION Standard Specifications for Highways and Bridges, latest edition thereof, together with such as may be added or adopted as Supplemental Specifications or Special Provisions, relating to the methods of performing the Work and/or to the quantities, qualities or proportions of the materials and labor to be furnished, the method of measurement of, and the basis of payment for the Work contemplated under the Contract. Any such adopted Supplemental Specifications shall prevail under these Standard Specifications whenever in conflict therewith.

Special Provisions. Specific directions and provisions additional to these Standard Specifications, and to any Supplemental Specifications, setting forth conditions or requirements of construction which are not satisfactorily covered by these Standard Specifications, or the Supplemental Specifications. Special Provisions shall prevail over the Standard and Supplemental Specifications whenever in conflict therewith, and over all Plans because they set forth the final contractual intent as to the matter involved.

Subcontractor. Any properly qualified individual, firm or corporation undertaking the performance of any part of the Work under the terms of the Contract, by virtue of an agreement between himself and the Contractor, with the written approval of the Owner.

Superintendent. The authorized representative for the Contractor present on the Work at all times during progress, who is able to efficiently superintend the Work.

Supplemental Agreement. A written agreement executed by the Owner and the Contractor with the consent of the Surety, covering major changes and/or revised or new unit prices and items supplementary to the original Contract.

Supplemental Specifications. Detailed specifications supplemental to or superseding certain specified portions of these Standard Specifications.

Surety. The corporate body, licensed under the laws of Alabama, bound with and for the Contractor for the acceptable performance of the Contract and also for the payment of all claims recoverable under the Contract Bonds. No Surety Bonds from any Insurance Company or Bonding Company which has a lower rating than those noted in Division III, Paragraph 2.07 "Proposal Guaranty" of these specifications will be accepted.

The Work. All performance required of the Contractor under the terms of the Contract.

DIVISION III - GENERAL CONDITIONS

SECTION 2

PROPOSAL REQUIREMENTS AND CONDITIONS

2.01 PREQUALIFICATION OF BIDDERS.

(a) Issuance of Proposal Forms. Prospective bidders must be able to show that they are capable of performing each of the various items of work upon which they bid, and that the equipment necessary for the prosecution of the Work is available. **Each perspective bidder shall submit a statement of qualifications including all contract information for a minimum of 3 years stating the project name, owner of the project with contact information, and value of the project.** The resume must contain at least one project of similar size and scope, successfully completed, to the project described in these project documents. The proposal will be awarded based on bid price and submitted qualifications. If the applicant is a corporation organized in a state other than Alabama, it shall furnish a certificate from the Secretary of State showing that it is qualified to transact business in Alabama. A corporation from another state can be issued a certificate valid for bidding only on projects involving Federal participation, without the certificate from the Secretary of State.

The Owner reserves the right to disqualify or refuse to issue a proposal if the bidder is in default for any of the following reasons:

1. Lack of competency as determined by review of .
2. Uncompleted work which, in the judgment of the Owner, might hinder or prevent the prompt completion of additional work if awarded.
3. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former accounts in force at the time of issuance of proposals.
4. Failure to comply with any qualification regulations of the Owner.
5. Default under previous contracts.

(b) License. Award of the contract to the successful bidder will be contingent upon him obtaining a license from the State Licensing Board in accordance with existing State laws.

2.02 CONTENTS OF PROPOSAL FORMS.

The Owner will furnish Bidders a blank Proposal Form for the Work contemplated, the approximate estimate of the various quantities of the pay items of the Work to be performed and materials to be furnished, the time in which the Work must be completed, the amount of the Proposal Guaranty, and the date, time and place of opening of Proposals. The Proposal Form will contain any Special Provisions or requirements that vary from, or are not contained in, the Standard Specifications. All papers bound with or attached to the Proposal Form are a necessary part thereof and must not be detached or altered. Whenever Proposals are requested on a lump sum basis, no estimate of quantities will be furnished, and the following paragraph, entitled "Interpretation of Approximate Estimates," will not be applicable.

2.03 INTERPRETATION OF APPROXIMATE ESTIMATES.

Although the estimate of quantities of work listed in the Proposal Form are the results of calculations made from field surveys and plans, they are to be considered as only approximate estimates of the quantities of the different pay items and are to be used only as a basis for comparing bids for awarding the Contract, where bids are requested on a unit price basis.

Such quantities, including the classification thereof, may or may not be representative of the actual conditions encountered during construction, and the Owner does not guarantee that the approximate quantities will conform strictly to the construction.

Final payment to the Contractor will be made for only the actual quantities of the respective pay items of the Work performed, at the contract unit prices bid in the Proposal, in accordance with the Plans and Specifications, as finally determined from actual measurements made during the progress or after completion of the Work, and if, upon completion of the Work, the actual quantities of the respective pay items performed be more or less than the quantities estimated in the Proposal, the contract unit prices bid in the Proposal will still prevail, except as otherwise hereinafter provided.

2.04 EXAMINATION OF PLANS AND SPECIFICATIONS, SPECIAL PROVISIONS, AND THE SITE OF WORK.

Before submitting a proposal, all Bidders are required to examine carefully the site of the proposed Work, the Proposal Form, Plans, Standard Specifications, Supplemental Specifications, Special Provisions and the Contract and Bond Forms, and it is mutually agreed that the submission of a Proposal shall be apparent evidence that the Bidder has made such examination and has judged for and satisfied himself as to the conditions to be encountered regarding the character, quality, and quantities of work to be performed and materials to be furnished, and as to the requirements of Plans, Standard Specifications, Supplemental Specifications, Special Provisions, Contract, Bonds and contingencies involved. Bidders shall also familiarize themselves with and shall comply with the requirements of all federal, State and local laws and ordinances which may directly or indirectly affect the Work or its prosecution, persons engaged in or employed on the Work, and the materials or equipment used in the Work. No adjustments or

compensations will be allowed for losses caused by failure to comply with the foregoing requirements of this entire paragraph.

2.05 PREPARATION OF PROPOSAL.

The Bidder's Proposal must be submitted on the Proposal Form furnished him by the Owner.

The Bidder must specify in figures without interlineations, alterations, or erasures, a unit price for each of the separate items for which a quantity is given in the Proposal Form (except when alternate bids are called for on items); he shall further show the products of the respective unit prices and the estimated quantities in the columns provided for that purpose, as well as the gross sum for which he will perform all of the estimated Work as required by these Standard Specifications, Supplemental Specifications, Special Provisions, and Plans. The Engineer will check the gross sum given in the Proposal and in case of error or discrepancy the gross sum obtained by adding the products of the unit price and the various estimated quantities listed in the Proposal shall prevail and this shall be the Contract Bid Price.

The Proposal shall be properly signed by the Bidder. If the Bidder is an individual, his name and post office address must be shown; if a firm or partnership, the name and post office address of each member of the firm, or partnership must be shown; if a corporation, the president, vice-president, or secretary shall sign and affix the corporate seal, or if the person signing the Proposal is an agent, the said agent must attach written authorization from the president, vice-president or secretary of the corporation and the Proposal must show the name of the corporation, the name of the state under the laws of which the corporation is chartered, and the names, titles, and the business addresses of the officers.

2.06 IRREGULAR PROPOSALS.

Proposals may be rejected if they contain any omissions, alterations of form, additions not called for, conditional bids, alternate bids unless called for, incomplete bids, erasures or irregularities of any kind. Proposals in which the unit or lump sum prices bid are obviously unbalanced may be rejected. No alteration of the terms and conditions of the sealed bid which are written upon or appended to the outside of the bid will be accepted or considered.

2.07 PROPOSAL GUARANTY.

No Proposal will be considered unless accompanied by a proper Bid Bond or certified check made payable to the Owner in the amount indicated in the Invitation for Bids. Cashier's Check will not be accepted in lieu thereof. No surety bonds from any insurance company or bonding company which has a lower rating in the Best Key Rating than those shown below or named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit and Staff Bureau of Accounts, U. S. Treasury Department will be

accepted. In addition, the surety company must have a rating of A or better, as rated by Standard and Poor's Corporation and Moody's Investors Service, Inc.

2.08 DELIVERY OF PROPOSALS.

Each proposal shall be placed, together with the Proposal Guaranty, in a sealed envelope on the outside of which is written in large letters "Proposal for Construction," and so marked as to indicate the Project and the name of the Bidder. Proposals may be delivered in person or by mail. When sent by mail, preferably registered, the sealed Proposal marked as indicated above, shall be enclosed in another envelope for mailing. Proposals will be received by the Owner until the hour of the date set in the Invitation for Bids for the opening thereof. No proposal will be accepted or considered which has not been received prior to the hour of the opening date.

2.09 WITHDRAWAL OR REVISION OF PROPOSALS.

A Proposal may be withdrawn at any time prior to the hour fixed for opening of Proposals, provided a request in writing executed by the Bidder or his duly authorized representative is filed with the Owner prior to that time.

When such Proposal is received, it will be returned to the Bidder unopened. Telegrams or written communications to correct Proposals will be accepted, and the Proposal corrected in accordance therewith if received by the Owner prior to the hour set in the Invitation for Bids. No Proposal can be withdrawn, modified or corrected after the hour set for opening such Proposals.

2.10 OPENING OF PROPOSALS.

Proposals will be opened and read publicly at the time and place indicated in the Invitation for Bids. Bidders or their authorized agents are invited to be present.

2.11 DISQUALIFICATION OF BIDDERS.

Any Bidder using the same or indirect names for submitting more than one Proposal upon any project or section of work will be disqualified from further consideration on that project or section of the Work. Evidence that any Bidder is interested, as a Principal, in more than one Proposal for the Work contemplated (for example, bidding in a partnership; as a joint partnership or association and as a partnership, association, or individual) will cause the rejection of any such Proposal. A Bidder may, however, submit a Proposal as principal and as a subcontractor to some other principal, or may submit a Proposal as a Subcontractor to as many other principals as he desires, and by so doing will not be liable to disqualification in the intent of these Specifications.

If there is reason for believing that collusion exists among the Bidders, any or all Proposals may be rejected, and participants in such collusion may not be considered in future Proposals for the same Work. Proposals in which prices are obviously unbalanced or unresponsive to the invitation may be rejected.

If the Bidder notes an error or omission in the plan details or estimated quantities shown, he shall notify the Engineer prior to the bid date so any necessary corrective action may be taken and all bidders made aware of the conditions. Any bidder who notes such an error or omission and imbalances his bid, or fails to notify the Engineer, will be subject to disqualification and rejection of his bid.

The right is reserved to reject a Proposal from a Bidder who has not paid, or satisfactorily settled all bills due for labor and material on former contracts in force at the time of letting.

2.12 LIQUIDATED DAMAGES.

Time is an essential element in the Contract. As the prosecution of the Work will inconvenience the public, obstruct traffic, and interfere with business, it is important that the Work be pressed vigorously to completion. Also, the cost to the Owner of the administration of the Contract, inspection, engineering, and in some cases maintenance of detours around the Work under construction will be increased or decreased as the time occupied in the Work is lengthened or shortened. Therefore, exclusive of Sundays, National holidays and other legal holidays of the State of Alabama, for each day that the Work remains uncompleted after the time specified in the Contract, or additional time that may be allowed by the Owner for the completion of authorized "Extra Work," it is agreed that for each calendar day the Work remains uncompleted after the expiration or consumption of the time as set out above, the Contractor shall pay to the Owner as liquidated damages the sum of money stipulated the General Conditions.

2.13 MATERIAL GUARANTY.

Before any Contract is awarded, the Bidder may be required to furnish a complete statement of the original, composition, and manufacture of any or all materials, proposed to be used in the construction of the Work, together with samples, which samples may be subjected to the tests provided for in these Specifications to determine their quality and fitness for the Work.

DIVISION III - GENERAL CONDITIONS

SECTION 3

AWARD AND EXECUTION OF CONTRACT

3.01 CONSIDERATION OF PROPOSALS.

After the Proposals are opened and read, the contract Bid Prices will be compared and the results of such comparison will be made public. Until the final award of the Contract, however, the Owner reserves the right to reject any an all Proposals, and to waive technicalities if, in its judgment, the best interests of the Owner will thereby be promoted.

3.02 AWARD OF CONTRACT.

The award of the Contract, if awarded, will be by the Owner, to the lowest responsible Bidder whose Proposal shall comply with all the requirements necessary to render it formal. The successful Bidder will be notified, by telegram or letter, to the address shown on this Proposal, that his bid has been accepted and that he has been awarded the Contract. Award of the Contract will be made within 60 days after bids are received unless otherwise stated in Special Provisions. This period may be extended if mutually agreed to by both the Owner and the Contractor.

3.03 RETURN OF PROPOSAL GUARANTEES.

All Proposal guarantees, except those of the three lowest Bidders, will be returned without undue delay after Proposals have been checked, tabulated and the relation of the Proposals established. The Proposal Guaranty of the three lowest Bidders will be returned as soon as the Contract Bonds and the contract of the successful Bidder have been properly executed and approved. The Owner reserves the right to return all Proposal Guarantees by mail and its responsibility shall end upon the mailing thereof.

3.04 REQUIREMENTS OF CONTRACT BONDS.

In order to insure the faithful performance of each and every condition, stipulation, and requirement of the Contract, and to indemnify and save the Owner harmless from any and all damage, either directly or indirectly (arising our of any failure to perform same), the successful Bidder to whom the Contract is awarded shall, within ten (10) days from the date of the award, furnish at his expense and file with the Owner an acceptable Surety Bond in an amount equal to one hundred percent (100%) of the contract Bid Price of the Contract as awarded. Said Bond shall be made on the approved bond form by a surety authorized to do business in the State of Alabama, with a rating of at least those shown on page 2-3 of Division III herein, shall be countersigned by an authorized agent resident in the State of Alabama who is qualified for the execution of such instruments, and shall have attached thereto power of attorney of the signing official. In case of

default on the part of the Contractor, all expenses incident to ascertaining and collecting losses suffered by the Owner under the Bond, including both engineering and legal services, shall lie against the Contract Bond for Performance of the Work.

In addition thereto, the successful Bidder to whom the contract is awarded shall, within ten (10) days, furnish at his expense and file with the Owner an acceptable surety bond for Payment of Labor, Materials, and Supplies payable to the Owner in an amount equal to one hundred percent (100%) of the contract price with the obligation that the Contractor shall promptly make payment to all persons furnishing him or them with labor, materials, equipment, or supplies for, or in, prosecution of the Work, including the payment of reasonable attorney's fees, incurred by successful claimants or plaintiffs in suits on said bond. Said bond shall be made on the approved bond form by a surety authorized to do business in the State of Alabama, with a rating in accordance with paragraph 2.07.

3.05 EXECUTION OF CONTRACT.

The contract shall be signed by the successful Bidder and returned to the Owner with satisfactory Contract Bonds within ten (10) days after the date of notice of award.

3.06 APPROVAL OF CONTRACT.

No Contract is binding upon the Owner until it has been executed by the Owner. The date of the final execution of the Contract shall be the date on which it is signed by the Owner.

3.07 FAILURE TO EXECUTE CONTRACT.

Failure to execute a Contract and file acceptable Contract Bonds within ten (10) days after the date of notice of award shall be just cause for the annulment of the award and the forfeiture of Proposal Guaranty in accordance with local and State law, not as a penalty, but in liquidation of damages sustained. Award may then be made to the next lowest responsible Bidder or the Work may be re-advertised, or otherwise contracted as the Owner may decide.

3.08 INSURANCE.

(a) General. The Contractor shall provide, insurance in accordance with the following, which shall amplify and be in addition to that required in Paragraph 3.07 of Section 3 in these specifications.

(b) Contractor Coverage. The Contractor shall not commence work under this contract until he has obtained all insurance required under the following paragraphs and until such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until all similar insurance required of the Subcontractor has been obtained and approved. If the Subcontractor does not take out insurance in his own name and his principal contractor wishes to provide such insurance protection for the Subcontractor and such

Subcontractor's employees, a rider must be attached to the Principal contractor's policy, which must take out appropriate policies in the name of the Subcontractor.

(c) Liability Insurance. The following insurance coverage (with limits not less than specified herein) shall be maintained by the Contractor for the duration of the contract, affording coverages for any claim arising out of Contractor's operations herein, whether by the Contractor or by any subcontractor or by any employee or agent of either:

(1) Claims of employees under Worker's Compensation and other similar employee benefit acts, including claims because of bodily injury, occupational sickness or disease, or death.

(2) Claims arising out of bodily injury, sickness, disease or death of any person other than employees.

(3) Claims for damages arising out of libel, slander, false arrest, detention or imprisonment, malicious prosecution, defamation or violation of right of privacy, wrongful entry or eviction or other right of private occupancy, including claims as a result of an offense related to the employment of a claimant by the Contractor. (So called "Personal Injury.")

(4) Claims arising out of damage to, or destruction of, tangible property, including loss of use.

a. Limits of Liability.

Type of Insurance	Bodily Injury
Worker's Compensation	Statutory
Employer's Liability	$500,000 Each Accident/$500,000 by Disease - Policy $500,000 Each Employee
Comprehensive Automobile	$1,000,000 per Liability Accident/$2,000,000 Aggregate Bodily Injury and Property Damage Combined

b. Comprehensive General Liability

Operations	$1,000,000 Combined Single Limit Each Occurrence/Bodily Injury and Property Damage
Including Independent	$2,000,000 Aggregate

Contractor's Completed Operations

c. Umbrella Liability

In addition to the basic limits previously set out for commercial General Liability Products Completed Operations, Automobile Liability and Worker's Compensation and Employer's Liability B, Contractors shall provide Umbrella Liability limits of $1,000,000 per occurrence and aggregate on an occurrence basis.

Coverage shall be issued with a "pay on behalf of" wording, including Personal Injury and other extensions, and provide coverage at least as broad as that afforded by the primary insurance policies.

Extensions

Blanket Contractual Liability
Personal Injury
Blanket Collapse and Underground Coverage
Broad Form Property (Including Completed Operations)
Employees as Additional Insured
Host Liquor Liability
Non owned Watercraft Liability
Worldwide Products
Fire Legal Liability
Incidental Medical Malpractice
Extended Bodily Injury (Assault and Battery)
Newly Acquired Organizations

When and if the use of explosives for blasting purposes appears necessary or desirable, such methods shall not be undertaken without written authorization of Owner, and then only provided that acceptable extension of liability coverage have been obtained specifically to include the explosion ("X") hazard and collapse ("C") hazard.

The policy of general liability shall include the special underground property damage coverage (providing the so-called "U" hazard) on a blanket basis.

(d) Owner's Protective Liability. The Contractor shall furnish, from a carrier acceptable to the Owner, a policy of liability insurance, commonly called "Owner's Protective Liability" in the name of the Owner, providing "Independent Contractor's Coverage" for the operations embraced by this Contract with limits of $1,000,000 bodily injury and $1,000,000

property damage. Policy shall be endorsed that the premium is to be paid by the named Contractor. This policy shall name the Engineer, Architect, and Surveyor as additional insured.

(e) Property Insurance Contractor.

1. The Contractor shall assume complete responsibility for safe-guarding all portions of the Work in progress, whether completed or not, until such work has been accepted by Owner, and shall maintain such insurance to protect himself against perils which may cause such property to be damaged or destroyed. Titles to such work in progress, whether completed or not, shall remain vested in Contractor until finally accepted by Owner.

2. Fire and Extended Coverage and Vandalism and Malicious Mischief: Where applicable, the Contractor shall provide fire and extended coverage (windstorm, hail, explosion, strike, riot and civil commotion, vehicle and smoke damage insurance), and Vandalism and Malicious Mischief Insurance. Same shall be provided on "Actual Completed Value" Builder's Risk form in the joint name of the Contractor and the Owner, for the duration of the contract. The Contractor shall be responsible for any and all damage to the project during construction and he will not be relieved of this responsibility until the project is accepted by the Owner.

(f) Certification: The Contractor shall furnish a certificate and/or policies verifying that the above coverages are in effect before commencing any work, and that each policy is endorsed to give Owner 30 days notice in writing in the event of cancellation or material change therein. Certificates of Insurance shall state that the Owner, the Engineers and the agents and employees, be named as additional insureds on the Contractor's Automobile Liability and Comprehensive General Liability policies. In respect to Worker's Compensation, a Waiver of Subrogation shall be issued in favor of the Owner and their Engineers, Architects, Surveyors and their agents, and employees.

(g) Insurance and Bonds. All insurance and bonds in connection with the Work to be performed under the contract shall be countersigned by a licensed agent resident in the State of Alabama.

(h) Transmittal of Bond and Proof of Carriage of Insurance. Three copies of the Proof of Insurance, as called for above, shall be delivered to the Engineer along with the Contract Documents and required Bonds.

DIVISION III - GENERAL CONDITIONS

SECTION 4

SCOPE OF WORK

4.01 INTENT OF PLANS AND SPECIFICATIONS.

The true intent of the Plans, Specifications and Special Provisions is to prescribe a complete Work or improvement which the Contractor undertakes to do, complete in every detail, in full compliance with the Plans, these Standard Specifications, the Supplemental Specifications, the Special Provisions, Proposal, Contract and Invitation for Bids together with all authorized alterations, Supplemental Agreements and Extra Work Orders. The Contractor shall perform all items of the Work covered and stipulated in the Proposal and on the Plans, shall remove all obstructions from the site, and shall do such special additional, extra, and incidental work as the Engineer may consider necessary to complete the project and its appurtenances, or structures, to the finished lines, grades, cross sections and dimensions shown on the Plans or as modified by written orders from the Engineer, in a satisfactory and acceptable manner. The Contractor shall furnish, unless definitely and expressly provided to the contrary in the Proposal, the Special Provisions or the Plans, all material, implements, machinery, equipment, tools, supplies, transportation and labor necessary to the prosecution and completion of the Work.

4.02 SPECIAL WORK.

Construction or conditions which have not been anticipated by the Plans and these Specifications, or changes, additions or amendments thereto, will be covered by Special Provisions incorporated in, or attached to, the Proposal Form, which shall be considered as part of the Contract. Should any Special Provision conflict with the Plans, Standard Specifications, or Supplemental Specifications, the Special Provisions shall govern.

4.03 ALTERATION OF PLANS OR CHARACTER OF WORK.

The Owner may make, without notice to the Surety or change in the unit bid price, alterations in the Plans or in the nature of the Work which he may consider necessary or desirable during the progress of the Work, to complete fully and acceptably the proposed construction. Such alterations may not materially change the general features of the original Plans and Specifications. Material changes shall be understood to mean those changes in the original Plans and Specifications made necessary by the exigencies of the Work, resulting in the alteration of costs to the Contractor by an amount which could not have been foreseen at the time of his bidding upon the Work. The Owner reserves the right for the Engineer to revise any part of the alignment, grades, structures, width, and other dimensions on the Work, if the Engineer deems it advisable, and such changes shall not be considered material changes. The Owner also reserves the right for the Engineer to increase or decrease the quantity of any or all of the items listed in the estimate of

approximate quantities in the Proposal Form. Such increase or decrease shall not be considered as a waiver of any of the conditions of the Contract or Contract Bonds.

4.04 EXTRA WORK.

In connecting with the Work covered by this Contract, the Owner may at any time during its progress order other work or materials incidental hereto. If any such work and materials is not listed as a pay item with a contract unit bid price or if compensation therefor is not included int he contract unit prices bid for other pay items under the terms of the Contract, it will be designated as Extra Work, and shall be performed by the Contractor as directed, provided, however, that before any Extra Work is started the Engineer shall furnish the Contractor a proposal form, stating the location, kind and estimated quantity of the Extra Work to be done. The Contractor shall indicate on the proposal for the compensation (unit price, or lump sum) for which he will perform the Extra Work and this Proposal shall be submitted to the Owner, through its Engineer for approval. The Owner may approve the proposal, in which case such approval must be in writing, signed by the Owner, and thereupon it shall be an authorization for doing the Work and shall become a part of the Contract; but if the Owner considers the price submitted for any item of the Extra Work excessive, and a satisfactory adjustment price cannot be reached for such item, it shall be optional with the Owner to terminate the Contract insofar as it applies to such item of Extra Work in question and perform such Extra Work by other agents or other means or to direct that the Contractor perform the Work on a "Force Account" basis. Claims for payment for Extra Work not so authorized shall be rejected by the Owner.

