

Addendum Acknowledgement Form

Project	Rock Cut Road Transfer Station Sanitary/Leachate System Rehabilitation	Project No.	11123638
Owner	Onondaga County Resource Recovery Agency	Date	August 14, 2019
Contract No.	5		

The undersigned hereby acknowledges receipt of the following Addenda (if any) for the Rock Cut Road Transfer Station Sanitary/Leachate System Rehabilitation detailed above. This form shall be completed for each Addendum and the form e-mailed to Christine Latham at <u>clatham@ocrra.org</u>.

	Addendum No.	<u>Date</u>
Contractor		
Signature		
Title		
Date		



Addendum No. 1 to Contract Documents

Project	Rock Cut Road Transfer Station Sanitary/Leachate System Rehabilitation	Project No.	11123638
Owner	Onondaga County Resource Recovery Agency	Date	August 14, 2019
Contract No.	5		

To All Contractors:

Contractors submitting proposals for the above-named project shall take note of the following changes, additions, deletions, clarifications, etc., in the Contract Documents, which shall become a part of and have precedence over anything contrarily shown or described in the Contract Documents, and all such shall be taken into consideration and be included in the Contractor's Bid Proposal.

(Please see attached pages.)

The return receipt requested with this communication is to be deemed evidence that the bidder has received this addendum and has followed the instructions outlined therein.



A 24

Jeffrey H. Heath, P.E.



Addendum No. 1 to Contract Documents

Rock Cut Road Transfer Station Sanitary/Leachate System Rehabilitation Onondaga County Resource Recovery Agency Contract No. 5 GHD Project No. 11123638 August 14, 2019

Item No. 1:

Bid Form. <u>**DELETE</u>** Bid Form pages 00410-1 through 00410-6 and <u>**REPLACE**</u> with attached Bid Form (Attachment No. 1). (See Clarification Item No. 9 below for an explanation related to Bid Item B-1.)</u>

Item No. 2:

Section 02741, Pressure Test of Force Mains. **DELETE** this section from the Contract Documents.

Item No. 3:

Section 11310, Submersible Pumps. <u>**REMOVE**</u> existing Section 11310 from the Contract Documents and <u>**REPLACE**</u> with the attached Section 11310 (Attachment No. 2).

Item No. 4:

Section 16055, Electrical Work. ADD attached Section 16055 (Attachment No. 3) to the Contract Documents.

Item No. 5:

Contract Drawings, Sheet G001. <u>DELETE</u> existing Sheet G001 and <u>REPLACE</u> with attached Sheet G001 (Attachment No. 4).

Item No. 6:

Contract Drawings, Sheet E001. In the title block, <u>DELETE</u> "Contract No. 2" and <u>REPLACE</u> with "Contract No. 5."

Item No. 7:

Contract Drawings, Sheets E002, E003, E004, and E005. <u>DELETE</u> the listed drawings and <u>REPLACE</u> with attached Sheets E002 (Attachment No. 5), E003 (Attachment No. 6), E004 (Attachment No. 7), and E005 (Attachment No. 8).

ON REQUESTS FOR INFORMATION (RFI)

Item No. 8:

RFI: Regarding cost estimate/budget.

Response – OCRRA has estimated the total budget for the project at \$150,000 to \$225,000.

Item No. 9:

RFI: Regarding removal of wastewater, Bid Item B-1.

Response – The Contractor will be paid for water used to pressure wash the piping. That being said, the Contractor shall only use the volume of water required to properly clean the piping. To better account for anticipated pressure wash water volume, the quantity under unit price Bid Item B-1 has been increased to



Addendum No. 1 to Contract Documents

Rock Cut Road Transfer Station Sanitary/Leachate System Rehabilitation Onondaga County Resource Recovery Agency Contract No. 5 GHD Project No. 11123638 August 14, 2019

15,000 gallons. If the bidder anticipates the total volume of debris to be disposed of is more than 15,000 gallons, the anticipated volume shall be indicated on the Bid Form so the Owner can take this into consideration. The bid price shall be based on the original estimated quantity.

Item No. 10:

RFI: Regarding pressure testing of force mains, Section 02741, Pressure Testing of Force Mains.

Response – Pressure testing of force mains will not be required for this project.

Item No. 11:

RFI: Regarding bypass pumping, Section 02769, Bypass Pumping.

Response – The schedule of work under the existing contracts may be extended, which would delay the beginning of full operations at the transfer station. As a result, the Contractor will not be required to monitor the system continuously outside of normal working hours.

Item No. 12:

RFI: Regarding Division 16 electrical specifications.

Response – Section 16055, Electrical Work, is being included in the Contract Documents (Attachment No. 3).

Item No. 13:

RFI: Regarding pipe diameter of floor drain piping.

Response - This information can be found on attached Drawing G001 (Attachment No. 4).

Item No. 14:

RFI: Regarding sequence and coordination of work.

Response – In reference to Note 12 on Contract Drawing C001 and as stated in Article 7 of the Supplementary Conditions, the Owner has issued four contracts for work at the Rock Cut Road Transfer Station. That work is currently scheduled to be substantially complete by the end of October 2019. However, the schedule may be extended. In addition, ongoing equipment maintenance operations are performed in the lower sections of Buildings 1 and 2. Night work will not be required and the Owner will work with the Contractor to coordinate ongoing operations with the