Extra Work shall be done in accordance with the plans and specifications.

4.05 CONSTRUCTION AND MAINTENANCE OF DETOURS.

No city or county streets, highways, or section of highway shall be closed to traffic except by permission of the City Traffic Engineer or ALDOT Engineer, as appropriate, and no construction operations that will in any way inconvenience the traveling public shall be started until adequate provision, satisfactory to the City Traffic Engineer or ALDOT Engineer, as appropriate, has been made to detour or by-pass traffic in safety and comfort.

The contractor shall maintain all detours for traffic over the Work. Unless otherwise provided in the Special Provisions, any road or city street undergoing improvement shall be kept continuously open to public traffic and in passable and safe condition, except at times when deemed impracticable by the Traffic Department.

When the Contractor hauls materials over any detour or public road, he shall take all precautions necessary to insure that his loads do not exceed the capacity of the road and its structures. He shall also be responsible for any specific damage that may result to the road or to its structures.

4.06 REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS.

Unless otherwise provided, the Contractor shall, at his expense, remove any existing structure or part of structure, fence, piling, building, foundation or other encumbrance within the limits of the site on which the Work is to be performed, that is unnecessary to the improvement, or which interferes in any way with the new construction. Compensation for the removal of any such structure or obstruction shall be included in the contract unit prices bid for the pay items of the Work, and under no condition will they be paid for as Extra Work.

All privately owned materials in structures removed shall be salvaged without damage and shall be piled neatly and in an acceptable manner upon the premises, if it belongs to an abutting property owner. Otherwise, it should be placed at accessible points along the improvement. Material in structures owned by the Owner which is fit for use elsewhere shall remain the property of the Owner. It shall be carefully removed without damage, in sections which may be readily transported, and shall be piled neatly at an accessible point by the Contractor at his expense. The Contractor may make use of the existing structures or portions of them during construction, but no material suitable for use elsewhere shall be removed, cut, bent, broken, or otherwise damaged. Stone masonry or similar material which is not to remain in place, may, if suitable for the purpose, be used in the new structure, upon written approval of the Engineer. The Contractor shall remove all discarded material, rubbish, or debris at his expense, and shall dispose of it in a satisfactory manner.

4.07 FINAL CLEANING UP.

Upon completion and before Work will be finally accepted and final payment made, the Contractor shall clean and remove from the site of the Work and adjacent property, stream channels, and all areas occupied by him in connection with the Work, all useless, surplus, excavated or discarded materials; and all loose rock, boulders, falsework, temporary structures, machinery and equipment. He shall restore in an acceptable manner all property, both public and private which has been damaged during the prosecution of the Work and shall leave the site of structures in a neat and presentable condition throughout the project. Clearing material from the site and depositing it on abutting property with or without the consent of the property owner will not be considered a satisfactory method of disposal.

4.08 MAINTENANCE OF THE WORK.

The Contractor will be required to maintain the Work from the date of the approval of his Contract until the entire Contract is completed and finally accepted.

This maintenance shall consist of such continuous and effective work prosecuted day by day, with adequate equipment and forces as are necessary to keep the structures and work area in satisfactory and acceptable condition at all times.

The Contractor shall take such precautions as necessary to protect all shrubs, plants and trees, within or adjacent to the limits of Work, from damage during the construction operations.

Compensation for the maintenance work during construction and before the Work is finally accepted shall be included in the contract unit prices bid on the pay items of the Work and the Owner will not pay additionally for such work.

4.09 FAILURE TO MAINTAIN WORK.

The failure of the Contractor, at any time, to comply with the above provisions for maintenance of the Work, will result in the following:

First, the Engineer will immediately notify the Contractor, his superintendent or employees to comply with the required maintenance provisions.

Second, in the event the Contractor fails to remedy his lack of or unsatisfactory maintenance within three (3) days after the date of issuance of this notice the Owner may, but is not required to, proceed immediately with adequate forces and equipment to maintain in a satisfactory and acceptable manner the roadway, or structure, and the entire cost of this maintenance will be deducted from monies due or that become due the Contractor on this contract.

Third, as an alternate to the Owner's taking over the maintenance, all the quantities of the Work performed which are not properly maintained, may be deducted from the current estimate even if such quantities have been allowed on a previous estimate.

4.10 DEWATERING

All work requiring dewatering shall be paid for at the specified unit price either each or per linear foot, whichever is designated by the contract documents. The dewatering of said work shall include all necessary pipes, pumps, connections, fuel, labor and maintenance to dewater the designated area for the duration of the project. Where unit price is designated as, per linear foot of trench, dewatering will be paid for as one foot for every linear foot of trench one time for the duration of the project. This is regardless of width, method, or duration. Upon completion of work removal of all dewatering equipment will be a subsidiary obligation of the dewatering work. It will be the contractor’s responsibility to properly maintain and dispose of discharged water from the project area. Any damage arising from improper maintenance or disposal of discharge water shall be the contractor’s responsibility to repair at no cost to the owner.

4.11 GUARANTEE.

Neither the final certificate of payment nor any provisions in the contract documents, nor partial or entire use or occupancy of the premises by the Owner, shall constitute an acceptance of Work not done in accordance with the contract documents or relieve the Contractor

of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The contractor shall remedy any defects in work and pay for any damage to other work resulting therefrom which shall appear within a period of one year from the date of final acceptance of the Work unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness. The Contractor's performance or Contract Bond shall remain in effect and cover guarantee for one year from the date of acceptance by the Utilities Board of the City of Gulf Shores, unless a longer period is specified.

DIVISION III - GENERAL CONDITIONS

SECTION 5

CONTROL OF WORK

5.01 AUTHORITY OF THE ENGINEER.

All the Work shall be done under the general review of the Engineer. To prevent misunderstandings, disputes, and litigations, the Engineer shall decide any and all questions which arise concerning the quality and acceptability of materials furnished and work performed, the rate of progress of the Work, interpretation of the Plans and Specifications, and the acceptable fulfillment of the Work required in the Contract on the part of the Contractor. The Engineer will determine the amount, quantity, character, classification and quality of the several kinds of work performed and materials furnished which are to be paid for under the Contract, and his decisions and estimate shall be conclusive and binding on both parties thereto and such decision and estimate of the Engineer, in case any question arises, shall be a condition precedent to the right of the Contractor to receive any money due him under the Contract. Explanations concerning the meaning of the Plans, Specifications and Contract, will be given by the Engineer and his findings shall be final and binding on both parties hereto. The Owner shall decide disputes and mutual rights between Contractors under the Specifications. The Engineer is not authorized to increase the obligations of the Owner to the Contractor, except in strict accordance with the terms of these Specifications.

5.02 PLANS AND SHOP DRAWINGS.

General drawings, showing such details as are necessary to give a comprehensive idea of the construction contemplated, will be included in the set of approved Plans. The approved Plans will be supplemented by such working drawings as are necessary to control the Work adequately. It is mutually agreed that all authorized alterations affecting the requirements and information given on the approved Plans shall be in writing.

After verifying all field measurements, and checking Shop Drawings for agreement and conformity with approved Plans and Specifications, the Contractor will submit to the Engineer for approval five (5) copies of all Shop Drawings, which will bear a stamp or specific written indication that contractor has satisfied Contractor's responsibilities under the Contract Documents with respect to the review of the submission. All submissions will be identified as Engineer may require. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable Engineer to review the information as required.

Before submission of each Shop Drawing, Contractor shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each Shop Drawing with other Shop Drawings and with the requirements of the Work and the contract documents.

At the time of each submission, Contractor shall give Engineer specific written notice of each variation that the Shop Drawings may have from the requirements of the Contract documents, and, in addition, shall cause a specific notation to be made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

Engineer will review and approve with reasonable promptness Shop Drawings, but Engineer's review and approval will be only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

Engineer's review and approval of Shop Drawings or samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at the time of submission as required by above and Engineer has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by Engineer relieve Contractor from responsibility for errors or omissions in the Shop Drawings or from responsibility for having complied with the provisions of the previous paragraphs.

Where a Shop Drawing is required by the Specifications, any related work performed prior to Engineers' review and approval of the pertinent submission will be the sole expense and responsibility of Contractor.

5.03 CONFORMITY WITH PLANS AND ALLOWABLE DEVIATIONS.

Finished Work in all cases shall conform with lines, grades, sections, details and dimensions of the Work contemplated as shown on the approved Plans except as modified by written order of the Engineer. Any deviations from the approved Plans and working drawings, that may be required by the exigencies of the construction, will be determined by the Engineer and authorized in writing.

5.04 COORDINATION OF PLANS, SPECIFICATIONS, AND SPECIAL PROVISIONS.

These Specifications, the Supplemental Specifications, the plans, Special Provisions and all supplementary documents are essential parts of the Contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete Work. In case of discrepancy, figured dimensions, unless obviously incorrect, shall govern over scaled dimensions. Supplemental Specifications shall govern over the Standard Specifications. Plans shall govern over Specifications. Special Provisions shall govern over both Specifications, Supplemental Specifications and Plans.

The Contractor shall take no advantage of and shall promptly notify the Engineer, if he discovers any error or omission of dimensions in the Plans, or if any discrepancy between the Plans and Specifications. The Engineer will make such corrections and supply such omitted dimensions as may be necessary and his interpretation shall be final.

5.05 COOPERATION OF THE CONTRACTOR.

The Contractor will be supplied with four (4) copies of the Plans, Specifications, Supplemental Specifications, and Special Provisions. The Contractor shall have available on the Work, at all times, one copy of each of said Plans, Specifications, Supplemental Specifications and Special Provisions; he shall give the Work the constant attention necessary to facilitate the progress thereof and shall cooperate with the Engineer, Inspectors, and with other Contractors in every way possible.

The Contractor shall at all times have a competent Superintendent on the Work, capable of reading and thoroughly understanding the Plans and Specifications, as his agent on the Work, with full authority to execute any orders or directions of the Owner issued through the Engineer without delay and to supply promptly such materials, tools, plant, equipment and labor as may be required. Such Superintendent shall be furnished without respect to the amount of Work sublet and shall have full authority over all subcontract work.

The Contractor shall schedule and conduct his Work and dispose of his material so as to avoid causing unnecessary inconvenience and delay to other Contractors engaged on adjacent work and so as to join his work to that of other contractors in a proper manner, and in accordance with the spirit of the Plans and Specifications, and so as to perform his work in the proper sequence in relation to that of other adjacent work. Each Contractor shall so conduct his operations and maintain the Work in such condition that adequate drainage shall be affected at all times.

It is mutually agreed that, in case of a dispute arising between two or more Contractors engaged on the same work, as to the respective rights of each under these Specifications, the Owner shall determine the matters at issue and shall define the respective rights of the various interests involved in order to secure completion of all parts of the Work in general harmony and with satisfactory results, and his decision shall be final and binding on all parties

concerned, and shall not in any way be a cause for claims for extra compensation by any of the parties.

5.06 CONSTRUCTION LAYOUT AND STAKES.

The Contractor shall lay out his work from the Engineer-established baseline and benchmarks shown on the plans and shall be responsible for all measurements therefrom. The Contractor shall furnish, at his own expense, all stakes, templates, platforms, equipment, markers, and skilled technical personnel, as may be required in layout out any part of the Work from the baseline and benchmarks established by the Engineer.

The Contractor, from the Engineer's baseline shown on the plans shall accurately establish such offset baseline and construction control points so as to accurately control the horizontal and vertical alignment of the Work.

Any control points and reference points shown on the plans that may conflict with the construction shall be offset, or otherwise protected, as necessary for the Contractor to adequately control his construction stakeout, by the Contractor before construction begins at his own expense.

In addition to the baseline control points, all required easement monuments are referenced and shall be protected by the Contractor. The location of the reference points will be furnished to the Contractor before construction begins and the contractor shall take all due care to see that these points are not disturbed. If, in the opinion of the Engineer, any points are destroyed or disturbed due to the Contractor's negligence, they shall be replaced by a licensed land surveyor at the Contractor's expense.

All measurements for determination of pay quantities will be made by the Owner, or his authorized representative.

No direct payment will be made for performing the Work required herein, but all costs thereof shall be included in the bid prices of pay items.

5.07 INSPECTORS, ASSISTANTS OR REPRESENTATIVES.

The Engineer may appoint such Inspectors, Assistants, or Representatives as he desires, and they shall be granted full access to the Work. They shall have authority to approve or reject materials, to make measurements of quantities, to keep records of costs, and otherwise to represent the Engineer. The Contractor may appeal their decisions to the Engineer, but pending settlement, no work shall be done in disregard of orders or instructions on items affected by such appeal.

If the contractor refuses to comply with instructions of the Inspector concerning the acceptability of the work performed, the Inspector shall immediately notify his immediate superior and obtain instructions.

Inspectors, Assistants or Representatives shall not be authorized to revoke, alter, enlarge, relax, or release any requirements of the Special Provisions, Specifications, or Contract; to approve or accept any portion of the Work nor to issue instructions contrary to the Plans and Specifications; nor shall they act as safety engineer, or foremen for the Contractor, or interfere with the management of the Work. Any advice which they may give the Contractor, shall nowise be construed as binding the Engineer or the Owner in any way, nor releasing the Contractor from fulfilling all of the terms of the Contract.

All transactions between the Contractor and the representatives of the Engineer which involve payments shall be made in writing. Neither party to this Contract shall take advantage of any transaction between the Contractor and the representatives of the Engineer. Objection must be made in writing at the time of transaction and delivered to the other party.

5.08 INSPECTION.

The contractor shall furnish the Engineer with every reasonable facility for ascertaining whether or not the work performed, and materials used are in accordance with the requirements and intent of the Specifications and Contract. At any time before final acceptance of the Work, the Contractor shall, if the Owner requests, remove and uncover such portion of the finished work as the Owner may direct. After the examination, the Contractor shall restore said portions of the Work to the standard required by the Specifications.

If the Work thus exposed or examined proves acceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed, shall be paid for as Extra Work, but if the work so exposed or examined proves unacceptable, no compensation will be allowed the Contractor for the uncovering, or removing and the replacing of the covering, or making good of the parts removed. No work shall be done, nor materials used, without suitable review by the Engineer or his representative. Failure to reject any defective work or material shall in no way prevent later rejection when such defect be discovered or obligate the Owner to Final Acceptance.

5.09 REMOVAL OF DEFECTIVE AND UNAUTHORIZED WORK.

All Work which has been rejected shall be remedied or else removed and replaced in an acceptable manner by the Contractor at his own expense, and no compensation shall be allowed him for such removal or replacement. Any Work done without the lines and grades shown on the Plans or as given, except as herein provided, or any Extra Work done without written authority will be considered as unauthorized and at the expense of the Contractor and will not be measured or paid for. The Engineer may order unauthorized Work removed and replaced at the Contractor's expense. All changes in the Work or departures from the Plans provided for in the Contract will be considered unauthorized unless, before proceeding with the Work, the Contractor has a copy of a change order signed by the Owner. This form will contain complete detailed instructions regarding proposed changes. Any departure from the instructions contained in such

written order shall be considered unauthorized. Upon failure on the part of the Contractor to comply immediately with any order of the Engineer made under the provisions of this Article, the Engineer shall have authority to cause defective work to be remedied, or removed and replaced, and unauthorized Work to be removed, deducting the cost thereof from any monies due or to become due the Contractor. In case no such monies are available, the amount shall be charged against the Contractor's Surety.

5.10 DISPUTED CLAIMS.

In any case where the Contractor wishes to make claim to the Owner for extra compensation for Work or materials he deems not clearly covered in the Contract, or not ordered by the Owner as Extra Work, the Contractor shall notify the Owner, through the Engineer, in writing, of his intention to make claim for such extra compensation, before he begins the Work on which he bases his claim. If such notice is given and the Engineer is not afforded proper facilities for keeping strict account of the actual cost to the Contractor, then the Contractor hereby agrees to waive claim for such extra compensation. Such notice by the Contractor and the fact that the engineer has kept account of the cost, shall in no way be construed as establishing the validity of the Claim. When the Work has been completed, the Contractor shall immediately file his claim with the Owner, through the Engineer.

5.11 FINAL CONSTRUCTION INSPECTION.

Whenever the Engineer considers the Work provided and contemplated by the Contract is nearing completion, or within ten (10) days after being notified by the Contractor that the Work is completed, the Engineer will review all the Work included in the contract. If the Engineer finds that the Work has not been satisfactorily completed at the time of such review, he shall inform the contractor in writing as to the Work to be done or the particular defects to be remedied to place the Work in condition satisfactory for Final Construction Inspection. After the Work has been satisfactorily completed, the Owner and Engineer shall make the Final Construction Inspection and shall notify the Contractor in writing that the Final Construction Inspection has been made, and that time charges end on the day of Final Construction Inspection. Maintenance time shall begin on the **date that The Utilities Board of the City of Gulf Shores accepted by the board of directors.**

5.12 FINAL ACCEPTANCE.

After the Final Construction Inspection is made and the Contractor has been notified as outlined above the Contractor shall maintain the Work for a period of 30 days in the same manner as set forth under "Maintenance of the Work During Construction." The Work will be finally accepted at the end of the 30-day maintenance period, provided all Work has been satisfactorily maintained.

The Contractor, immediately after the completion of the contract, shall give notice of said completion by an advertisement in some newspaper of general circulation published in Baldwin County, Alabama, for a period of four (4) successive weeks. Proof of publication of said

notice shall be made by the Contractor to the Owner, by affidavit of the publisher and a printed copy of the notice published. The advertisement of completion shall provide that any person having claims for labor and/or materials are requested to file notice of such claims with the Owner.

In no instance shall a final settlement be made upon the Contract until the expiration of the maintenance period and until the contract is complete and the project is accepted, subject to the one-year guarantee is required in Section 4.10 elsewhere herein.

DIVISION III - GENERAL CONDITIONS

SECTION 6

CONTROL OF MATERIAL

6.01 SOURCE OF SUPPLY AND QUALITY OF MATERIALS.

All materials proposed to be used may be inspected or tested at any time during their preparation and use. Only materials conforming to the requirements of Specifications and approved by the Testing Laboratory shall be incorporated in the Work. Material which, after approval, has become in any way unfit for use, shall not be used in the Work. Any material which has become mixed with or coated by dirt or other foreign substance during its delivery or handling shall not be used in the Work.

The source of supply of each of the materials shall be approved by the Engineer before the delivery is made to any section of the Work. When so indicated or directed, representative preliminary samples of character and quality shall be submitted for examination or test, and written approval of the quality of such samples must be received by the Contractor prior to obtaining materials from the respective sources of supply.

6.02 SAMPLES AND TESTS.

For the purpose of assisting his judgment, the Engineer may require any or all material to be subject to test by means of samples or otherwise as he may determine.

Inspection and tests will be conducted promptly, and the Contractor shall notify the Engineer and Testing Laboratory, in writing, immediately on the placing of orders for materials, giving the source and the dates when shipments are to be made.

Materials to be tested will be sampled by the Testing Laboratory, or their authorized representative, at the source of supply, upon delivery, or at any time before use, and acceptance or rejection will be based on the tests of such samples.

In any event, material incorporated in the construction must meet the requirements of the Specifications. The Contractor shall afford such facilities as may be required for collecting and forwarding samples; but shall not make use of nor incorporate in the Work any material represented by the samples until the tests have been made and the materials found acceptable in accordance with the requirements of the Specifications. The Contractor in all cases shall furnish the required samples without charge.

When tests are to be made at the source of production, the producer shall furnish reasonable facilities for the performance of the tests and for the protection of testing equipment and

supplies, and shall permit the Owner's representative to have free access to al parts of the plant to enable adequate inspection and selection of samples to be tested. Suppliers of bituminous material shall have adequate testing facilities and laboratory equipment. Equipment shall meet the requirements of the standard methods mentioned.

Tests of samples of materials will be performed according to the procedures set forth in Division III of the Alabama Department of Transportation Standard Specifications for Highway Construction, latest edition.

6.03 STORAGE OF MATERIALS.

Materials shall be stored so as to insure the preservation of their quality and fitness for the Work. Materials in storage shall be so arranged as to facilitate prompt inspection. Stored materials, even though approved before storage, may be inspected prior to their use in the Work and shall meet the requirements of the Specifications at the time they are incorporated into the Work.

The Contractor shall be responsible for any damage or injury due to storing of materials on the site of the Work. Private property shall not be used without written permission of the owner or lessee.

Payment for stored materials will be allowed on this project. Materials will be paid in the amount of the approved invoices subject to the following conditions:

1. Ordered materials must have an approved submittal from the engineer.
2. Invoice must be submitted for said materials from the respective vendor.
3. Invoice must have only materials for the project covered under the current contract. Project Name and Number must be clearly marked on the invoice.
4. Materials payment will be subject to retainage with the contract.
5. No stored materials payment will be made for erosion control products. These products will be paid at estimate after installation.
6. Payment of stored materials for pipe will be made only up to 75% of the total pipe quantity. Pipe, at the discretion of the Board, may be stored at a Utilities Board of the City of Gulf Shores facility. Said material shall be clearly marked and separated from any other materials on site. Under no circumstance shall materials be used for any other project or use during the course of the work. Upon completion of the project, any unused material will subject to become the property of The Utilities Board of Gulf Shores. No payment for labor will be made on any unused quantity of piping, or any other material. In the event that the Utilities Board of the City of Gulf Shores does not wish to take possession of unused materials then the materials will be returned to the contractor and payment for materials at the list price of the original invoice will be deducted from the final pay request. The Utilities Board of the City of Gulf Shores in this event will not pay any restocking fees.
7. Upon acceptable installation of the stored material, payment for the stored material will be deducted from the next successive pay request and the full unit price will be paid for the

installed unit quantity. Materials will remain subject to retainage per the contract documents.

6.04 DEFECTIVE MATERIAL.

All materials not conforming to the requirements of the Specifications shall be considered defective and all such materials, whether in place or not, shall be rejected and shall be removed immediately from the site of the Work. Defective materials discovered in the process of the Work will be rejected. All defective material shall be replaced by the Contractor at his expense. No rejected material, the defects of which have been subsequently corrected, shall be used until written approval has been issued by the Engineer. Upon the failure of the contractor to comply at once with any order of the Engineer made under the provisions of this Article, the Owner shall have authority to remove and replace defective material and to deduct cost of removal and replacement from any monies due or which may become due the Contractor or his Surety.

6.05 "OR EQUAL" CLAUSE.

Whenever a material or article required is specified or shown on the plans by using the name of any proprietary product or of a manufacturer or vendor, any material or article which will meet the design criteria and is equal in function and durability will be considered acceptable.

DIVISION III - GENERAL CONDITIONS

SECTION 7

LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

7.01 LAWS TO BE OBSERVED.

The Contractor shall at all times observe and comply with all Federal, State, and local laws, ordinances, orders, decrees, and regulations existing or enacted subsequent to the execution of the Contract which in any manner affect the prosecution of the Work. The contractor and his Surety shall indemnify and save harmless the Owner, the engineer, and all of their representatives, agents, and employees against any claim or liability arising from or based on the violation of any such law, ordinance, regulations, order or decree, whether by himself, his employees, or his subcontractors. The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the contract Work Hours and Safety Standards Act (PL 91-54).

The Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operations.

7.02 PERMITS AND LICENSES.

The Contractor, at his own expense, shall procure all permits and licenses, pay all charges, royalties and fees, and give all notices necessary and incident to the due and lawful prosecution of the work.

7.03 PATENTED DEVICES, MATERIALS AND PROCESSES.

If the Contractor is required or desires to use any design, device material, or process covered by letters patent or copyright, he shall arrange and provide for such use by suitable agreement with the patentee or owner, and a copy of the agreement shall be filed with the Owner. Whether or not such agreement is made or filed, the Contractor and the Surety shall indemnify and save harmless the Owner, the Engineer and all their authorized representatives from any and all suits, costs, penalties, or claims for infringement by reason of the use of any such patented design, device, material, or process, or any trademark or copyright in connection with the Work agreed to be performed under the Contract, and shall indemnify the Owner, the Engineer and all their authorized representatives for any costs, expenses, and damages which it or they may be obliged to pay by reason of such infringement or alleged infringement at any time during the prosecution or after the completion of the Work.

7.04 SANITARY PROVISIONS.

The Contractor shall provide and maintain in a neat, sanitary condition, such accommodations for the use of his employees as may be necessary to comply with the rules and regulations of the State or local health department or of other authorities having jurisdiction, and shall take necessary precautions to avoid creating unsanitary conditions.

7.05 PUBLIC CONVENIENCE AND SAFETY.

No road or street shall be closed by the Contractor to the public except by permission of the Engineer, and except while so closed, the Contractor shall maintain traffic over, through or around the Work included in this contract, with the maximum practical convenience, for the full twenty-four hours of each day of the Contract, whether or not Work has ceased temporarily. The Contractor shall notify the Engineer at the earliest possible date after the Contract has been executed, and in any case before the starting of any construction that might in any way inconvenience or endanger traffic so that the necessary arrangements to be made by the contractor can be determined.

The convenience of the general public shall be provided for in a reasonably adequate and satisfactory manner at all times. The Contractor shall provide and maintain at his own expense, such temporary roads as may be necessary to provide convenient access to driveways, house, buildings, or other property.

The Contractor shall arrange his work so that no undue and prolonged blocking of business establishments will occur.

The Contractor shall be responsible for any damage or injury due to storing material and equipment on the site of the Work.

In order that all unnecessary delay to the traveling public may be avoided, where deemed necessary by the Engineer, the Contractor shall provide and station competent flagmen whose sold duties shall consist of directing and controlling the movement of public traffic either through or around the Work.

7.06 TRAFFIC HANDLING, WARNING AND DETOUR SIGNS.

The Contractor shall, at all times gain permission from the Traffic Department of any proposed construction that will affect traffic on any street and inform the Engineer that permission has been received. The Contractor shall request in writing, to the Engineer at least two (2) days before the start of construction, for permission to proceed with construction. The Contractor shall not start said construction until permission is received and all detour signs, warning signs, barricades, flagmen, and other required conveniences and safety devices as required by the Engineer and by the "Manual on Uniform Traffic Control Devices, Latest Edition," have been installed and approved by the Engineer. All flagmen used on major streets, as determined by

the Engineer, shall be uniformed off-duty policemen. The Contractor shall be responsible for maintaining proper traffic handling controls at all times during construction of the Work.

There will be no direct payment for traffic handling, including flagmen, as described herein, or as directed during construction.

7.07 PRESERVATION AND RESTORATION OF PROPERTY, TREES, MONUMENTS, ETC.

The Contractor shall not enter upon private property for any purpose without first obtaining permission from the owners and the lessees. The Contractor shall be responsible for the preservation of all public and private property monuments, highway traffic, and street signs, telephone lines, other utilities, etc., along and adjacent to the Work; shall use every precaution necessary to prevent damage to pipes, conduits, and other underground structures; shall protect carefully from disturbance or damage all monuments until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed; and shall bear all expense related to protecting, or having a licensed land surveyor reset any known property monuments that may be disturbed as a result of the Work. The Contractor must obtain all necessary information in regard to existing utilities, and shall give notice in writing to the owners or the proper authorities in charge of streets, gas and water pipes, electric and other conduits, railways, poles, and pipelines, manholes, catch basins, fixtures, appurtenances, and all other property that may be affected by the Contractors operations, at least forty-eight (48) hours before his operations will affect such property. The Contractor shall not hinder or interfere with any person in the protection of such work, or with the operation of utilities, at any time. When property or the operation of railways, telephone lines, telegraph lines, or other public utilities are endangered, the Contractor shall at his own expense, maintain flagmen or watchmen and the other necessary precautions to avoid interruption of service or damage to life or property and he shall promptly repair, restore or make good at his own expense, any injury or damage caused by his operations in an acceptable manner.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or otherwise of the con tractor, he shall make good such damage or injury in an acceptable manner.

The Contractor shall not cut, injury, destroy or remove any shrubs, plants, or trees on or adjacent to the Work, public or private, without first obtaining permission in writing from the proper authority.

7.08 RESPONSIBILITY FOR DAMAGE CLAIMS, ETC..

The Contractor and Surety shall save harmless the Owner, the Engineer and all their representatives from all suits, actions, or claims of any character brought on account of any injuries or damages sustained by any person or property in consequence of any negligence in performing any work in connection with this project, or of any neglect in safeguarding the work, or of any

delay in completing the work, or of the use of any unacceptable or defective materials, or of any other act or omission either similar or dissimilar to the above enumerated acts, by said Contractor or his agent by which any person or property is injured through the fault of the said Contractor or his agents.

So much of the money due the said Contractor under and by virtue of his Contract as shall be considered necessary by the Owner for such purposes, may be retained for the use of the Owner, or in case no money is due, his Surety shall be held until such suit or suits, action or actions, claim or claims for injuries or damages as aforesaid shall have been settled and suitable evidence to that effect furnished to the Owner. The Owner shall not be liable to the Contractor for damages or delay resulting from work by third parties or by injunctions or other restraining orders obtained by third parties.

The Contractor shall report to the Owner all accidents occurring on the Work within 48 hours after their occurrence, and shall furnish the Engineer a copy of the report. The report shall contain complete information on the accident including names, addresses of persons involved, and names and addresses of witnesses. This shall be done in addition to the Contractor complying with all requirements of the Occupational Safety and Health Act of 1970 (PL 91-54).

7.09 INTERFERENCE OF CONTRACTORS.

The right is reserved by the Owner to award any work not included in the Contract to another Contractor for performance during the progress of this Contract, or to perform such work by their forces, and the Contractor for this Contract shall so cooperate ad conduct his operations so as to minimize the interference therewith. Where two or more contractors are employed on related or adjacent work, each shall conduct his operations in such a manner as not to cause any unnecessary delay or hindrance to the other. Each Contractor shall be responsible to the other for any damage, injury, loss, or expense which may be suffered on account of interference of operations, neglect or failure to finish the Work at the specified time, or for any other cause.

7.10 CONTRACTOR'S RESPONSIBILITY FOR WORK.

Until the final acceptance of the Work by the Owner, as evidenced in writing and subject to the guarantee required in Section 4.10, the Work shall be in the custody and under the charge and care of the Contractor, and he shall take every necessary precaution against injury or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore and make good at his own expense, all injuries or damages to any portion of the work occasioned by any of the above causes before its completion and acceptance and shall bear the expenses thereof, except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy, or of governmental authorities. In case of suspension of the Work from any cause whatever, the Contractor shall be responsible for all materials and shall properly store them, if necessary, and shall provide suitable temporary structures where necessary.

7.11 WORK ON RAILROAD RIGHT OF WAY.

No work of any character shall be commenced on any railroad right of way until the railroad company involved has bee duly notified by the Contractor in writing, with a copy of the correspondence forwarded to the Engineer, of the date he proposes to begin work and until an authorized representative of the railroad company is present, unless the railroad company waives such requirements. Any precautions and requirements considered necessary by the Railroad company shall be complied with by the Contractor at his own expense.

7.12 RIGHT OF WAY.

All right of way and necessary easements as shown on the plans shall be provided the Contractor, at no expense to him, unless otherwise specified.

7.13 NO WAIVER OF LEGAL RIGHTS

The Owner or the Engineer shall not be precluded by any measurement, estimate or certificate made or given by either of them or any representative or employee of the Owner, before or after the completion and acceptance of the Work and payment therefore, pursuant to any measurement, estimate or certificate, from showing the true and correct amount and character of the Work performed and materials furnished by the Contractor; or from showing, at any time, that any such measurements, estimate or certificate is untrue or incorrectly made in any way; or from showing at any time that the work or materials, or any part of either one, do not conform to the Specifications and Contract. The Owner shall have the right to reject the whole or any part of the aforesaid Work or materials should the said measurement, estimate or payment be found, or be known, to be inconsistent with the terms of the Contract, or otherwise improperly given; and the Owner shall not be precluded from demanding and recovering from the Contractor and his Surety such damages as it may sustain by reason of the Contractor's failure to comply with the terms of the Specifications and Contract. Neither the acceptance by the Owner, or any representative, or employee, nor any certificate by the Engineer for payment of money; nor any payment for, nor acceptance of the whole or any part of the work by the Owner, nor any extension of time, nor any possession taken by the Owner or its employees, shall operate as a waiver of any portion of the Contract or of any power herein reserved by the Owner or of any right to damages herein provided, nor shall any breach of the Contract be held to be waiver of any other or subsequent breach.

DIVISION III - GENERAL CONDITIONS

SECTION 8

PROSECUTION AND PROGRESS

8.01 SUBLETTING OR ASSIGNING OF CONTRACT.

The Contractor shall not sublet, assign, transfer, convey, sell, or otherwise dispose of any portion of the Contract, his right, title, or interest therein, or his power to execute such Contract, to any person, firm or corporation without written consent of the Owner and such written consent shall not be construed to relieve the Contractor of any responsibility for the fulfillment of the contract. If such consent is given, the Contractor will be permitted to sublet a portion of the Work, but shall perform with his own organization, work amounting to not less than 55 percent of the total contract amount. A subcontractor shall be recognized only in the capacity of an employee or agent of the Contractor and his removal may be required by the Owner, as in the case of any other employee.

8.02 NOTICE TO PROCEED.

After the signing of the contract and Bonds by all parties thereto, and after approval thereof by the Owner, the Engineer shall deliver to the Contractor a written "Notice to Proceed." It is understood that the mailing to the address given by the Contractor in his Proposal, or the delivery to the Contractor or his authorized representative of such "Notice to Proceed," shall constitute compliance by the Engineer with this provision of the Specifications. Commencement of work shall not begin prior to receipt of the written "Notice to Proceed," signed by the Engineer. The time allotted for construction of the project shall begin ten (10) days after the date of the "Notice to Proceed," or on the day work actually begins, whichever occurs first.

8.03 PROSECUTION OF WORK.

The Contractor shall begin the Work to be performed under the Contract within ten (10) days after issuance of the Notice to Proceed as above defined and he shall give the Engineer definite notice of his intention to start work at least seventy-two (72) hours in advance of beginning Work. During the progress of the Work the Contractor shall notify the Engineer at least twenty-four (24) hours before he expects to be ready to undertake particular features of construction in order that proper review may be provided.

The Contractor must continuously and diligently prosecute the Work in such order and manner as set out in his schedule. The contractor shall employ an ample force of men and provide adequate equipment, properly adapted to the Work and of sufficient capacity and efficiency to accomplish the work in a safe and workmanlike manner at the rate of progress deemed necessary to insure its completion within the time set forth in the Proposal and Contract. Each operation shall be begun as soon after the Contract is awarded as conditions will permit.

Each class of Work will be expected to progress from the date it is begun until completed. All plant and equipment shall be maintained in good working order and provision shall be made for immediate emergency repairs.

Should the Contractor fail to maintain a satisfactory rate of progress, the Owner will require that additional personnel and/or equipment be placed on the work, or a reorganization of plant and equipment layout be effected in order that the Work be brought up to the required progress schedule and maintained there.

All work in progress shall receive the personal attention either of the Contractor or of a competent and reliable superintendent who shall have full and final authority to act for him.

Should the prosecution of the Work be discontinued by the Contractor, with the consent of the Owner, the Contractor shall notify the Engineer in writing at least twenty-four (24) hours before resuming operations.

8.04 LIMITATIONS OF OPERATIONS.

The Contractor shall at all times conduct the work in such manner and in such sequence as will insure the least practicable interference with traffic. He shall not begin new work to the prejudice of work already started and the Engineer may require the Contractor to finish a section on which work is in progress before work is started on any additional section.

Whenever work is being done by the other Contractors is contiguous or related to the Work included in the Contract, the respective rights of the various interests involved shall be established by the Owner in order to secure the completion of the various portions of the Work in general harmony.

8.05 CHARACTER OF WORKERS AND EQUIPMENT.

All subcontractors, superintendents, foremen, and workers employed by the Contractor shall be competent and reliable. All workers must have sufficient skill and experience to properly perform the work assigned them. All workers engaged on special work or skilled work, in any trade, shall have had sufficient experience and ability in such work to perform it properly and satisfactorily and operate the equipment involved, and shall make due and proper effort to execute the work in the manner prescribed in Specifications and Contract. The Owner may demand the dismissal of any persons employed by the Contractor in, about, or upon the Work who misconducts himself or is incompetent or negligent in the due and proper performance of his duty, or who neglects or refuses to comply with the directions given, and such person shall not again be employed thereon without the written consent of the Owner. Should the Contractor continue to employ or re-employ any such person, the Owner may withhold all monies, which are or may become due, or he may suspend the Work until the Contractor complies with such order.

The methods and appliances used, the labor employed and the machinery and equipment used, shall be of sufficient size and in such mechanical condition as to meet the

requirements and produce a satisfactory quality and quantity of work, and shall be adequate to complete the Contract within the time specified in the Contract. No change in the machinery and equipment employed on the Work which shall have the effect of decreasing its capacity shall be made. The measure of the capacity of machinery and equipment shall be its actual performance on the work.

In case the actual progress shall fall behind the estimated progress at any time, or should it become apparent that the Contractor will be unable to complete the Contract at the time and in the manner specified in the contract, the Owner may require that additional equipment meeting with his approval be placed on the Work.

Should the Contractor fail to furnish suitable or sufficient tools, machinery, equipment or force for the proper prosecution of the Work, the Owner may withhold all monies, which are or may become due, until his orders are complied with, or the Contract may be annulled as hereinafter provided.

8.06 TEMPORARY SUSPENSION OF WORK.

The Owner shall have the authority to suspend the Work wholly or in part for such period or periods as he may deem necessary, due to unsuitable weather, or other essential conditions which he considers unfavorable for the suitable prosecution of the Work, or for failure on the part of the Contractor to carry out orders given or to perform any provision of the Contract or on account of any other conditions, which in his opinion make it impractical to secure satisfactory work as required by the plans and specifications. The Owner shall not have the authority to suspend work because of the Contractor's safety precautions since the Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods, and for any damage which may result from their failure, or their improper construction, maintenance or operations. No additional compensation shall be paid the Contractor on account of such suspension. The Contractor shall immediately respect the written order of the Owner to suspend the Work wholly or in part. Upon suspension, the Work shall be put in proper and satisfactory condition, carefully covered and properly protected. The work shall be resumed when conditions are favorable as ordered in writing by the Owner, and the Contractor shall notify the Engineer when he proposes to resume Work, sufficiently in advance of such time, so as to afford the Engineer opportunity to re-establish review of the work.

Should the progress of the Work be stopped by a temporary injunction, court restraining order, process, or judgment of any kind directed to either of the parties hereto, then such period or delay shall not be charged against the Contract time nor shall the Owner be liable to the Contractor on account of such delay or termination of the Work.

If for any reason it should become necessary to stop work for an indefinite period, the Contractor shall store all materials in such a manner that they will not obstruct or impede the traveling public or become damaged in any way, and he shall provide suitable drainage and take every precaution to prevent damage to or deterioration of the work performed.

8.07 DETERMINATION AND EXTENSION OF CONTRACT TIME FOR COMPLETION OF WORK.

When the time set forth for completion of the Work in the Proposal Form is in calendar days, working days are not applicable and no extension of time beyond the said days will be made except that where the final estimate exceeds the Contract Bid Price, an extension in calendar days will be granted the Contractor. This extension shall be in direct proportion to amount of total overrun in dollars, that is, the percentage of overrun shall first be computed and the calendar days shall be increased by the same percentage.

Time shall not be charged for the required maintenance period after the Final Construction Inspection.

8.08 FAILURE OR DELAY IN COMPLETING WORK ON TIME.

Should the Contractor, or, in case of default, the Surety, fail to complete the Work within the time stipulated in the Contract, or within such extra time as may be allowed as hereinabove provided, a deduction of $**1500** per calendar day, exclusive of Sundays, National Holidays and other legal holidays of the State of Alabama, that such Contract remains uncompleted after the calendar days specified for completion. The said amount stipulated in the said contract is hereby agreed upon as liquidated damages for the loss to the Owner due to the obstruction of traffic, interference with business, and increased cost of engineering, administering the contract, maintenance of detours around or over the Work, inspection, etc., after the expiration of the calendar days of completion specified in the Contract, and the Contractor and his Surety shall be liable for any liquidated damages in excess of the amount due the Contractor.

Permitting the contractor to continue and finish the Work or any part of it after the calendar date specified for completion or after the expiration of the number of calendar days allowed for completion, after any extension of time, shall in nowise operate as a waiver of the rights of the Owner under this Contract.

In any suit for the collection of, or involving the assessment of, liquidated damages, the reasonableness of the amount per day stipulated in the contract shall be presumed. The liquidated damages referred to herein are intended to be and are cumulative, and shall be in addition to every other remedy, now or hereafter enforceable at law, in equity, by statute, or under the Contract.

8.09 DEFAULT OF CONTRACT.

If the Contractor fails to begin the work under Contract within the time specified, or fails to perform the Work with sufficient workers, equipment, or materials to insure its prompt completion, or performs the Work unsuitably, or neglects or refuses to remove materials or perform anew such work as shall be rejected as defective and unsuitable, or discontinues the prosecution of the Work, or from any other cause whatsoever does not carry on the Work in an acceptable manner, or becomes insolvent or is adjudicated as bankrupt, or commits any act of

bankruptcy or insolvency, or allows any final judgement to stand against him unsatisfied for a period of ten (10) days, the Owner may give notice in writing by registered mail to the Contractor and the Surety of such delay, neglect, or default. If within ten (10) days after such notice the Contractor does not proceed to remedy the fault specified in said notice, or the Surety does not proceed to take over the work for completion, the Owner shall have full power and authority, without impairing the obligation of the Contract or the Contract Bonds, to take over the completion of the Work; to appropriate or use any or all material and equipment on the ground that may be suitable and acceptable; to enter into agreements with others for the completion of the Contract according to the terms and provisions thereof; or to use such other methods as in its opinion may be required for the completion of the contract. The Contractor and his Surety shall be liable for all costs and expenses incurred by the Owner, in completing the Work and also for all liquidated damages in conformity with the terms of the Contract. In case the sum of such liquidated damages and the expense so incurred by the Owner is less than the sum which would have been payable under the Contract if it had been completed by the Contractor or his Surety, the contractor or his Surety, as the case may be, shall be entitled to receive the difference; and in case the sum of such expense and such liquidated damages exceeds the sum which would have been payable under the Contract, the Contractor and his Surety shall be liable and shall pay to the Owner the amount of such excess. Notice to the Contractor shall be deemed to be served when delivered to the person in charge of any office used by the Contractor, his representative at or near the work or by registered mail addressed to the Contractor at his last known place of business.

8.10 TERMINATION OF CONTRACTOR'S RESPONSIBILITY.

Whenever all parts of the Work included in the improvement called for by the Contract have been completely performed on the part of the Contractor, and found satisfactory by the Engineer and Owner at the time of the Final Construction Inspection, when the period of the necessary advertisements has expired, when the Owner or his authorized representative has made final acceptance of the Work and the Owner has paid the final estimate, the Contractor's obligations shall then be considered fulfilled, except as set forth in his Contract Bonds, and in Section 4.10 elsewhere herein.

DIVISION III - GENERAL CONDITIONS

SECTION 9

MEASUREMENT AND PAYMENT

9.01 MEASUREMENT OF QUANTITIES.

All work acceptably completed under the Contract shall be measured by the Engineer according to United States Standard Measures and Weights, unless otherwise provided on the Plans or in the Special Provisions. No local rules or customs shall be adhered to or considered.

Structures shall be measured according to neat lines shown on the plans or as ordered, unless otherwise provided.

In computing volume, the method of average end areas will be used for excavation (hydraulic or dry), embankments and borrow pits.

Material specified to be paid for by the pound or by the ton, shall be weighed on tested truck or platform scales, if local material or material not shipped by rail is used. The scales used for weighing shall be satisfactory to the Engineer and they shall be tested at the expense of the Contractor as often as the Engineer may deem necessary to insure their accuracy. Weigh tickets showing the net weight of each load of material delivered shall be furnished to the Engineer for his use in computing quantities. If material is shipped by rail, the car weights may be accepted, subject to check by the Engineer on platform scales when he deems necessary, provided however, the actual weight of the material only will be paid for and not the minimum car weight used for assessing freight tariff, and car weights will not be acceptable for material passed through mixing plants. The expense incurred in providing for and operating the necessary weighing facilities and the weigh tickets shall be borne by the Contractor. Structural steel shall be paid for on the basis of computed weights; and the method of computation shall be that specified in the latest edition of the Manual of the A.I.S.C., "Code of Standard Practice." Reinforcing steel shall be paid for on the basis of the weight of theoretical sections, with no allowance for overrun or underrun.

All materials which are specified for measurement by the cubic yard "loose measurement" or "measured in the vehicle" shall be hauled in approved vehicles and measured therein at the point of delivery on the Work. The bodies of approved vehicles for this purpose may be of any size or type satisfactory to the Engineer, provided that they are of such shape that the capacity thereof will remain constant and the volume of the actual delivered contents may be readily and accurately determined. Unless all the approved vehicles on the Work are of uniform capacity, each approved vehicle must bear a plainly legible identification mark indicating the specific approved capacity.

After the Work is completed and before final payment is made therefor, the Engineer will make final measurement to determine the quantities of various items of work performed, as the basis of final payment. The Contractor, in all cases, will be paid for the actual amount of work performed in accordance with the Specifications and Contract and as shown by the final measurements and for prices set forth by the Contractor's Proposal.

In case the Basis of Payment for any pay item of the Work provides that the contract unit price bid for that item shall cover and include compensation for certain other work essential to, or performed in connection with that item, such work shall not be measured or paid for under any other pay item which may appear elsewhere in the Specifications or Contract.

9.02 SCOPE OF PAYMENT.

The Contractor shall receive and accept the compensation provided for in the Contract as full payment for furnishing all materials, labor, tools, and equipment, and for performing all Work contemplated and embraced under the Contract in a complete and acceptable manner in accordance with the Plans and Specifications including any Special Provisions and/or Supplemental Specifications; for any infringement of patent, trademark or copyright, for all loss or damage arising from the nature of the work, or from the action of the elements, except as hereinbefore provided; for all expenses incurred by, or in consequence of the suspension or discontinuance of the said prosecution of the Work as herein specified, or from any unforeseen difficulties which may be encountered during the prosecution of the Work and for all risks of every description connected with the prosecution of the work until its final acceptance by the Owner. The payment of any current or final estimate, or the acceptance of any portion of the work as provided in the Specifications, shall in no way affect the obligation of the Contractor, who at his own expense and cost, shall repair, correct, renew, or replace any defects or imperfections in the construction, strength, or quality of materials used in or about the construction of the Work under the Contract, and this payment shall in no way affect his responsibility for all damages due or attributable to such defect or imperfections which may be discovered before final acceptance of the whole Work, and the Engineer to be the judge of such defects or imperfections.

9.03 PAYMENT AND COMPENSATION FOR ALTERED QUANTITIES.

When alteration in plans or quantities of work not requiring Supplemental Agreements as hereinbefore provided for area ordered and performed, the Contractor shall accept payment in full at the contract unit bid prices for the actual quantities of work done, and no allowance will be made for increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor, resulting either directly from such alterations, or indirectly from unbalanced allocation among the contract items of overhead expense on the part of the Bidder and subsequent loss of expected reimbursement therefor, or from any other cause. Compensation for alterations in Plans or quantities of work requiring Supplemental Agreements shall be as stipulated in such agreements.

9.04 EXTRA AND FORCE ACCOUNT WORK.

Extra Work, as before defined, when ordered, authorized and accepted, will be paid for in accordance with the following.

The Contractor shall submit to the Engineer a written agreement or work order for the work to be done and basis of payment (lump sum, force account or unit price), and submit the same together with his estimate of amount and cost of work to the Owner for authorization to perform such Extra Work.

When Extra Work is authorized to be paid for on a lump sum basis, the Contractor shall compute the percentage done each month and submit with the monthly estimate, a detail sheet showing this percentage and the amount due him.

When Extra Work is authorized to be paid for on a unit price basis, the Contractor shall include on each monthly estimate the amount of work done that month.

When Extra Work is authorized to be paid for on a Force Account Basis, the Contractor shall furnish itemized statement to the Engineer of the cost of all force account work which shall include a certified copy of the weekly payroll and original receipted bills for all materials used and freight charges paid on same, provided that where materials used are not specifically purchased for use on Extra Work, but are taken from the Contractor's stock, the Contractor shall submit an affidavit of the quantity, price and freight on such material in lieu of original bills and invoices, which affidavit must be approved by the Engineer and Owner.

With each monthly estimate on Work paid for on a Force Account Basis, the Contractor shall submit in duplicate a detailed statement showing the following:

(1) Name, class, date, number of hours worked each day, total hours, rate and extension for each hour laborer and foreman engaged.

(2) Designation, number of hours worked each day, total hours, rental rate and extension for each unit of machinery or equipment used.

(3) Quantity of materials, price and extension.

(4) Freight on Materials.

(5) When the Extra Work is complete, the cost of property damage, liability, worker's compensation insurance premiums, unemployment insurance contributions, and social security tax.

All Extra Work done by Force Account will be paid in the following manner:

(a) For all labor and foremen in direct charge of the specific Work, the Contractor shall receive the current rate of wage as set out elsewhere herein, to be agreed upon in writing before beginning work, for each and every hour that said labor and foremen are actually engaged in such work, to which shall be added an amount equal to twenty percent (20%) thereof. No allowance shall be made for general superintendence and use of small tools and ordinary equipment.

(b) For the cost of property damage, liability, worker's compensation insurance premiums, unemployment insurance contributions, and social security tax required for Force Account Work, the Contractor shall receive the actual cost to which no percentage shall be added. The Contractor shall furnish satisfactory evidence of the rate or rates paid for such insurance.

(c) For materials, the Contractor shall receive the actual cost of such material delivered to the work, including the freight charges, as shown by original receipted bills to which shall be added an amount equal to fifteen percent (15%) of the sum thereof, provided, however, that the Owner reserves the right to furnish such materials required as the Engineer deems expedient, and the Contractor shall have no claim for any additional percentage of the cost of such materials.

(d) For any machinery or special equipment other than small tools, including pertinent fuel and lubricants, which it may be deemed necessary or desirable to use, the Contractor shall be allowed a reasonable rental price, to be agreed upon in writing before such work is begun, for the time that such equipment is in use on the work and to which sum no percentage shall be added.

No Extra Work will be paid for unless prices or wages have been agreed upon in writing before such work is started.

The compensation as above provided in (a), (b), (c) and (d) shall be accepted by the Contractor as payment in full for Extra Work done on a Force Account basis including superintendence, general expense, overhead, use of tools and equipment for which no rental is allowed, Contract Bonds and profit.

9.05 PARTIAL PAYMENTS.

Once in each month, not later than the 25th day of the calendar month, the contractor will submit a duly certified and approved estimate, on the regulation form, of the materials in place complete and the amount of work performed and the value thereof at the contract unit bid prices. From the total amount so ascertained will be deducted an amount equivalent to five percent (5%) of the whole to be retained by the Owner until after the completion of fifty percent (50%) of the entire contract, and the balance of a sum approximately equivalent to ninety-five percent (95%) of the whole, less any payments previously made, shall be certified by the Owner for payment, unless the Owner should elect to withhold or otherwise apply such payment because of some default by the Contractor in complying with the terms of his Contract. This 5% retainage shall not be paid to the contractor until completion of the entire contract in an acceptable manner.

A statement of any sums due the Owner for equipment, labor or supplies furnished under these Specifications shall be rendered the Contractor each month with the current estimate, and the amount of same shall be deducted from the estimate before payment is made by the Owner.

9.06 ACCEPTANCE AND FINAL PAYMENT.

Final acceptance is stipulated to mean written final acceptance by the Owner, followed by final payment in accordance with the Engineer's final estimate. Whenever, in the opinion of the Engineer, the Contractor shall have completed the Work in an acceptable manner and in accordance with the terms of the contract, he shall certify to the Owner in writing as to said completion and shall further certify as to the entire amount of every class of work performed and as to the value thereof. The Owner, upon receipt of said certificate, shall in turn notify the Contractor and his Surety that the work has been accepted, subject to the one-year guarantee, as required in Section 4.10. The action of the Owner and the Engineer by which the Contractor is to be bound according to the terms of the Contract shall be evidenced by the aforesaid certificate and final payment and all prior certificates or estimates upon which payment may have been made being merely partial estimates and subject to correction in the final payment.

The acceptance of the final payment as aforesaid shall operate as, and shall be, a release to the Owner and the Engineer from all claims of liability under his Contract for anything done or furnished relating to the Work under this Contract, or any alteration thereof, or for any act or neglect of by said Owner or said Engineer.

Subsequent to the final acceptance of this project by the Engineer, the following requirements must be satisfied by the Contractor before final payment can be made.

A. The Contractor must publicly advertise the NOTICE OF COMPLETION furnished by the Engineer in accordance with Title 39, Code of Alabama, 1975.

B. The Contractor must execute copies of CONTRACTOR'S AFFIDAVIT OF PAYMENT OF CLAIMS AND DEBTS on the form furnished by the Engineer.

C. The Contractor must have his surety execute copies of CONSENT OF SURETY TO FINAL PAYMENT on the form furnished by the Engineer.

D. The Contractor must furnish a letter on his letterhead acknowledging that acceptance of final payment by the Contractor constitutes a waiver of all claims, present or future, in connection with this project.

E. Omitted.

F. If any purchased items have been incorporated in the work, the Contractor must furnish a letter on his letterhead assigning those warranties to the OWNER. Copies of said warranties shall be bound in one binder and submitted along with the letter assignment.

G. Before final acceptance of this project, the Contractor shall prepare and submit to the engineer a complete set of "As-Built" plans showing actual quantities, **new mains** and service line locations. The engineer will furnish the contractor with an "Issue for Construction" set of drawings to be used for this purpose.

9.07 OMITTED ITEMS AND CANCELED WORK.

Should any items contained in the proposal be found unnecessary for the proper completion of the work contracted, the Owner may eliminate such items from the Contract. Such action shall in no way invalidate the contract, and no allowance will be made for items so eliminated in making final payment to the Contractor, except for such actual work as may have been done, materials actually purchased, and bona fide equipment costs incurred for such eliminated item prior to elimination of the items.

For materials ordered and delivered for the unfinished portion of such canceled or omitted items, the Owner will pay actual certified cost-plus 10 percent (10%) as an overhead charge. The Contractor's expense for work of handling or transporting such material shall be included in computing the cost; however, no anticipated profit will be included. Material paid for shall become the property of the Owner and shall be disposed of in a satisfactory manner.

DIVISION III - GENERAL CONDITIONS

SECTION 10

TESTING PROCEDURES

10.01 GENERAL.

The Engineer may require that any or all materials, backfill material, shell or sand-shell base course or other items be tested, if in his opinion tests are necessary to assure that all material and construction operations are in compliance with the Plans and Specifications. All tests shall be performed by a reputable testing laboratory, subject to the approval of the Owner, and shall be paid in accordance with the Special Provision.

The test requirements set forth hereinafter shall be the minimum required and if, in the opinion of the Engineer or Testing Laboratory, the materials or construction operations required for the prosecution of the work merit further tests or other testing procedures than those specified herewith or if any deviation from the procedures set forth is considered necessary, then such tests or procedures shall be performed as outlined above.

Materials or construction operations not listed hereinafter, but of which tests are necessary, in the opinion of the Engineer or Testing Laboratory, to assure compliance with the Plans and Specifications, shall be tested in accordance with a procedure satisfactory to the Engineer and Testing Laboratory.

Material that is to be tested shall not be used in the Work until the tests have been completed and the material is found to be acceptable. All defective material, whether in place or not, shall be rejected as stated hereinbefore.

Construction operations such as backfill and base course, that are tested and found to be unacceptable according to the requirements of the Plans and Specifications, shall be rejected and the Contractor, at his own expense, shall correct the unacceptable work as required to make such work comply with the Plans and Specifications.

Where A.S.T.M. specifications and serial numbers are stipulated, the reference shall be construed to be the specification and serial number as amended to date of opening bids for the Contract, either as an adopted standard, an adopted tentative standard, or an adopted supplement. When the term "Federal Specifications" or "Federal Board Specifications" is cited, the reference shall be construed to mean the specification as modified by any amendments promulgated before the date of opening bids for the Contract. Where a "Federal Board Specification" has been superseded by a "Federal Standard Specification" promulgated before the date of opening bids for the contract, citation of such "Federal Board Specification" shall be construed to mean the superseding "Federal Standard Specification."

10.02 PORTLAND CEMENT.

Minimum test requirements are:

(a) Where less than one carload if required, successful operation of the mill used for a period of one year.

(b) Where on to five carloads are required, certificate of mill test stating that it conforms to A.S.T.M. Specifications.

(c) Where more than five carloads are required, test shall be performed on all required cement by an independent laboratory in accordance with A.S.T.M. Specifications.

10.03 AGGREGATES FOR USE IN CEMENT CONCRETE.

Minimum test requirements are:

(a) Concrete aggregates shall conform to "Standard Specifications for Concrete Aggregates," A.S.T.M. C33.

(b) During the progress of the Work, tests shall be made periodically to assure conformity, in accordance with A.S.T.M. Specifications.

10.04 CONCRETE.

Minimum test requirements are:

(a) Where 0 to 50 cubic yards are required, slump tests and compression tests, made prior to construction, of the concrete mix proposed for use in the Work, in accordance with A.S.T.M. specifications. Unless otherwise specified in the special inspections section.

(b) Where more than 50 cubic yards are required, slump tests and compression tests, made prior to construction, of the concrete mix proposed for use in the Work and of the concrete actually used in the Work, from samples taken during any major pour. Preliminary tests shall consist of four cylinders, two to be broken at 7 days, and two to be broken at 28 days. Tests made during construction shall consist of six cylinders for each test, three to be broken at 7 days and three to be broken at 28 days. Tests are to be made in accordance with A.S.T.M. Specifications.

10.05 REINFORCING STEEL.

Minimum test requirements are:

(a) Where 0 to 50,000 pounds are required, visual inspection for rust, shape and dimensions.

(b) Where more than 50,000 pounds are required, visual inspection as above and test in accordance with A.S.T.M. Specifications.

10.06 STRUCTURAL STEEL.

Minimum test requirements are:

(a) All structural steel shall be visually inspected for rust, shape and dimensions.

(b) Where 25 to 200 tons are required, independent shop inspection and certified copies of mill tests.

(c) Where over 200 tons are required, mill and shop inspection by independent laboratory.

10.07 BRICK.

Minimum test requirements are:

(a) Where 0 to 5,000 are required, visual inspection for shape, color,soundness and freedom from cracks.

(b) For each additional 50,000 or part thereof, test in accordance with A.S.T.M. Specifications.

10.08 BUILDING BLOCK AND STONE.

Minimum test requirements are:

(a) Where 0 to 5 tons are required, a visual inspection for shape and color will be required.

(b) For each additional 5 tons or part thereof, a visual inspection for shape and color and tests in accordance with A.S.T.M. Specifications.

10.09 VITRIFIED OR UNGLAZED SEWER PIPE.

Minimum test requirements are:

(a) Inspection shall be made at the factory by a reputable testing laboratory and each joint of approved pipe and fitting shall be stamped by the laboratory. Testing shall be performed in accordance with A.S.T.M. Specifications.

10.10 CONCRETE SEWER PIPE.

Minimum test requirements are:

(a) Inspection shall be made at the factory by a reputable testing laboratory and each joint of approved pipe and fitting shall be stamped by the laboratory. Testing shall be performed in accordance with A.S.T.M. Specifications.

10.11 CAST IRON, DUCTILE IRON PIPE AND SPECIAL CASTINGS.

Minimum test requirements are:

(a) Visual inspection and certified tests, furnished by the manufacturer, stating that the pipe and special castings conform to A.S.T.M. Specifications.

10.12 BACKFILL AND BASE MATERIALS.

Minimum test requirements are:

(a) Backfill material will be visually inspected to assure suitability for use.

(b) Base materials will be visually inspected to assure suitability for use and tested to assure conformance, as to type and composition, with the Plans and Specifications. Tests performed will be in accordance with A.S.T.M. Specifications.

(c) All backfill and base materials will be tested to assure that the compaction obtained conforms to the requirements as specified in the Plans and Specifications. Tests performed shall be in accordance with the A.S.T.M. Specifications.

10.13 EQUIPMENT.

Minimum test requirements are:

(a) Manufacturer's certificate stating that all equipment to be used in the Work has been tested and inspected as necessary to assure conformance with the Plans and Specifications.

ADDENDUM A

E-VERIFY DOCUMENTATION

Company ID Number: _____

THE E-VERIFY MEMORANDUM OF UNDERSTANDING FOR EMPLOYERS

ARTICLE I
PURPOSE AND AUTHORITY

The parties to this agreement are the Department of Homeland Security (DHS) and the _____(Employer). The purpose of this agreement is to set forth terms and conditions which the Employer will follow while participating in E-Verify.

E-Verify is a program that electronically confirms an employee's eligibility to work in the United States after completion of Form I-9, Employment Eligibility Verification (Form I-9). This Memorandum of Understanding (MOU) explains certain features of the E-Verify program and describes specific responsibilities of the Employer, the Social Security Administration (SSA), and DHS.

Authority for the E-Verify program is found in Title IV, Subtitle A, of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (IIRIRA), Pub. L. 104-208, 110 Stat. 3009, as amended (8 U.S.C. § 1324a note). The Federal Acquisition Regulation (FAR) Subpart 22.18, "Employment Eligibility Verification" and Executive Order 12989, as amended, provide authority for Federal contractors and subcontractors (Federal contractor) to use E-Verify to verify the employment eligibility of certain employees working on Federal contracts.

ARTICLE II
RESPONSIBILITIES

A. RESPONSIBILITIES OF THE EMPLOYER

1. The Employer agrees to display the following notices supplied by DHS in a prominent place that is clearly visible to prospective employees and all employees who are to be verified through the system**:**
    a. Notice of E-Verify Participation
    b. Notice of Right to Work
2. The Employer agrees to provide to the SSA and DHS the names, titles, addresses, and telephone numbers of the Employer representatives to be contacted about E-Verify. The Employer also agrees to keep such information current by providing updated information to SSA and DHS whenever the representatives' contact information changes.
3. The Employer agrees to grant E-Verify access only to current employees who need E-Verify access. Employers must promptly terminate an employee's E-Verify access if the

employee is separated from the company or no longer needs access to E-Verify.
4. The Employer agrees to become familiar with and comply with the most recent version of the E-Verify User Manual.
5. The Employer agrees that any Employer Representative who will create E-Verify cases will complete the E-Verify Tutorial before that individual creates any cases.

a. The Employer agrees that all Employer representatives will take the refresher tutorials when prompted by E-Verify in order to continue using E-Verify**.** Failure to complete a refresher tutorial will prevent the Employer Representative from continued use of E-Verify.

6. The Employer agrees to comply with current Form I-9 procedures, with two exceptions:

a. If an employee presents a "List B" identity document, the Employer agrees to only accept "List B" documents that contain a photo. (List B documents identified in 8 C.F.R. § 274a.2(b)(1)(B)) can be presented during the Form I-9 process to establish identity.) If an employee objects to the photo requirement for religious reasons, the Employer should contact E-Verify at 888-464-4218.

b. If an employee presents a DHS Form I-551 (Permanent Resident Card), Form I-766 (Employment Authorization Document), or U.S. Passport or Passport Card to complete Form I-9, the Employer agrees to make a photocopy of the document and to retain the photocopy with the employee's Form I-9. The Employer will use the photocopy to verify the photo and to assist DHS with its review of photo mismatches that employees contest. DHS may in the future designate other documents that activate the photo screening tool.

Note: Subject only to the exceptions noted previously in this paragraph, employees still retain the right to present any List A, or List B and List C, document(s) to complete the Form I-9.

7. The Employer agrees to record the case verification number on the employee's Form I-9 or to print the screen containing the case verification number and attach it to the employee's Form I-9.
8. The Employer agrees that, although it participates in E-Verify, the Employer has a responsibility to complete, retain, and make available for inspection Forms I-9 that relate to its employees, or from other requirements of applicable regulations or laws, including the obligation to comply with the antidiscrimination requirements of section 274B of the INA with respect to Form I-9 procedures.

a. The following modified requirements are the only exceptions to an Employer's obligation to not employ unauthorized workers and comply with the anti-discrimination provision of the INA: (1) List B identity documents must have photos, as described in paragraph 6 above; (2) When an Employer confirms the identity and employment eligibility of newly hired employee using E-Verify procedures, the Employer establishes a rebuttable presumption that it has not violated section 274A(a)(1)(A) of the Immigration and Nationality Act (INA) with respect to the hiring of that employee; (3) If the Employer receives a final nonconfirmation for an employee, but continues to employ that person, the Employer must notify DHS and the Employer is subject to a civil money penalty between $550 and $1,100 for each failure to notify DHS of continued employment

following a final nonconfirmation; (4) If the Employer continues to employ an employee after receiving a final nonconfirmation, then the Employer is subject to a rebuttable presumption that it has knowingly employed an unauthorized alien in violation of section 274A(a)(1)(A); and (5) no E-Verify participant is civilly or criminally liable under any law for any action taken in good faith based on information provided through the E-Verify.

b. DHS reserves the right to conduct Form I-9 compliance inspections, as well as any other enforcement or compliance activity authorized by law, including site visits, to ensure proper use of E-Verify.

9. The Employer is strictly prohibited from creating an E-Verify case before the employee has been hired, meaning that a firm offer of employment was extended and accepted and Form I-9 was completed. The Employer agrees to create an E-Verify case for new employees within three Employer business days after each employee has been hired (after both Sections 1 and 2 of Form I-9 have been completed), and to complete as many steps of the E-Verify process as are necessary according to the E-Verify User Manual. If E-Verify is temporarily unavailable, the three-day time period will be extended until it is again operational in order to accommodate the Employer's attempting, in good faith, to make inquiries during the period of unavailability.

10. The Employer agrees not to use E-Verify for pre-employment screening of job applicants, in support of any unlawful employment practice, or for any other use that this MOU or the E-Verify User Manual does not authorize.

11. The Employer must use E-Verify for all new employees. The Employer will not verify selectively and will not verify employees hired before the effective date of this MOU. Employers who are Federal contractors may qualify for exceptions to this requirement as described in Article II.B of this MOU.

12. The Employer agrees to follow appropriate procedures (see Article III below) regarding tentative nonconfirmations. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee’s E-Verify case. The Employer agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending. Further, when employees contest a tentative nonconfirmation based upon a photo mismatch, the Employer must take additional steps (see Article III.B. below) to contact DHS with information necessary to resolve the challenge.

13. The Employer agrees not to take any adverse action against an employee based upon the employee's perceived employment eligibility status while SSA or DHS is processing the verification request unless the Employer obtains knowledge (as defined in 8 C.F.R. § 274a.1(l)) that the employee is not work authorized. The Employer understands that an initial inability of the SSA or DHS automated verification system to verify work authorization, a tentative nonconfirmation, a case in continuance (indicating the need for additional time for the government to resolve a case), or the finding of a photo mismatch, does not establish, and should not be interpreted as, evidence that the employee is not work authorized. In any of such cases, the employee must be provided a full and fair opportunity to contest the finding, and if he or she does so, the employee

may not be terminated or suffer any adverse employment consequences based upon the employee's perceived employment eligibility status (including denying, reducing, or extending work hours, delaying or preventing training, requiring an employee to work in poorer conditions, withholding pay, refusing to assign the employee to a Federal contract or other assignment, or otherwise assuming that he or she is unauthorized to work) until and unless secondary verification by SSA or DHS has been completed and a final nonconfirmation has been issued. If the employee does not choose to contest a tentative nonconfirmation or a photo mismatch or if a secondary verification is completed and a final nonconfirmation is issued, then the Employer can find the employee is not work authorized and terminate the employee's employment. Employers or employees with questions about a final nonconfirmation may call E-Verify at 1-888-464-4218 (customer service) or 1-888-897-7781 (worker hotline).

14. The Employer agrees to comply with Title VII of the Civil Rights Act of 1964 and section 274B of the INA as applicable by not discriminating unlawfully against any individual in hiring, firing, employment eligibility verification, or recruitment or referral practices because of his or her national origin or citizenship status, or by committing discriminatory documentary practices. The Employer understands that such illegal practices can include selective verification or use of E-Verify except as provided in part D below, or discharging or refusing to hire employees because they appear or sound "foreign" or have received tentative nonconfirmations. The Employer further understands that any violation of the immigration-related unfair employment practices provisions in section 274B of the INA could subject the Employer to civil penalties, back pay awards, and other sanctions, and violations of Title VII could subject the Employer to back pay awards, compensatory and punitive damages. Violations of either section 274B of the INA or Title VII may also lead to the termination of its participation in E-Verify. If the Employer has any questions relating to the anti-discrimination provision, it should contact the Immigrant and Employee Rights Section, Civil Rights Division, U.S. Department of Justice at 1-800-255-8155 or 1-800-237-2515 (TTY) or go to https://www.justice.gov/ier.

15. The Employer agrees that it will use the information it receives from E-Verify only to confirm the employment eligibility of employees as authorized by this MOU. The Employer agrees that it will safeguard this information, and means of access to it (such as PINS and passwords), to ensure that it is not used for any other purpose and as necessary to protect its confidentiality, including ensuring that it is not disseminated to any person other than employees of the Employer who are authorized to perform the Employer's responsibilities under this MOU**,** except for such dissemination as may be authorized in advance by SSA or DHS for legitimate purposes.

16. The Employer agrees to notify DHS immediately in the event of a breach of personal information. Breaches are defined as loss of control or unauthorized access to E-Verify personal data. All suspected or confirmed breaches should be reported by calling 1-888-464-4218 or via email at E-Verify@dhs.gov. Please use "Privacy Incident – Password" in the subject line of your email when sending a breach report to E-Verify.

17. The Employer acknowledges that the information it receives from SSA is governed by the Privacy Act (5 U.S.C. § 552a(i)(1) and (3)) and the Social Security Act (42 U.S.C. 1306(a)). Any person who obtains this information under false pretenses or uses it for any purpose other than as provided for in this MOU may be subject to criminal penalties.

18. The Employer agrees to cooperate with DHS and SSA in their compliance monitoring and evaluation of E-Verify, which includes permitting DHS, SSA, their contractors and

other agents, upon reasonable notice, to review Forms I-9 and other employment records and to interview it and its employees regarding the Employer's use of E-Verify, and to respond in a prompt and accurate manner to DHS requests for information relating to their participation in E-Verify.
19. The Employer shall not make any false or unauthorized claims or references about its participation in E-Verify on its website, in advertising materials, or other media. The Employer shall not describe its services as federally-approved, federally-certified, or federally-recognized, or use language with a similar intent on its website or other materials provided to the public. Entering into this MOU does not mean that E-Verify endorses or authorizes your E-Verify services and any claim to that effect is false.
20. The Employer shall not state in its website or other public documents that any language used therein has been provided or approved by DHS, USCIS or the Verification Division, without first obtaining the prior written consent of DHS.
21. The Employer agrees that E-Verify trademarks and logos may be used only under license by DHS/USCIS (see M-795 (Web)) and, other than pursuant to the specific terms of such license, may not be used in any manner that might imply that the Employer's services, products, websites, or publications are sponsored by, endorsed by, licensed by, or affiliated with DHS, USCIS, or E-Verify.
22. The Employer understands that if it uses E-Verify procedures for any purpose other than as authorized by this MOU, the Employer may be subject to appropriate legal action and termination of its participation in E-Verify according to this MOU.

B. RESPONSIBILITIES OF FEDERAL CONTRACTORS

1. If the Employer is a Federal contractor with the FAR E-Verify clause subject to the employment verification terms in Subpart 22.18 of the FAR, it will become familiar with and comply with the most current version of the E-Verify User Manual for Federal Contractors as well as the E-Verify Supplemental Guide for Federal Contractors.
2. In addition to the responsibilities of every employer outlined in this MOU, the Employer understands that if it is a Federal contractor subject to the employment verification terms in Subpart 22.18 of the FAR it must verify the employment eligibility of any "employee assigned to the contract" (as defined in FAR 22.1801). Once an employee has been verified through E-Verify by the Employer, the Employer may not create a second case for the employee through E-Verify.

a. An Employer that is not enrolled in E-Verify as a Federal contractor at the time of a contract award must enroll as a Federal contractor in the E-Verify program within 30 calendar days of contract award and, within 90 days of enrollment, begin to verify employment eligibility of new hires using E-Verify. The Employer must verify those employees who are working in the United States, whether or not they are assigned to the contract. Once the Employer begins verifying new hires, such verification of new hires must be initiated within three business days after the hire date. Once enrolled in E-Verify as a Federal contractor, the Employer must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

b. Employers enrolled in E-Verify as a Federal contractor for 90 days or more at the time of a contract award must use E-Verify to begin verification of employment

eligibility for new hires of the Employer who are working in the United States, whether or not assigned to the contract, within three business days after the date of hire. If the Employer is enrolled in E-Verify as a Federal contractor for 90 calendar days or less at the time of contract award, the Employer must, within 90 days of enrollment, begin to use E-Verify to initiate verification of new hires of the contractor who are working in the United States, whether or not assigned to the contract. Such verification of new hires must be initiated within three business days after the date of hire. An Employer enrolled as a Federal contractor in E-Verify must begin verification of each employee assigned to the contract within 90 calendar days after date of contract award or within 30 days after assignment to the contract, whichever is later.

c. Federal contractors that are institutions of higher education (as defined at 20 U.S.C. 1001(a)), state or local governments, governments of Federally recognized Indian tribes, or sureties performing under a takeover agreement entered into with a Federal agency under a performance bond may choose to only verify new and existing employees assigned to the Federal contract. Such Federal contractors may, however, elect to verify all new hires, and/or all existing employees hired after November 6, 1986. Employers in this category must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

d. Upon enrollment, Employers who are Federal contractors may elect to verify employment eligibility of all existing employees working in the United States who were hired after November 6, 1986, instead of verifying only those employees assigned to a covered Federal contract. After enrollment, Employers must elect to verify existing staff following DHS procedures and begin E-Verify verification of all existing employees within 180 days after the election.

e. The Employer may use a previously completed Form I-9 as the basis for creating an E-Verify case for an employee assigned to a contract as long as:

i. That Form I-9 is complete (including the SSN) and complies with Article II.A.6,
ii. The employee's work authorization has not expired, and
iii. The Employer has reviewed the Form I-9 information either in person or in communications with the employee to ensure that the employee's Section 1, Form I-9 attestation has not changed (including, but not limited to, a lawful permanent resident alien having become a naturalized U.S. citizen).

f. The Employer shall complete a new Form I-9 consistent with Article II.A.6 or update the previous Form I-9 to provide the necessary information if:

i. The Employer cannot determine that Form I-9 complies with Article II.A.6,
ii. The employee's basis for work authorization as attested in Section 1 has expired or changed, or
iii. The Form I-9 contains no SSN or is otherwise incomplete.

Note: If Section 1 of Form I-9 is otherwise valid and up-to-date and the form otherwise complies with Article II.C.5, but reflects documentation (such as a U.S. passport or Form I-551) that expired after completing Form I-9, the Employer shall

not require the production of additional documentation, or use the photo screening tool described in Article II.A.5, subject to any additional or superseding instructions that may be provided on this subject in the E-Verify User Manual.

g. The Employer agrees not to require a second verification using E-Verify of any assigned employee who has previously been verified as a newly hired employee under this MOU or to authorize verification of any existing employee by any Employer that is not a Federal contractor based on this Article.

3. The Employer understands that if it is a Federal contractor, its compliance with this MOU is a performance requirement under the terms of the Federal contract or subcontract, and the Employer consents to the release of information relating to compliance with its verification responsibilities under this MOU to contracting officers or other officials authorized to review the Employer's compliance with Federal contracting requirements.

C. RESPONSIBILITIES OF SSA

1. SSA agrees to allow DHS to compare data provided by the Employer against SSA's database. SSA sends DHS confirmation that the data sent either matches or does not match the information in SSA's database.
2. SSA agrees to safeguard the information the Employer provides through E-Verify procedures. SSA also agrees to limit access to such information, as is appropriate by law, to individuals responsible for the verification of Social Security numbers or responsible for evaluation of E-Verify or such other persons or entities who may be authorized by SSA as governed by the Privacy Act (5 U.S.C. § 552a), the Social Security Act (42 U.S.C. 1306(a)), and SSA regulations (20 CFR Part 401).
3. SSA agrees to provide case results from its database within three Federal Government work days of the initial inquiry. E-Verify provides the information to the Employer.
4. SSA agrees to update SSA records as necessary if the employee who contests the SSA tentative nonconfirmation visits an SSA field office and provides the required evidence. If the employee visits an SSA field office within the eight Federal Government work days from the date of referral to SSA, SSA agrees to update SSA records, if appropriate, within the eight-day period unless SSA determines that more than eight days may be necessary. In such cases, SSA will provide additional instructions to the employee. If the employee does not visit SSA in the time allowed, E-Verify may provide a final nonconfirmation to the employer.

Note: If an Employer experiences technical problems, or has a policy question, the employer should contact E-Verify at 1-888-464-4218.

D. RESPONSIBILITIES OF DHS

1. DHS agrees to provide the Employer with selected data from DHS databases to enable the Employer to conduct, to the extent authorized by this MOU:
   a. Automated verification checks on alien employees by electronic means, and
   b. Photo verification checks (when available) on employees.

2. DHS agrees to assist the Employer with operational problems associated with the Employer's participation in E-Verify. DHS agrees to provide the Employer names, titles, addresses, and telephone numbers of DHS representatives to be contacted during the E-Verify process.
3. DHS agrees to provide to the Employer with access to E-Verify training materials as well as an E-Verify User Manual that contain instructions on E-Verify policies, procedures, and requirements for both SSA and DHS, including restrictions on the use of E-Verify.
4. DHS agrees to train Employers on all important changes made to E-Verify through the use of mandatory refresher tutorials and updates to the E-Verify User Manual. Even without changes to E-Verify, DHS reserves the right to require employers to take mandatory refresher tutorials.
5. DHS agrees to provide to the Employer a notice, which indicates the Employer's participation in E-Verify. DHS also agrees to provide to the Employer anti-discrimination notices issued by the Immigrant and Employee Rights Section, Civil Rights Division, U.S. Department of Justice.
6. DHS agrees to issue each of the Employer's E-Verify users a unique user identification number and password that permits them to log in to E-Verify.
7. DHS agrees to safeguard the information the Employer provides, and to limit access to such information to individuals responsible for the verification process, for evaluation of E-Verify, or to such other persons or entities as may be authorized by applicable law. Information will be used only to verify the accuracy of Social Security numbers and employment eligibility, to enforce the INA and Federal criminal laws, and to administer Federal contracting requirements.
8. DHS agrees to provide a means of automated verification that provides (in conjunction with SSA verification procedures) confirmation or tentative nonconfirmation of employees' employment eligibility within three Federal Government work days of the initial inquiry.
9. DHS agrees to provide a means of secondary verification (including updating DHS records) for employees who contest DHS tentative nonconfirmations and photo mismatch tentative nonconfirmations. This provides final confirmation or nonconfirmation of the employees' employment eligibility within 10 Federal Government work days of the date of referral to DHS, unless DHS determines that more than 10 days may be necessary. In such cases, DHS will provide additional verification instructions.

ARTICLE III
REFERRAL OF INDIVIDUALS TO SSA AND DHS

A. REFERRAL TO SSA

1. If the Employer receives a tentative nonconfirmation issued by SSA, the Employer must print the notice as directed by E-Verify. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of

the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.
2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.
3. After a tentative nonconfirmation, the Employer will refer employees to SSA field offices only as directed by E-Verify. The Employer must record the case verification number, review the employee information submitted to E-Verify to identify any errors, and find out whether the employee contests the tentative nonconfirmation. The Employer will transmit the Social Security number, or any other corrected employee information that SSA requests, to SSA for verification again if this review indicates a need to do so.
4. The Employer will instruct the employee to visit an SSA office within eight Federal Government work days. SSA will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.
5. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.
6. The Employer agrees not to ask the employee to obtain a printout from the Social Security Administration number database (the Numident) or other written verification of the SSN from the SSA.

B. REFERRAL TO DHS

1. If the Employer receives a tentative nonconfirmation issued by DHS, the Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.
2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.
3. The Employer agrees to refer individuals to DHS only when the employee chooses to contest a tentative nonconfirmation.
4. If the employee contests a tentative nonconfirmation issued by DHS, the Employer will instruct the employee to contact DHS through its toll-free hotline (as found on the referral letter) within eight Federal Government work days.
5. If the Employer finds a photo mismatch, the Employer must provide the photo mismatch tentative nonconfirmation notice and follow the instructions outlined in paragraph 1 of this section for tentative nonconfirmations, generally.
6. The Employer agrees that if an employee contests a tentative nonconfirmation based upon a photo mismatch, the Employer will send a copy of the employee's Form I-551, Form I-766, U.S. Passport, or passport card to DHS for review by:

a. Scanning and uploading the document, or
b. Sending a photocopy of the document by express mail (furnished and paid for by the employer).

7. The Employer understands that if it cannot determine whether there is a photo match/mismatch, the Employer must forward the employee's documentation to DHS as described in the preceding paragraph. The Employer agrees to resolve the case as specified by the DHS representative who will determine the photo match or mismatch.
8. DHS will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.
9. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

ARTICLE IV
SERVICE PROVISIONS

A. NO SERVICE FEES

1. SSA and DHS will not charge the Employer for verification services performed under this MOU. The Employer is responsible for providing equipment needed to make inquiries. To access E-Verify, an Employer will need a personal computer with Internet access.

ARTICLE V
MODIFICATION AND TERMINATION

A. MODIFICATION

1. This MOU is effective upon the signature of all parties and shall continue in effect for as long as the SSA and DHS operates the E-Verify program unless modified in writing by the mutual consent of all parties.
2. Any and all E-Verify system enhancements by DHS or SSA, including but not limited to E-Verify checking against additional data sources and instituting new verification policies or procedures, will be covered under this MOU and will not cause the need for a supplemental MOU that outlines these changes.

B. TERMINATION

1. The Employer may terminate this MOU and its participation in E-Verify at any time upon 30 days prior written notice to the other parties.
2. Notwithstanding Article V, part A of this MOU, DHS may terminate this MOU, and thereby the Employer's participation in E-Verify, with or without notice at any time if deemed necessary because of the requirements of law or policy, or upon a determination by SSA or DHS that there has been a breach of system integrity or security by the Employer, or a failure on the part of the Employer to comply with established E-Verify procedures and/or legal requirements. The Employer understands that if it is a Federal contractor, termination of this MOU by any party for any reason may negatively affect the

performance of its contractual responsibilities. Similarly, the Employer understands that if it is in a state where E-Verify is mandatory, termination of this by any party MOU may negatively affect the Employer's business.
3. An Employer that is a Federal contractor may terminate this MOU when the Federal contract that requires its participation in E-Verify is terminated or completed. In such cases, the Federal contractor must provide written notice to DHS. If an Employer that is a Federal contractor fails to provide such notice, then that Employer will remain an E-Verify participant, will remain bound by the terms of this MOU that apply to non-Federal contractor participants, and will be required to use the E-Verify procedures to verify the employment eligibility of all newly hired employees.
4. The Employer agrees that E-Verify is not liable for any losses, financial or otherwise, if the Employer is terminated from E-Verify.

ARTICLE VI
PARTIES

A. Some or all SSA and DHS responsibilities under this MOU may be performed by contractor(s), and SSA and DHS may adjust verification responsibilities between each other as necessary. By separate agreement with DHS, SSA has agreed to perform its responsibilities as described in this MOU.
B. Nothing in this MOU is intended, or should be construed, to create any right or benefit, substantive or procedural, enforceable at law by any third party against the United States, its agencies, officers, or employees, or against the Employer, its agents, officers, or employees.
C. The Employer may not assign, directly or indirectly, whether by operation of law, change of control or merger, all or any part of its rights or obligations under this MOU without the prior written consent of DHS, which consent shall not be unreasonably withheld or delayed. Any attempt to sublicense, assign, or transfer any of the rights, duties, or obligations herein is void.
D. Each party shall be solely responsible for defending any claim or action against it arising out of or related to E-Verify or this MOU, whether civil or criminal, and for any liability wherefrom, including (but not limited to) any dispute between the Employer and any other person or entity regarding the applicability of Section 403(d) of IIRIRA to any action taken or allegedly taken by the Employer.
E. The Employer understands that its participation in E-Verify is not confidential information and may be disclosed as authorized or required by law and DHS or SSA policy, including but not limited to, Congressional oversight, E-Verify publicity and media inquiries, determinations of compliance with Federal contractual requirements, and responses to inquiries under the Freedom of Information Act (FOIA).
F. The individuals whose signatures appear below represent that they are authorized to enter into this MOU on behalf of the Employer and DHS respectively. The Employer understands that any inaccurate statement, representation, data or other information provided to DHS may subject the Employer, its subcontractors, its employees, or its representatives to: (1) prosecution for false statements pursuant to 18 U.S.C. 1001 and/or; (2) immediate termination of its MOU and/or; (3) possible debarment or suspension.
G. The foregoing constitutes the full agreement on this subject between DHS and the

Employer.

To be accepted as an E-Verify participant, you should only sign the Employer's Section of the signature page. If you have any questions, contact E-Verify at 1-888-464-4218.

Approved by:

E-Verify Employer	
Name (Please Type or Print)	Title
Signature	Date
Department of Homeland Security – Verification Division	
Name (Please Type or Print)	Title
Signature	Date

Information Required for E-Verify Information relating to your Company:	
Company Name:	
Company Facility Address:	
Company Alternate Address:	
County or Parish:	

Employer Identification Number:	
North American Industry Classification Systems Code:	
Parent Company:	
Number of Employees:	
Number of Sites Verified for:	

Are you verifying for more than one site?
If yes, please provide the number of sites verified for in each State:

State	Number of sites	Site(s)

Information relating to the Program Administrator(s) for your Company on policy questions or operational problems:	
Name:	
Telephone Number:	
Fax Number:	
E-mail Address:	

Name:	
Telephone Number:	
Fax Number:	
E-mail Address:	

GeoCon

Engineering & Materials Testing, Inc.

Report of Geotechnical Exploration

Proposed Headworks Improvements
Gulf Shores Water Reclamation Facility
Gulf Shores, Alabama

GeoCon Project No. DL 2456-20

Prepared For:

Mr. Andy Bobe, PE
Dewberry
25353 Friendship Road
Daphne, Alabama 36526

Date: November 25, 2020

Prepared By:
GeoCon Engineering & Materials Testing, Inc.
22885 McAuliffe Drive
Robertsdale, Alabama 36567

GeoCon
Engineering & Materials Testing, Inc.

November 25, 2020

Mr. Andy Bobe, PE
Dewberry
25353 Friendship Road
Daphne, AL 36526

RE: **Report of Geotechnical Exploration**
Proposed Headworks Improvements
Gulf Shores Water Reclamation Facility
Gulf Shores, Alabama
GeoCon Project No. DL 2456-20

Dear Mr. Bobe:

GeoCon Engineering & Materials Testing, Inc. is pleased to submit this report of geotechnical exploration for the above referenced project. Included in this report is a summary of our understanding of the project, results of the field exploration, and our recommendations for site grading, subgrade preparation and foundation design. This testing has been performed in general accordance with our signed proposal and our earlier discussions with you.

Enclosed please find our report with evaluations and recommendations followed by an Appendix which includes a Site Location Map, Test Location Plan, graphical logs of the soundings and borings, laboratory test data, a Unified Soil Classification Chart, important notes about your Geotechnical Report and the Terms and Conditions that govern our work.

We appreciate the opportunity to have provided you with our geotechnical engineering services. If you have any questions concerning this report, or if we can be of any further assistance, please contact our office.

Sincerely,

GeoCon, Inc.

Jason J. Christian, P.E.
Geotechnical Engineer

22885 McAuliffe Drive Robertsdale, Alabama 36567
Phone (251) 947-1035

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1.0 Project Description

The project subject to this report is the headworks improvements to the Gulf Shores Water Reclamation Facility in Gulf Shores, Alabama. The location of the subject site is shown on the attached Site Location Map (Figure 1). During our November 2020 field exploration, the site was clear and open.

The provided information indicated that the headworks improvements will include new grit storge, grit classification, grit sumps, weir and screen system structures. The structures will include concrete walls with concrete slab-on-grade floors and be supported on shallow foundations. Structural loading information was not available at the time of this report; however, we anticipate maximum wall loads will be less than about 2 kips per linear foot. We understand that final subgrade elevations for the new structures will be close to the existing ground elevations. We also understand that the project may include new access drives or parking areas that will include an aggregate surface.

Note: If our understanding of the above project information differs from the actual project plans and specifications or if revisions to the project plans are made after this report, we should be contacted for analysis and comment as needed.

2.0 Geotechnical Exploration

Soil conditions were investigated by performing six (6) Cone Penetration Test (CPT) soundings to depths of about 15 to 30 feet below the existing ground surface and four (4) hand auger borings to depths of about 4 feet below the existing ground surface in the proposed new construction areas. The general sounding and boring locations are shown on the attached Test Location Plan (Figure 2).

CPT testing was performed in accordance with ASTM D-5778 using a Vertek S4 electronic CPT rig. CPT testing includes pushing an electronic cone on a series of rods into the ground at a constant rate. The electronic cone collects continuous measurements of the resistance to penetration of the cone tip and side friction sleeve. Correlations between Cone Resistance values and Standard Penetration Test (SPT) "N" values were performed using methods developed by Robertson, Campanella and Wightman. The CPT logs attached in the appendix shows the cone tip friction, sleeve friction, pore pressure, correlated "N" value and the soil behavior type (SBT). At each test sounding location, samples were collected of the soils encountered in the upper 4 feet of the soil-profile.

The hand auger test borings included Dynamic Cone Penetrometer (DCP) soundings to evaluate relative soil density/consistency characteristics. With the DCP, a 1½-inch diameter cone is seated to penetrate any loose cuttings, and then driven in 1¾-inch increments with blows from a 15 pound weight falling 20 inches. The number of blows required to drive the cone the 1¾-inch increments is an index of relative soil strength and compressibility. Samples collected were visually classified by GeoCon, Inc. personnel, placed in containers and transported to our laboratory for further testing and for further review by our engineering staff. Samples will be retained at our lab for a period of 60 days after the date of this report. If no written instructions are given to GeoCon, we will discard the samples after 60 days.

3.0 Soil Conditions Encountered

The soundings and borings initially encountered about 4 to 12 inches of organic topsoil material. Below the topsoil material, the soundings and borings generally encountered fine-grained silty sand soils intermixed with clay layers within the upper 8 to 15 feet of the soil-profile. Below depths of about 8 to 15 feet, the deeper soundings generally encountered sand soils with layers of cohesive clay to sounding termination at depths of about 15 to 30 feet below the existing ground surface.

Based on the cone tip friction values and the correlated Standard Penetration Test values (N-values) and DCP values, the near-surface silty sand soils were generally in a loose to firm condition. The deeper sand soils were generally in a firm to very dense condition while the clay layers were in a soft condition. A more detailed description of the soil conditions encountered is shown on the CPT Sounding and Boring Logs in the Appendix.

4.0 Ground Water Conditions Encountered

The soundings encountered ground water from depths of about 8 to 14½ feet at the time of the field exploration. Ground water conditions are subject to seasonal variations and are expected to fluctuate in response to local variations in precipitation and drainage conditions. Considering the relatively short time frame of the field exploration, ground water levels may not have had sufficient time to stabilize. Therefore, actual depths to ground water may vary. We do not anticipate that natural ground water will impact foundation construction; however, the contractor should be aware that the fine-grained near-surface soils at the site are prone to holding perched ground water following rain events.

5.0 Laboratory Test Data

The soil samples taken from the site were visually classified in general accordance with the guidelines of ASTM D-2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). The quantity and type of laboratory tests performed for this geotechnical study were determined and adjusted by GeoCon engineering personnel based on the uniformity and characteristics of the subsurface soil conditions encountered and our experience and knowledge of local soil conditions.

Laboratory soil tests were performed to aid in the classification of the soils and to help in the evaluation of engineering characteristics of the soils. Representative soil samples recovered from the soil test borings were selected for grain-size analysis (6 tests) and Atterberg limit determination (6 tests). The laboratory data is shown on the attached lab data sheets.

6.0 Site Preparation Recommendations

6.1 General Site Preparation

Areas beneath and 5 feet beyond the footprint of the structures and 2 feet beyond aggregate surfaces (access drives, aprons, etc.) should be designated as "controlled areas". The dark color, fine-grained subgrade soils encountered at the site are prone to rutting and displacing/pumping during the initial phases of site grading, especially if wet weather conditions persist during site preparation. We recommend that low ground pressure track mounted equipment be used in the debris/topsoil removal and general site preparation. Dump truck traffic should not be allowed on the native subgrade in the structure controlled areas and limited as much as possible on the native subgrade in pavement areas. The use of heavy rubber tire equipment will further deteriorate the subgrade soil conditions and increase the risk for excessive rutting or pumping and the need for additional undercut.

These subgrade soils encountered consisted of dark color, fine-grained silty sand soils intermixed with clay lenses. These subgrade soils are considered weak in nature and are not suitable to support the proposed structural loadings and pavement construction. To provide a stable subgrade to support the foundations and concrete slabs we recommend that the structure controlled areas be undercut by a depth of at least 2 feet below the existing ground surface or to a depth that will allow for placement of 24 inches of structural fill below the bottom of the deepest foundation footing. The access drives, apron areas and any parking areas should be undercut to a depth of at least 2 feet below the existing ground surface or to a depth that will allow for placement of 18 inches of structural fill below the bottom of the base aggregate course.

We understand that final subgrade elevations will be close to the existing ground surface. Due to the soft clay soils encountered below depths of about 10 to 15 feet, we recommend that no more than 2 feet of fill (in height) be placed above the existing ground surface. Fill heights over 2 feet could potentially stress the deeper soft clay soils when coupled with the anticipated structural loads.

Deeper undercuts may be required to remove organic material or isolated pockets of unsuitable soils. Prior to fill placement, the bottom of the undercut excavations should be bladed with a small low-ground pressure dozer or other suitable means that will provide a level subgrade that is free of loose soils.

Following the above recommended undercut and removal of debris, unsuitable soils, etc., the exposed subgrade should be observed by a field representative of the Geotechnical Engineer of Record to verify that the exposed subgrade soils are suitable for fill placement. Subgrade soils that exhibit excessive rutting or pumping should be further undercut or stabilized as per the recommendation of the project geotechnical consultant.

6.2 Site Drainage

Positive drainage should be established during the early stages of site grading and maintained throughout the project's construction process. Perched ground water may be encountered during the undercut operation. If the undercut excavation exhibits water seepage, temporary tail ditching and/or placement of sump pumps may be required to drain free standing water and help facilitate proper backfilling.

The "controlled areas" should be maintained in a well-drained condition that will promote the continual removal of surface water that may flow over the construction areas. This positive drainage is critical for the fine-grained subgrade soils that are predominate at the site. Saturation of the cohesive soils can result in substantial time delays in the construction and significant decreases in soil strengths. During construction (both site grading and building), the contractor should exercise caution during inclement weather to ensure the subgrade and structural fill courses are not degraded by construction traffic. Water should not be allowed to pond against the structures during and following construction. Ponding water adjacent to the building foundations can lead to settlement due to deterioration of the foundation bearing soils.

6.3 Placement of Structural Fill

The initial lift of fill in the controlled areas should consist of select sand fill and be placed in an 18 inch thick lift and compacted to 95% ASTM D-698 standard compaction with low ground pressure tracked equipment to help prevent pumping of the underlying saturated soils. The initial 18 inch lift of fill should consist of clean sand material with less than 10% passing the No. 200 mesh sieve. The remaining fill required to achieve final subgrade elevations should consist of structural fill. Structural fill should originate from an approved off-site borrow source and should meet the following minimum requirements:

1) Exhibit SM classification according to the Unified Soil Classification System
2) Have a maximum of 25% soil fines passing the No. 200 sieve
3) Have a maximum Liquid Limit (LL) of 20%
4) Have a Plasticity Index (PI) of 0% (Non-Plastic)
5) Have a minimum standard Proctor (ASTM D-698) maximum dry density of 110 pcf

Structural fill should be placed in 8 inch loose lifts and compacted to 98% ASTM D-698 standard compaction at moisture contents within +/- 3% of the material's optimal moisture content. Once the surface of each lift of structural fill is ready for the next lift, the exposed soil should be maintained at the placed moisture content until the next lift of fill is placed. The surface of the lifts should not be exposed to weather, especially drying, for an extended period of time.

6.4 Weather Considerations

Weather conditions at the time of site preparation will directly impact earthmoving activities. Exposed cohesive subgrade soils and structural fill soils can be expected to degrade during wet weather conditions. Additional soil processing and drying efforts or undercutting are typically required during wet weather conditions.

6.5 Unit Costs

Considering the fine-grained subgrade soils across this site, we expect that additional undercut may be required beyond the above recommended undercut depths. Again, weather conditions prior to and during site grading will directly impact the condition of the subgrade soils at this site and the amount of undercut required. Therefore, we recommend that the contract documents establish a unit cost (per cubic yard) for undercutting and replacing unsuitable soils.

6.6 Testing Requirements

The geotechnical consultant should monitor and document the results of the topsoil stripping, debris removal, subgrade proof-rolling, correction of weak soil conditions and the conditions of the final subgrades, foundation construction, and floor slab bearing soils.

During fill placement, field density testing should be performed to confirm that the specified compaction criteria is being achieved. Sufficient samples of on-site soils should be collected for Proctor compaction tests to provide the moisture-density relationships needed for compaction control. Sufficient samples of structural fill materials should be submitted by the contractor for classification and Proctor density tests to show substantial compliance with the specifications and to provide the moisture-density relationships needed for compaction control. It is important that proper quality assurance testing be performed during site grading.

A minimum of one (1) field density test should be performed per each 100 linear feet (per each 2 ft. of vertical thickness) of fill placed at utility trenches extending through the "controlled areas". Current OSHA regulations should be followed with respect to excavations for this project. Heavy construction traffic and stockpiling of excavated earth should not be permitted near the top of open unsupported excavations.

7.0 Shallow Foundation Recommendations

Provided the structure “controlled areas” are prepared in accordance with this report, the proposed buildings can be supported by typical reinforced concrete spread foundations bearing at shallow depths in properly compacted structural fill. Foundations can be designed using a net allowable soil bearing pressure up to 1,500 psf. The allowable soil bearing pressure applies to dead loads plus design live loads. The allowable soil bearing pressure may be increased by one-third when considering total loads that include transient loads such as wind and seismic. The bottom of all foundation footings should be compacted to at least 95% standard Proctor density prior to reinforcing steel (rebar) and concrete placement.

Note: The foundation footings should bear above at least 24 inches of compacted structural fill material as outlined in section 6.1 of this report.

Lateral and uplift loads can be resisted by passive pressure of the soil acting against the side of the individual footings and/or the friction developed between the base of the footings and the underlying soils. For compacted backfill and firm native soils, the passive pressure may be taken as the equivalent to the pressure exerted by a fluid weighing 350 pounds per cubic foot (pcf). A coefficient of friction equal to 0.32 may be used for calculating the frictional resistance at the base of spread footings. These lateral resistance values are based on the assumption that the foundations can withstand horizontal movements on the order of ¼ inch. Spread foundation depths can be increased for uplift resistance as required. A soil unit weight of 120 pcf can be used for backfill atop foundations.

Soils exposed in the bottom of all satisfactory excavations should be protected against disturbance, excessive drying, freezing or rain. Surface runoff should be drained away from excavations and not allowed to pond. The saturation of soils at the footing bearing elevation levels can reduce their strength and load carrying ability. Concrete for foundations should be placed as soon after completion of the excavations as possible. If a delay in concrete placement is expected or if exposed to wet weather, a 2 to 3 inch "mud mat" consisting of lean concrete should be placed in the footing excavations to protect the bearing soils.

The "frost penetration" depth in the areas of this project is generally taken to be less than 10 inches. Provided our recommendations for the development of the foundations, floor slabs and pavements are followed, we do not expect that the "frost penetration" will have any detrimental effects on the performance of the foundations, floor slabs or pavements.

8.0 Ground Supported Concrete Slabs

The subgrade soil beneath all ground supported concrete slabs should consist of properly compacted structural fill as described in the Grading Section of this report. A plastic vapor barrier should be installed over the subgrades prior to installation of the floor slabs. The plastic vapor barrier should be properly lapped and all joints and intrusions properly taped and sealed. Special attention should be given to properly compacting utility trenches in the building areas. Utility trenches below the slab areas should be compacted to 95% ASTM D-698 standard density. Provided that the floor slabs are supported over properly compacted structural fill, a subgrade modulus of 150 pci could be used for design.

9.0 Exposed Aggregate Build-Up

The below exposed aggregate build-up can be used for this project.

Exposed Aggregate Section

6" ALDOT Section 825 B crushed aggregate base material (compacted to 100% standard density)

18" Compacted Structural Fill (compacted to 100% standard density)

The crushed concrete that meets the gradation requirements of ALDOT Section 825 B could be used as the crushed aggregate layer. Recycled asphalt millings could also be used as the aggregate layer. Asphalt millings would need to be compacted with a roller to a smooth and stable condition. Samples of both the crushed concrete and asphalt milling should be provided and approved by GeoCon prior to placement. Periodic regrading may be required, especially following periods of heavy traffic and use.

10.0 Closure

This report has been prepared for the exclusive use of Dewberry and their project design professionals for specific application to the above referenced project in accordance with generally accepted current standards of geotechnical engineering practice common to the local area.

The comments and recommendations of this report provide manageable and reasonable solutions to the advancement of the project based on the collected test data and the provided design information. Significant changes in site conditions or project design may result in alternative solutions to the design required or may permit more manageable and economical construction techniques. Should such significant changes occur, we will be available to offer supplemental comment.

The comments and recommendations of this report are based upon our interpretation of the information supplied by the client, the data collected at the six (6) CPT soundings, the four (4) hand auger borings and the site conditions observed at the time of testing. A significant amount of interpolation was necessary. Because it is not possible to know or predict detailed conditions hidden beneath the ground surface, our comments and recommendations are presented as opinions and judgements, as opposed to statements of fact.

Improper site preparation, extremes in climatic conditions, significant changes in grade, time, etc., can affect the ground water, surface and subsurface conditions. If conditions are encountered as the construction advances which vary significantly from those described by this report, we should be contacted for additional comment.

We have not intended to reflect specific volumes of subsurface conditions at the site. Volumetric estimates often require a large number of borings placed on a close grid with the collected data associated with civil engineering cross-sections. If volume estimates are required of us for the design/development of this project to advance, please contact us for further comment.

Again, we appreciate the opportunity to provide our geotechnical engineering services for this project. To ensure that our recommendations are correctly interpreted and followed during construction, we recommend that the owner retain GeoCon, Inc. to provide construction observation and construction materials testing for the project.

APPENDIX

A-1 Site Location Map

A-2 Test Location Plan

A-3 Graphical Logs of the Soundings and Borings

A-4 Laboratory Test Data

A-5 Unified Soil Classification Chart

A-6 Important Notes About Your Geotechnical Report

A-7 Terms & Conditions Sheet

Figure 1	NOT TO SCALE **SITE LOCATION MAP** Proposed Headworks Improvements Gulf Shores Water Reclamation Facility Gulf Shores, AL DL 2456-20	***GEOCON, INC.*** 22885 McAuliffe Drive Robertsdale, Alabama 36567
Date 11/20/2020		

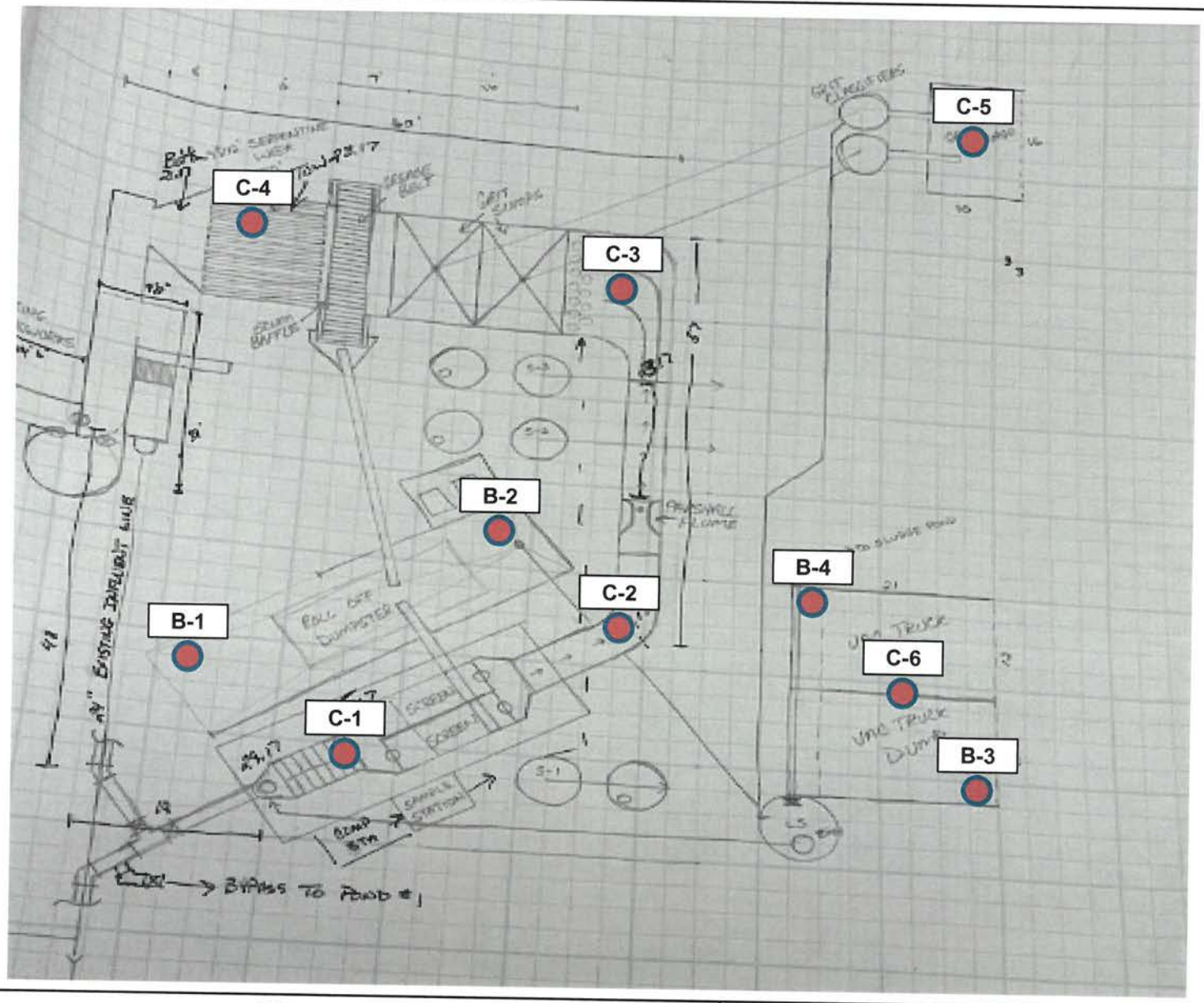
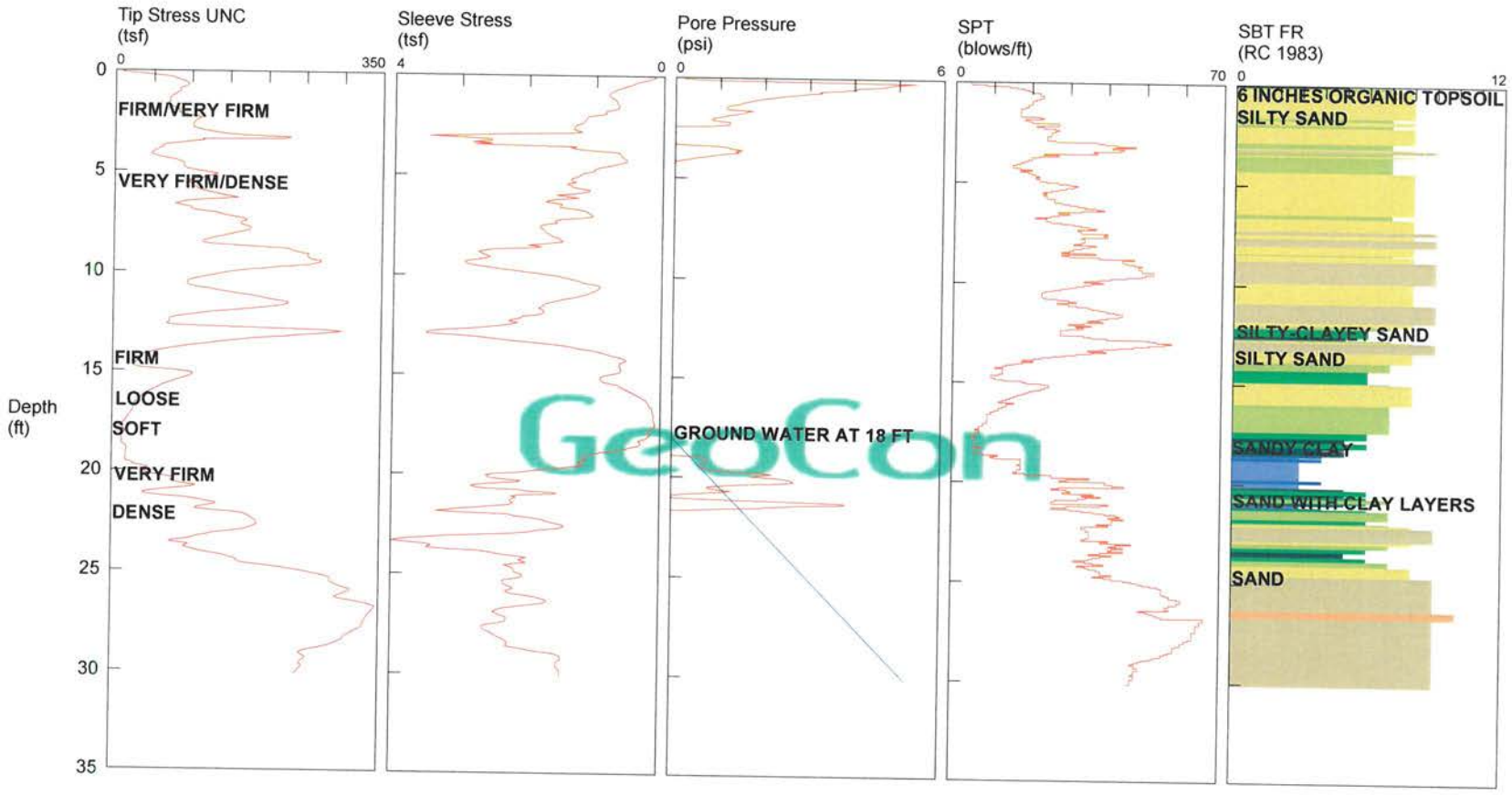


Figure 2	NOT TO SCALE **TEST LOCATION PLAN** Proposed Headworks Improvements Gulf Shores Water Reclamation Facility Gulf Shores, AL DL 2456-20	***GEOCON, INC.*** 22885 McAuliffe Drive Robertsdale, AL 36567
Date 11/20/2020		

C-1

CPT Testing Done By: GeoCon
Proposed: Phase II to the Gulf Shores Water Reclamation Facility
CUSTOMER: City of Gulf Shores
LOCATION: Gulf Shores, AL
HOLE NUMBER: C-1

JOB NUMBER: DL 2456-20
TEST DATE: 11/19/2020
OPERATOR: Chris Rea



GeoCon

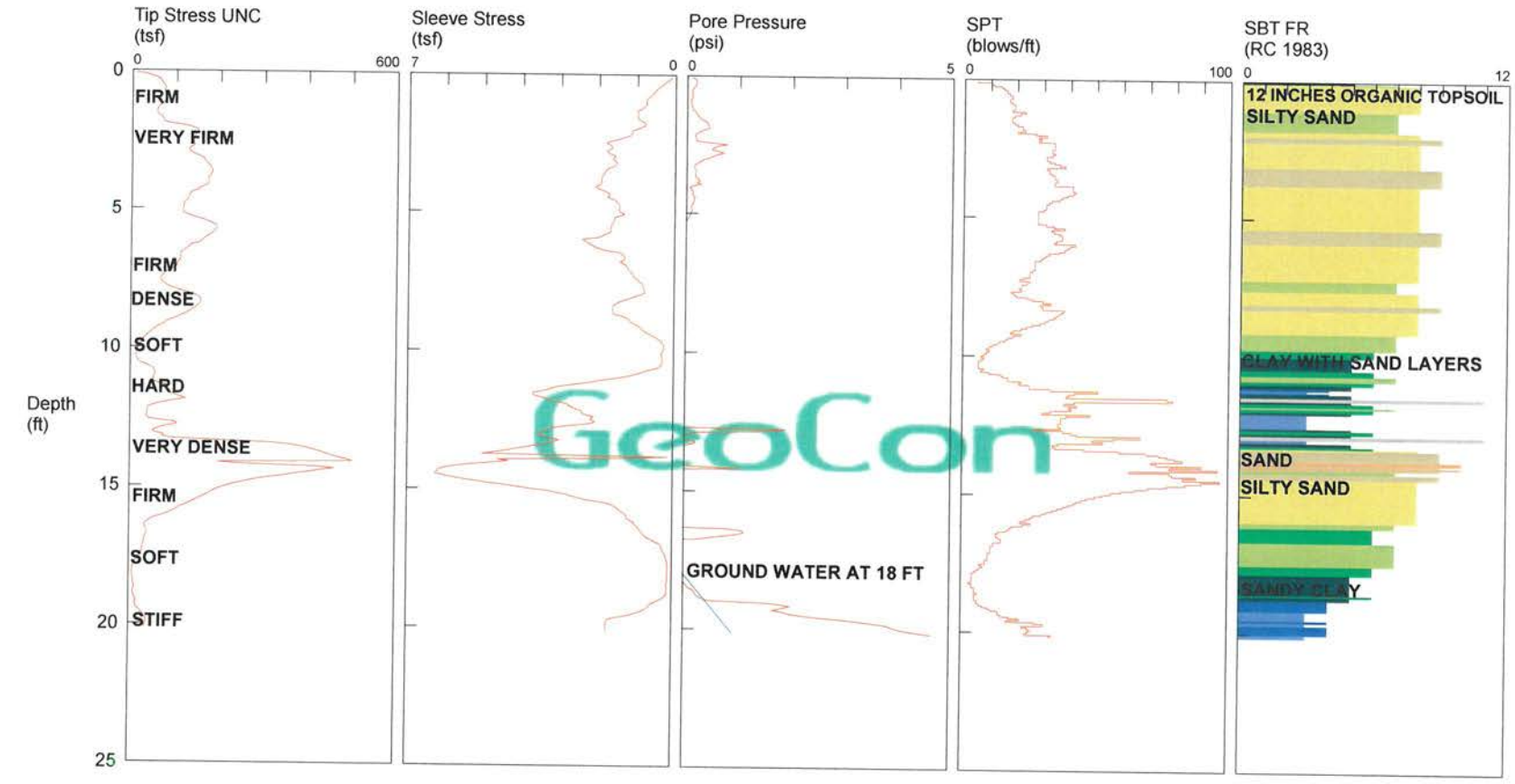
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-2

CPT Testing Done By: GeoCon
Proposed: Phase II to the Gulf Shores Water Reclamation Facility
CUSTOMER: City of Gulf Shores
LOCATION: Gulf Shores, AL
HOLE NUMBER: C-2

JOB NUMBER: DL 2456-20
TEST DATE: 11/19/2020
OPERATOR: Chris Rea



GeoCon

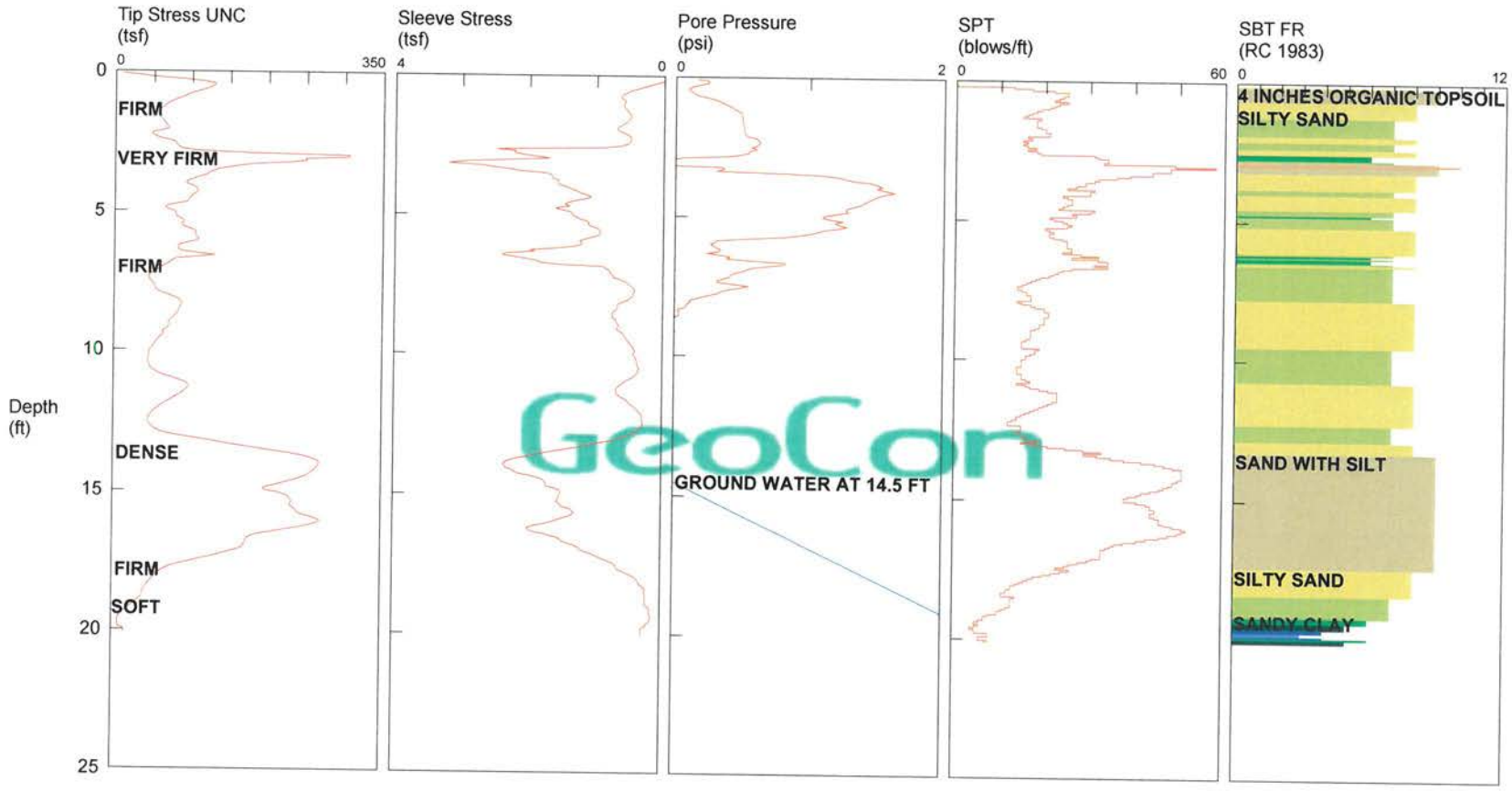
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-3

CPT Testing Done By: GeoCon
Proposed: Phase II to the Gulf Shores Water Reclamation Facility
CUSTOMER: City of Gulf Shores
LOCATION: Gulf Shores, AL
HOLE NUMBER: C-3

JOB NUMBER: DL 2456-20
TEST DATE: 11/19/2020
OPERATOR: Chris Rea



1 sensitive fine grained
2 organic material
3 clay
*SBT/SPT CORRELATION: UBC-1983

4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt

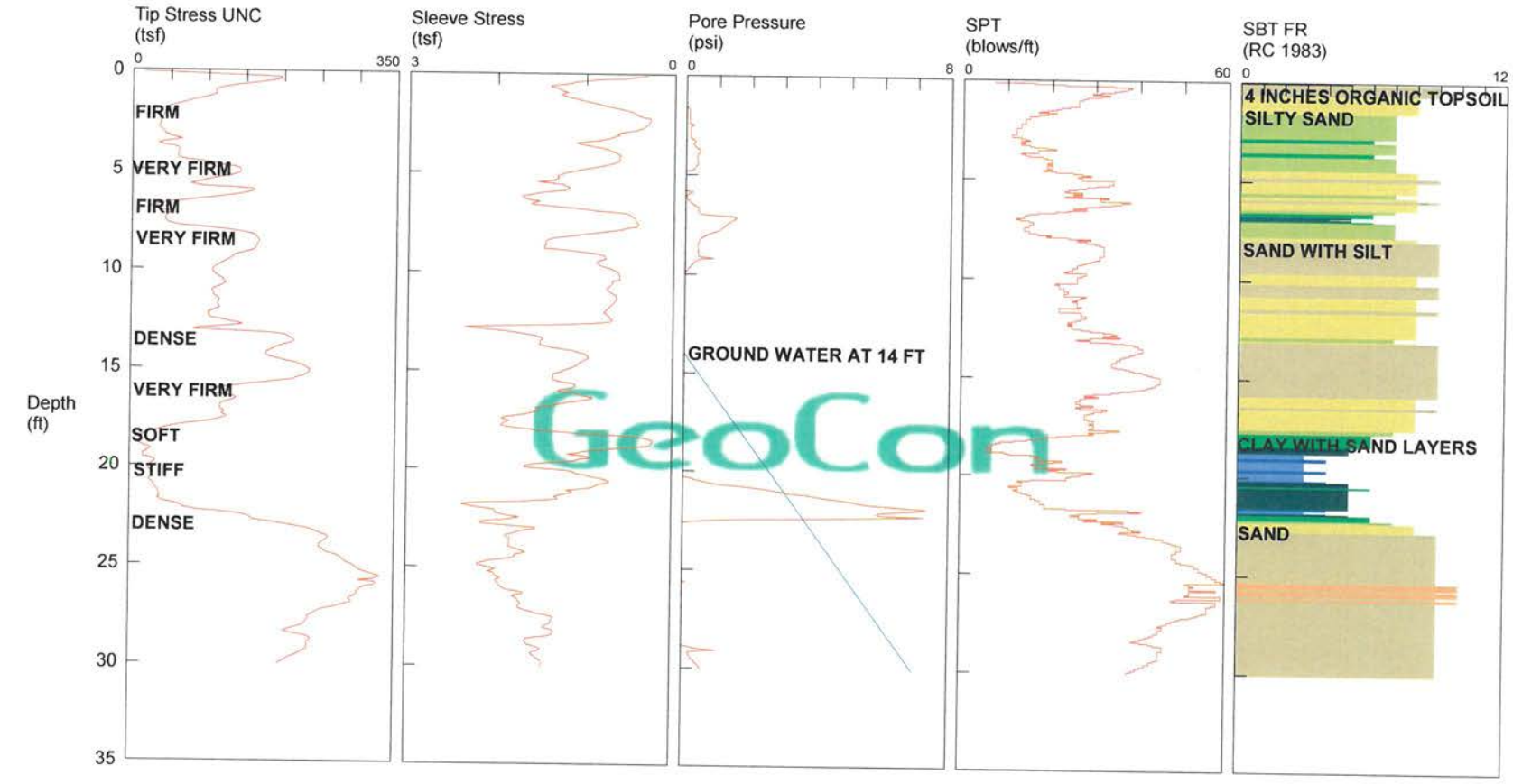
7 silty sand to sandy silt
8 sand to silty sand
9 sand

10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

C-4

CPT Testing Done By: GeoCon
Proposed: Phase II to the Gulf Shores Water Reclamation Facility
CUSTOMER: City of Gulf Shores
LOCATION: Gulf Shores, AL
HOLE NUMBER: C-4

JOB NUMBER: DL 2456-20
TEST DATE: 11/19/2020
OPERATOR: Chris Rea



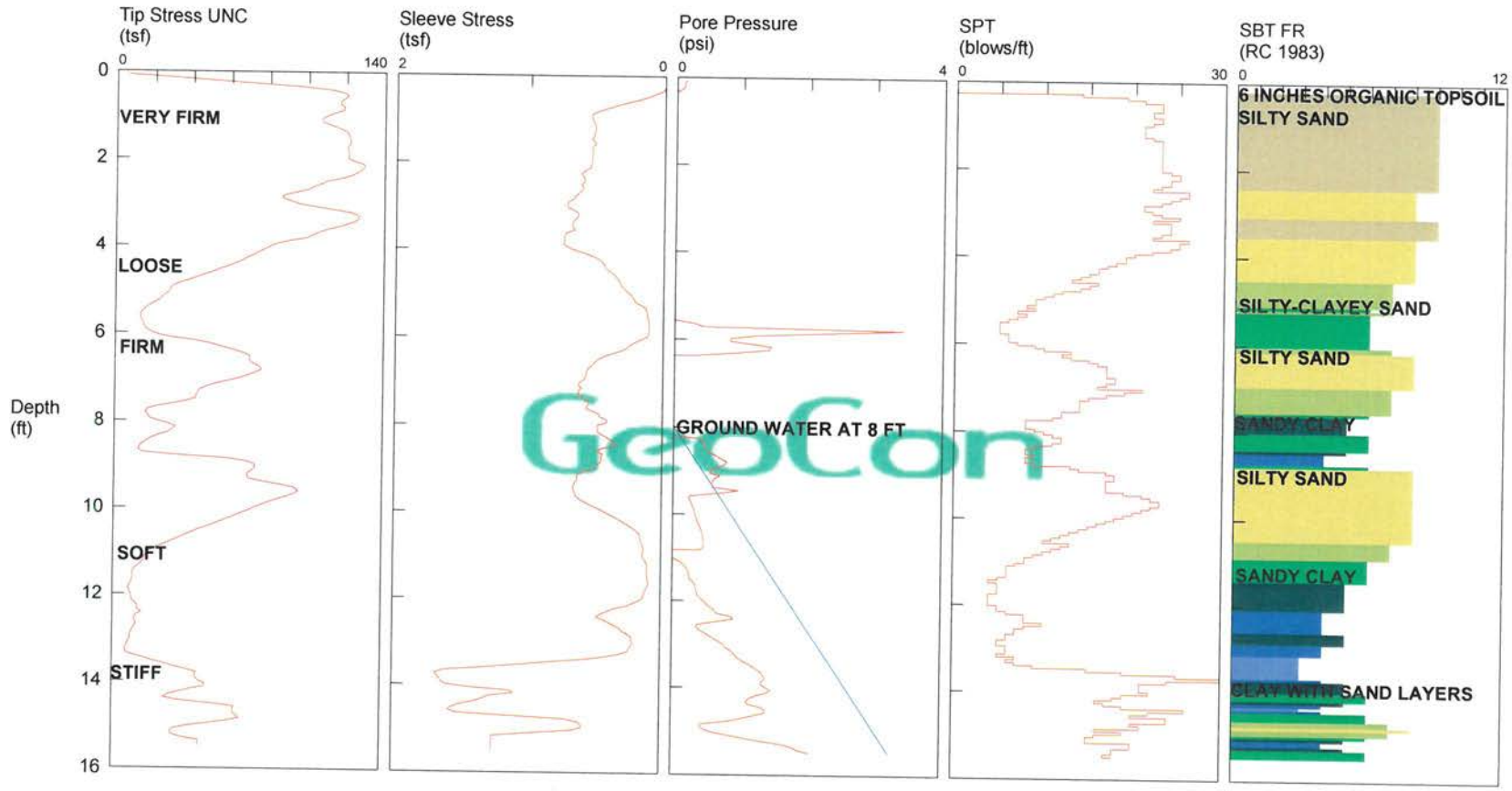
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-5

CPT Testing Done By: GeoCon
Proposed: Phase II to the Gulf Shores Water Reclamation Facility
CUSTOMER: City of Gulf Shores
LOCATION: Gulf Shores, AL
HOLE NUMBER: C-5

JOB NUMBER: DL 2456-20
TEST DATE: 11/19/2020
OPERATOR: Chris Rea



GeoCon

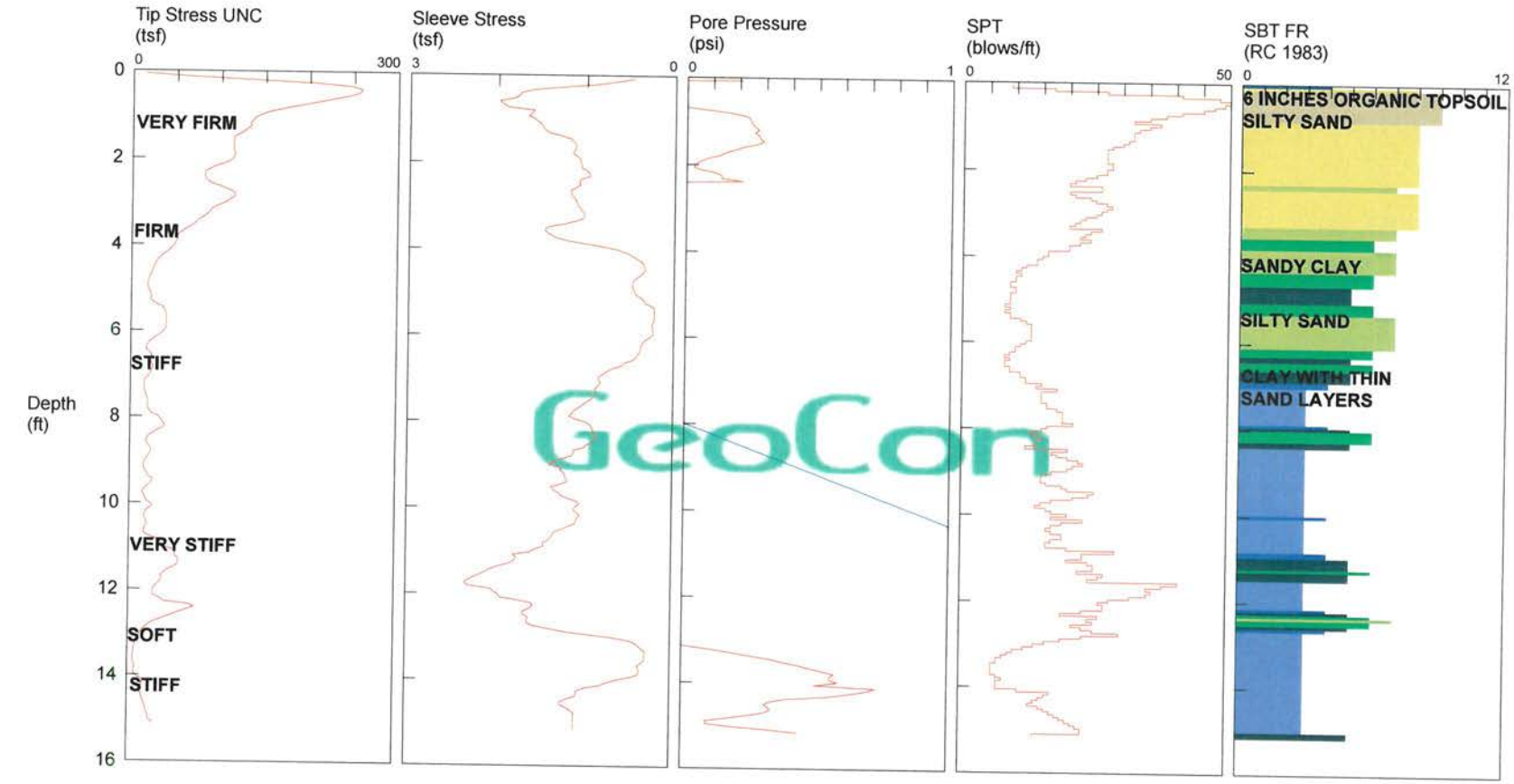
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-6

CPT Testing Done By: GeoCon
Proposed: Phase II to the Gulf Shores Water Reclamation Facility
CUSTOMER: City of Gulf Shores
LOCATION: Gulf Shores, AL
HOLE NUMBER: C-6

JOB NUMBER: DL 2456-20
TEST DATE: 11/19/2020
OPERATOR: Chris Rea



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

DRILL HOLE LOG
BORING NO.: B-1

PROJECT: Proposed Phase II to the Gulf Shores Water Reclamation Facility
CLIENT: City of Gulf Shores
LOCATION: Gulf Shores, AL
DRILLER: Chris Rea
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : AT COMPLETION ▼ :

PROJECT NO.: DL 2456-20
DATE: 11/19/2020
ELEVATION:
LOGGED BY: Jason Christian

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	STANDARD PENETRATION TEST N	STANDARD PENETRATION TEST CURVE (10 30 50)
0				12 Inches Organic Topsoil					
1			SM	Gray, Tan Silty Sand Innermixed with Orange Silty Sand Layers, Loose				7	●
2									
3									
4				Boring Terminated at 4 ft					
5									
6									
7									

"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG

BORING NO.: B-2

PROJECT: Proposed Phase II to the Gulf Shores Water Reclamation Facility
CLIENT: City of Gulf Shores
LOCATION: Gulf Shores, AL
DRILLER: Chris Rea
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : AT COMPLETION ▼ :

PROJECT NO.: DL 2456-20
DATE: 11/19/2020
ELEVATION:
LOGGED BY: Jason Christian

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	STANDARD PENETRATION TEST N	STANDARD PENETRATION TEST CURVE (10 30 50)
0				4 Inches Organic Topsoil					
1			SM	Dark Gray Silty Sand Innermixed with Clay Balls, Loose				9	
2									
3									
4				Boring Terminated at 4 ft					
5									
6									
7									

"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG
BORING NO.: B-3

PROJECT: Proposed Phase II to the Gulf Shores Water Reclamation Facility
CLIENT: City of Gulf Shores
LOCATION: Gulf Shores, AL
DRILLER: Chris Rea
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : AT COMPLETION ▼ :

PROJECT NO.: DL 2456-20
DATE: 11/19/2020
ELEVATION:
LOGGED BY: Jason Christian

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	STANDARD PENETRATION TEST N	STANDARD PENETRATION TEST CURVE (10 30 50)
0				4 Inches Organic Topsoil					
1			SM	Dark Gray Silty Sand, Loose				6	
2									
3									
4			SC	Light Gray, Tan Clayey Sand					
				Boring Terminated at 4 ft					
5									
6									
7									

"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG
BORING NO.: B-4

PROJECT: Proposed Phase II to the Gulf Shores Water Reclamation Facility
CLIENT: City of Gulf Shores
LOCATION: Gulf Shores, AL
DRILLER: Chris Rea
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : AT COMPLETION ▼ :

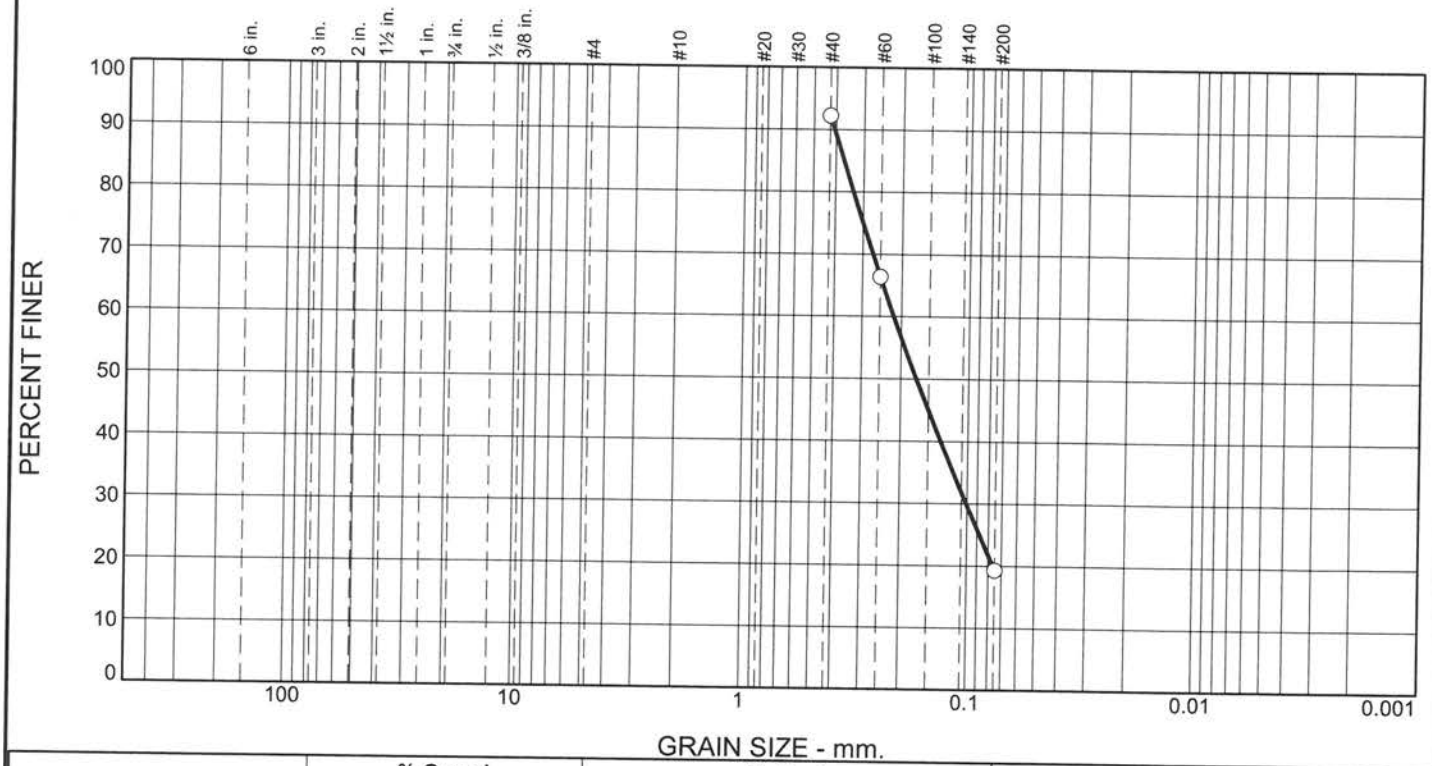
PROJECT NO.: DL 2456-20
DATE: 11/19/2020
ELEVATION:
LOGGED BY: Jason Christian

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	STANDARD PENETRATION TEST N	STANDARD PENETRATION TEST CURVE (10 30 50)
0				12 Inches Organic Topsoil					
1			SM	Dark Gray Silty Sand, Loose				7	
2									
3									
4				Boring Terminated at 4 ft					
5									
6									
7									

"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
					73.0	19.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#40	92.3		
#60	66.4		
#200	19.3		

* (no specification provided)

Material Description

Gray, Tan Silty Sand

Atterberg Limits (ASTM D 4318)

PL= 13 LL= 15 PI= 2

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 0.4063 D_{85}= 0.3677 D_{60}= 0.2166
D_{50}= 0.1706 D_{30}= 0.1009 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: _____ **Date Tested:** 11/23/2020

Tested By: JJ

Checked By: JJC

Title: _____

Location: Gulf Shores, AL
Sample Number: B-1 **Depth:** 2 ft **Date Sampled:**

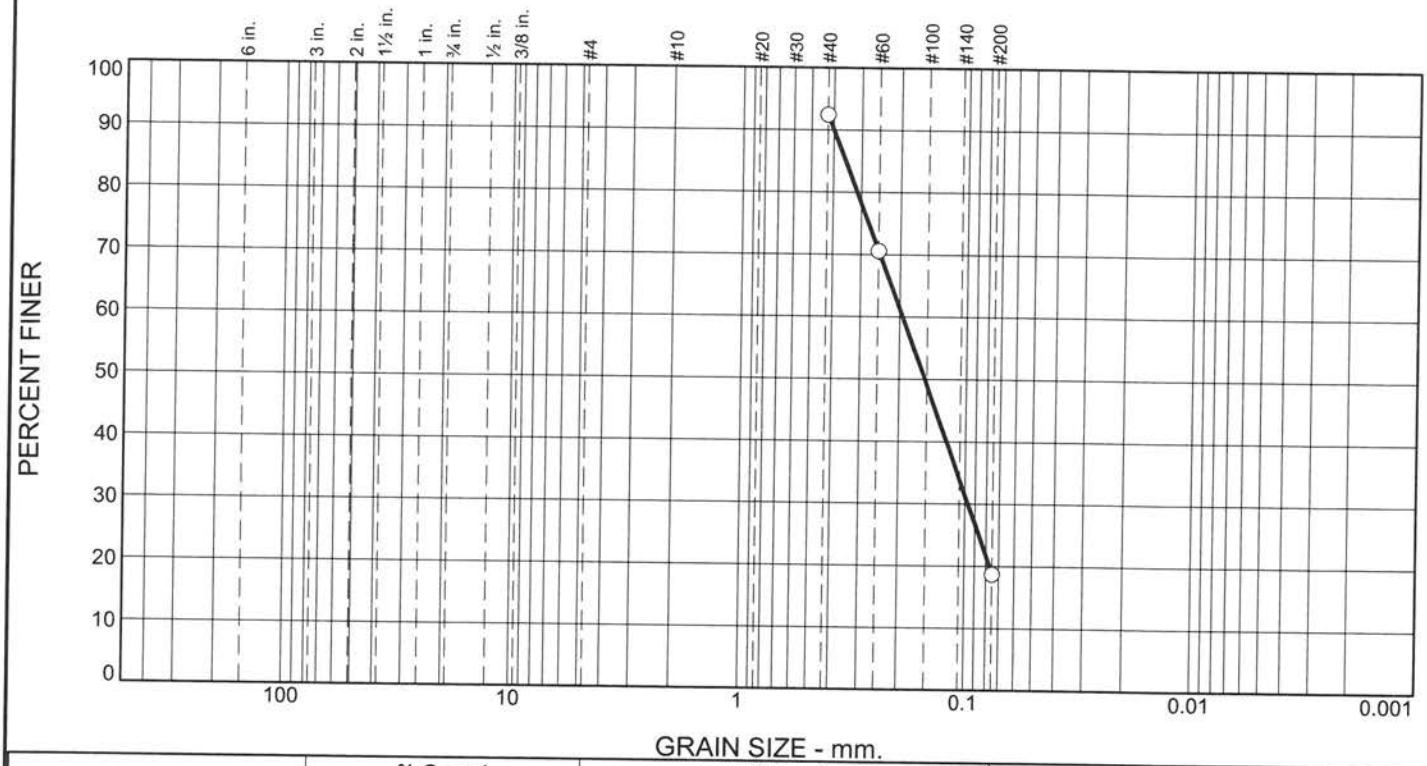
GeoCon

Robertsdale, Alabama

Client: City of Gulf Shores
Project: Proposed Phase II to the Gulf Shores Water Reclamation Facility

Project No: DL 2456-20 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
					73.8	18.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#40	92.5		
#60	70.6		
#200	18.7		

* (no specification provided)

Material Description

Dark Gray Silty Sand

Atterberg Limits (ASTM D 4318)

PL= 13 LL= 13 PI= 0

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 0.4002 D_{85}= 0.3541 D_{60}= 0.1943
D_{50}= 0.1538 D_{30}= 0.0970 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: _____ **Date Tested:** 11/23/2020

Tested By: JJ

Checked By: JJC

Title: _____

Location: Gulf Shores, AL
Sample Number: B-2 **Depth:** 4 ft **Date Sampled:**

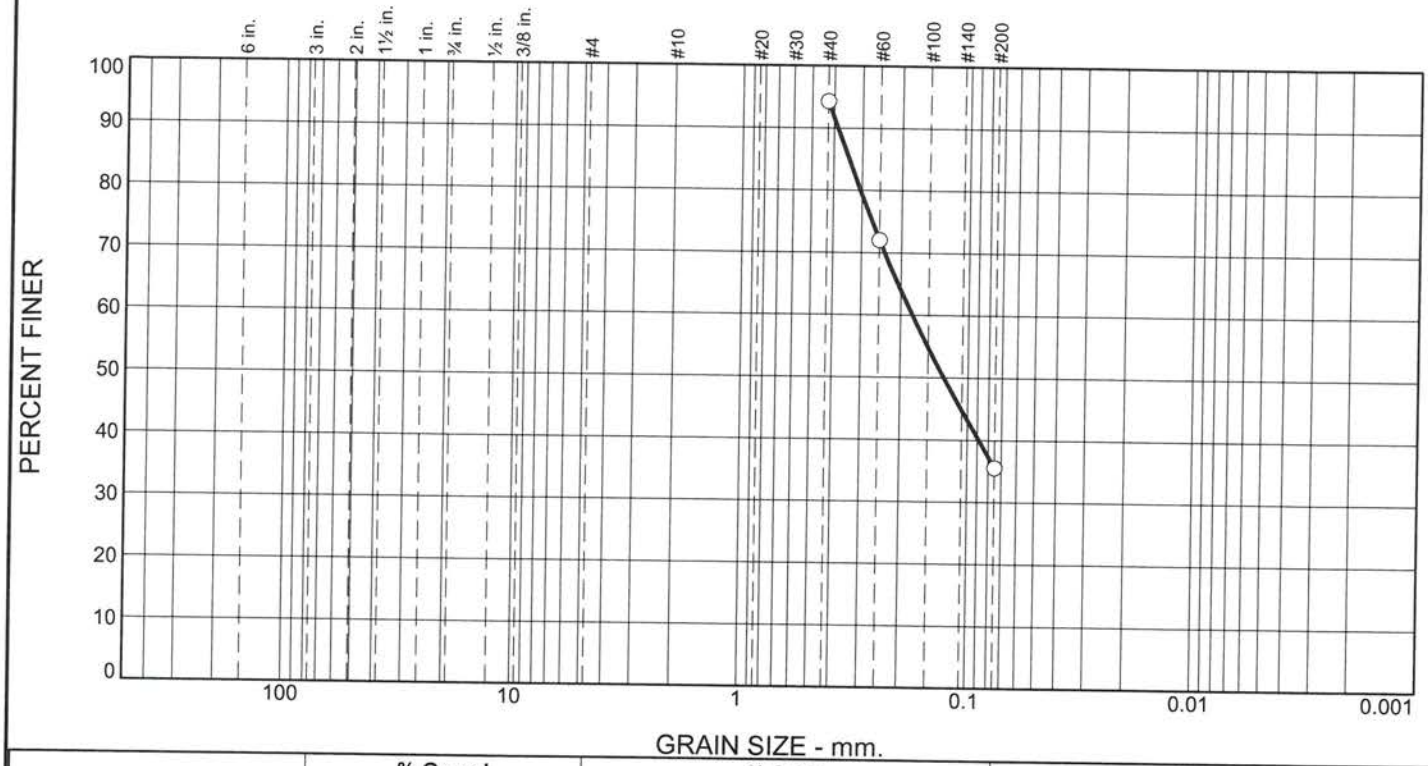
GeoCon

Robertsdale, Alabama

Client: City of Gulf Shores
Project: Proposed Phase II to the Gulf Shores Water Reclamation Facility

Project No: DL 2456-20 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
					58.7	35.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#40	94.3		
#60	72.1		
#200	35.6		

* (no specification provided)

Material Description

Light Gray, Tan Clayey Sand

Atterberg Limits (ASTM D 4318)

PL= 19 LL= 29 PI= 10

Classification

USCS (D 2487)= SC AASHTO (M 145)=

Coefficients

D_{90}= 0.3853 D_{85}= 0.3431 D_{60}= 0.1776
D_{50}= 0.1278 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: _____ **Date Tested:** 11/23/2020

Tested By: JJ

Checked By: JJC

Title: _____

Location: Gulf Shores, AL
Sample Number: B-3 **Depth:** 3.5 ft **Date Sampled:**

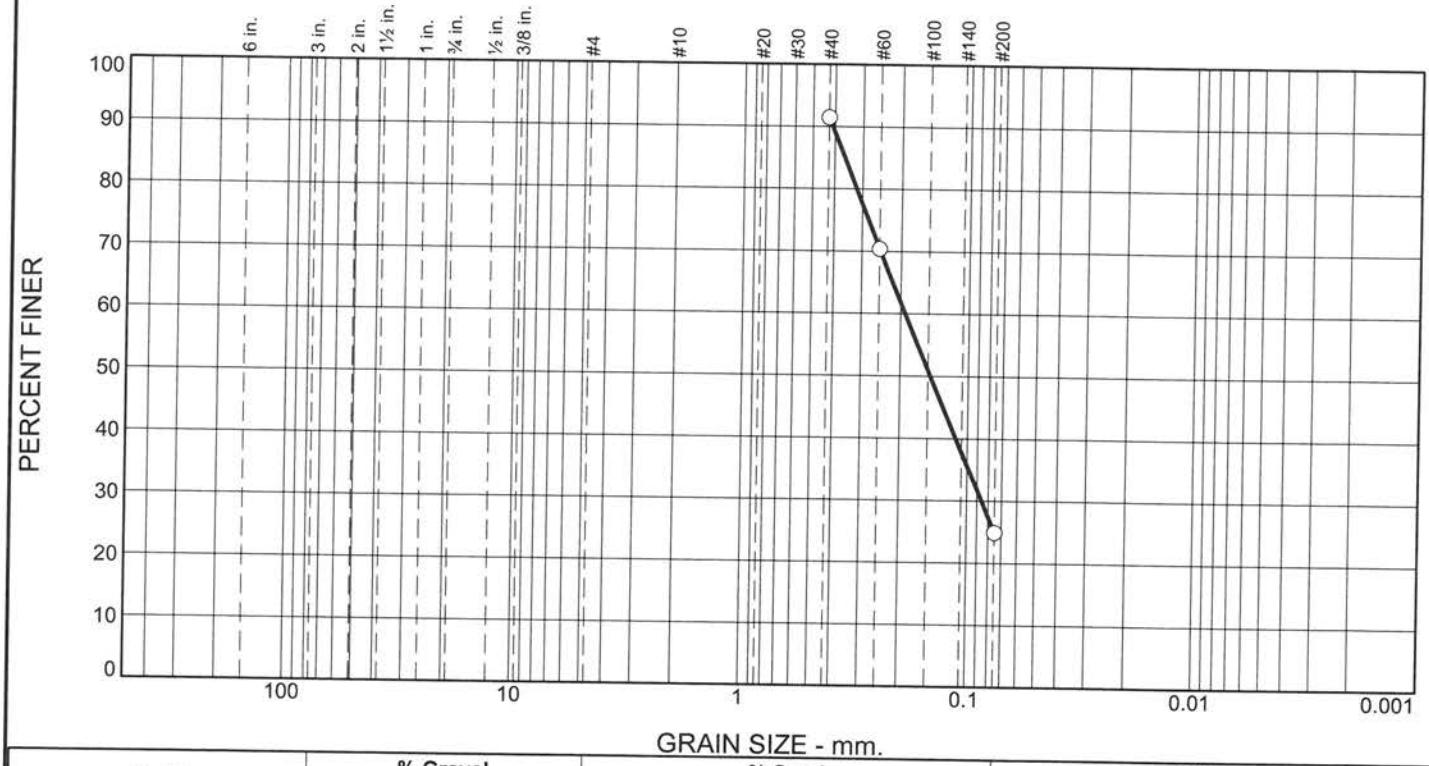
GeoCon

Robertsdale, Alabama

Client: City of Gulf Shores
Project: Proposed Phase II to the Gulf Shores Water Reclamation Facility

Project No: DL 2456-20 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
					66.6	24.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#40	91.5		
#60	70.4		
#200	24.9		

* (no specification provided)

Material Description

Dark Gray Silty Sand

Atterberg Limits (ASTM D 4318)

PL= 13 LL= 13 PI= 0

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 0.4095 D_{85}= 0.3614 D_{60}= 0.1912
D_{50}= 0.1469 D_{30}= 0.0860 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: _____ **Date Tested:** 11/23/2020

Tested By: JJ

Checked By: JJC

Title: _____

Location: Gulf Shores, AL
Sample Number: C-1 **Depth:** 4 ft **Date Sampled:**

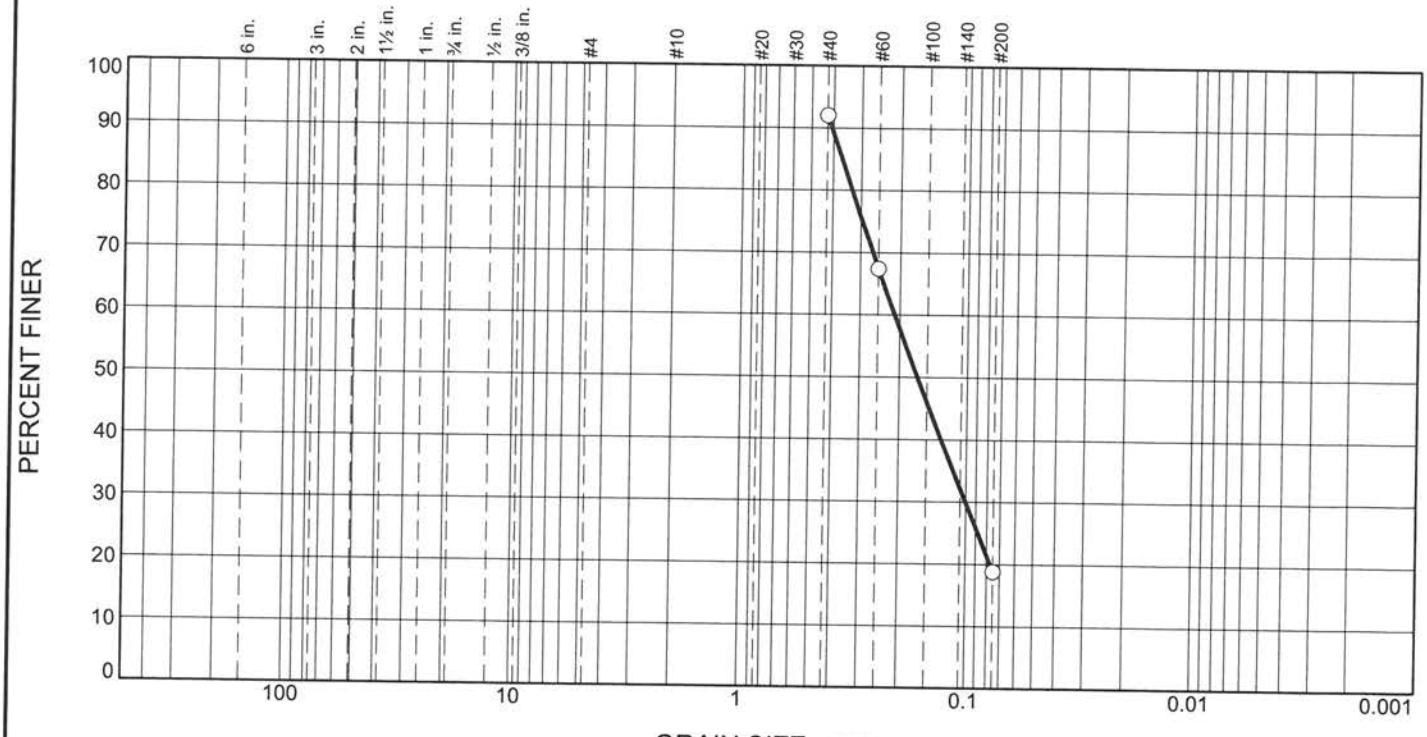
GeoCon

Robertsdale, Alabama

Client: City of Gulf Shores
Project: Proposed Phase II to the Gulf Shores Water Reclamation Facility

Project No: DL 2456-20 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
					73.2	18.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#40	92.0		
#60	67.4		
#200	18.8		

* (no specification provided)

Material Description

Gray, Tan Silty Sand

Atterberg Limits (ASTM D 4318)

PL= 13 LL= 13 PI= 0

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 0.4071 D_{85}= 0.3661 D_{60}= 0.2109
D_{50}= 0.1662 D_{30}= 0.1004 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 11/23/2020

Tested By: JJ

Checked By: JJC

Title:

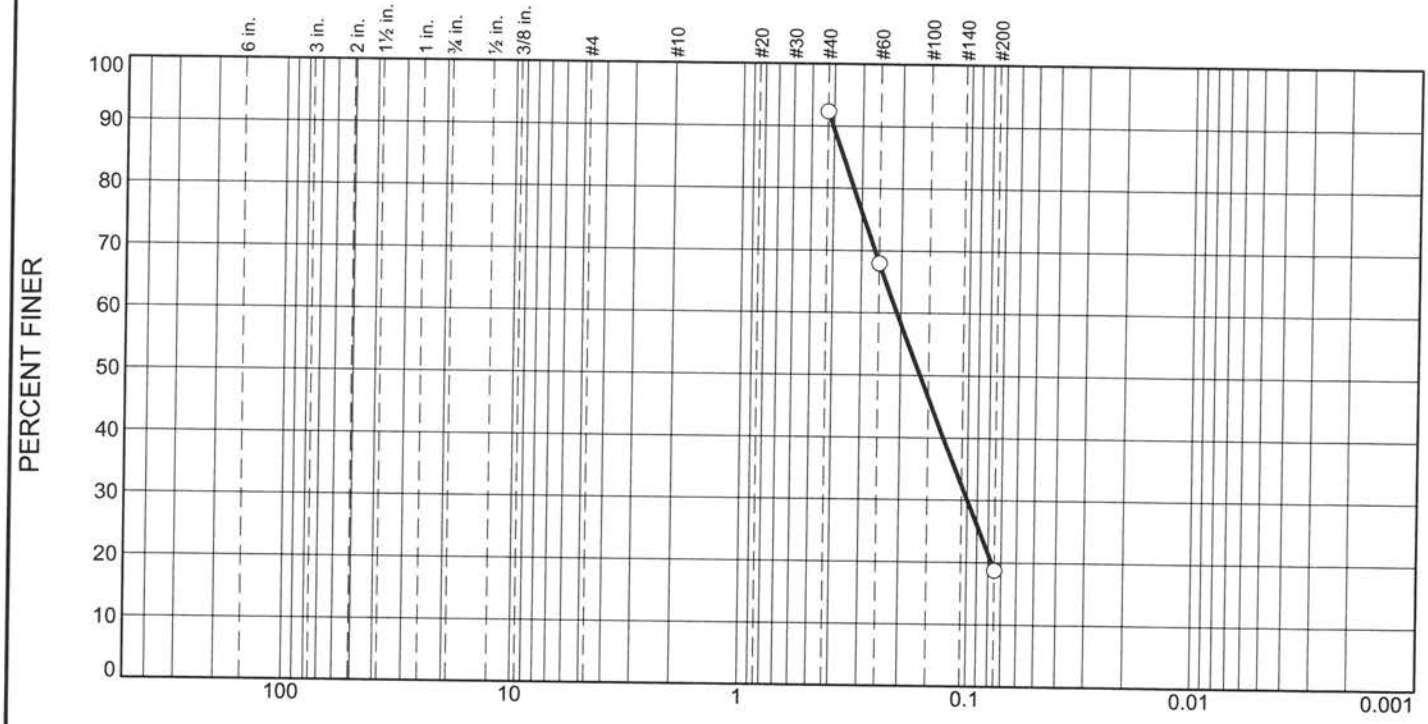
Location: Gulf Shores, AL
Sample Number: C-3 **Depth:** 2 ft **Date Sampled:**

GeoCon

Robertsdale, Alabama

Client: City of Gulf Shores
Project: Proposed Phase II to the Gulf Shores Water Reclamation Facility
Project No: DL 2456-20 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
					73.6	18.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#40	92.4		
#60	68.0		
#200	18.8		

* (no specification provided)

Material Description

Tan, Gray Silty Sand

Atterberg Limits (ASTM D 4318)

PL= 13 LL= 13 PI= 0

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 0.4041 D_{85}= 0.3630 D_{60}= 0.2082
D_{50}= 0.1642 D_{30}= 0.0998 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: _____ **Date Tested:** 11/23/2020

Tested By: JJ

Checked By: JJC

Title: _____

Location: Gulf Shores, AL
Sample Number: C-5 **Depth:** 2 ft

Date Sampled:

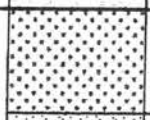
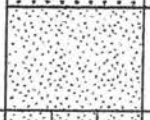
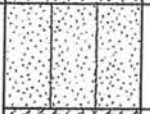
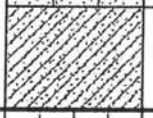
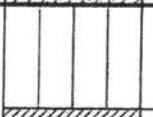
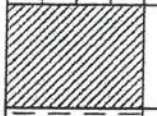
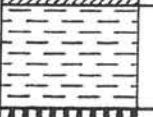
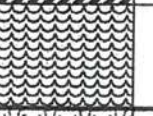
GeoCon

Robertsdale, Alabama

Client: City of Gulf Shores
Project: Proposed Phase II to the Gulf Shores Water Reclamation Facility

Project No: DL 2456-20 **Figure**

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

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Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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IIGER03135.0MRP

TERMS AND CONDITIONS

SERVICES TO BE PROVIDED. GeoCon Engineering & Material Testing, Inc. (hereinafter GeoCon) is an independent consultant and agrees to provide Client, for its sole benefit and exclusive use, consulting services set forth in our proposal.

PAYMENT TERMS. Client agrees to pay our Invoice upon receipt. If payment is not received within 30 days from the invoice date, Client agrees to pay a service charge on the past due amount at a rate of 1.5% per month, and GeoCon reserves the right to suspend all work until payment is received. No deduction shall be made from our invoice on account of liquidated damages or other sums withheld from payments to contractors or others.

TERMINATION. Either party may terminate this Agreement without cause upon 20 days advance notice in writing. In the event Client requests termination prior to completion of the proposed services, Client agrees to pay GeoCon for all costs incurred plus reasonable charges associated with termination of the work.

PROFESSIONAL LIABILITY. Notwithstanding any other provision of this Agreement, the Engineer's and GeoCon's total liability to the Owner for any loss or damages from claims arising out of or in connection with this Agreement from any cause including the Engineer's strict liability, breach of contract, or professional negligence, errors and omissions (whether claimed in tort, contract, strict liability, nuisance, by statute or otherwise) shall not exceed the lesser of the total contract price of this Agreement or the proceeds paid under Engineer's liability insurance in effect at the time such claims are made. The Owner hereby releases the Engineer from any liability exceeding such amount. In no event shall either party to this Agreement be liable to the other for special, indirect, incidental or consequential damages, whether or not such damages were foreseeable at the time of the commencement of the work under this Agreement.

SITE OPERATIONS. Client will arrange for right-of-entry to all applicable properties for the purpose of performing studies, tests and evaluations pursuant to the agreed services. Client represents that it possesses necessary permits and licenses required for its activities at the site.

OWNERSHIP AND USE OF PROJECT DOCUMENTS. All documents are instruments of service in respect to the Services, and Engineer shall retain an ownership and proprietary property interest therein {including the right of reuse at the discretion of the Engineer) whether or not the Services are completed. Client may make and retain copies of documents for information and reference in connection with the services by Client. Such documents are not intended or represented to be suitable for reuse by Client or others on extensions of the services or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the spedfic purpose intended, will be at Client's sole risk and without liability or legal exposure to Engineer or to Engineer's consultants. Client shall indemnify and hold harmless Engineer and Engineer's consultants from all claims, damages, and expenses including attorneys' fees arising out of or resulting therefrom.

ADDITIONAL SERVICES OF CONSULTANT. If authorized in writing by the Client, GeoCon shall furnish additional services that are not considered as an integral part of the Scope of Services outlined in the Proposal Acceptance Sheet. Under this Agreement, all costs for additional services will be negotiated as to activities and compensation. In addition, it is possible that unforeseen conditions may be encountered that could substantially alter the original scope of services. If this occurs, GeoCon will promptly notify and consult with Client and any additional services will be negotiated.

ASSIGNABI LITY, GeoCon shall not assign any interest on this Agreement, and shall not transfer any interest in the same (whether by assignment or novation), without the prior written consent of the Client; provided, however, that claims for money by GeoCon against Client under this Agreement may be assigned to a bank, trust company, or other financial institution without such approval. Written notice of any such assignment or transfer shall be promptly furnished to the Client.

SERVICES TO BE CONFIDENTIAL. All services, including opinions, designs, drawings, plans, specifications, reports and other services and information, to be furnished by GeoCon under this Agreement are confidential and shall not be divulged, in whole or in part, to any person, other than to duly authorized representatives of the client, without prior written approval of the Client, except by testimony under oath in a judicial proceeding or as otherwise required by law. GeoCon shall take all necessary steps to ensure that no member of its organization divulges any such information except as may be required by law.

CLAIMS. The parties agree to attempt to resolve any dispute without resort to litigation. However, in the event a claim is made that results in litigation, and the claimant does not prevail at trial, then the claimant shall pay all costs incurred in defending the claim, including reasonable attorney's fees. The claim will be considered proven if the judgment obtained and retained through any applicable appeal is at least ten percent greater than the sum offered to resolve the matter prior to the commencement of trial.

SEVERABILITY. It is understood and agreed by the parties hereto, that if any part, term or provision of this Agreement is held by any court of competent jurisdiction to be illegal or in conflict with any applicable law, the validity of the remaining portion or portions of this Agreement shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Agreement did not contain the particular part, term or provision held to be invalid.

SURVIVAL. All obligations arising prior to the termination of this Agreement and all provisions of this Agreement allocating responsibility or liability between Client and GEOCON shall survive the completion of the services and the termination of this Agreement.

INTEGRATION. This Agreement, the attached documents and those incorporated herein constitute the entire Agreement between the parties and cannot be changed except by a written instrument signed by both parties.

GOVERNING LAW. This Agreement shall be governed in all respects by the laws of the State of Alabama and venue shall be in Baldwin County, Alabama.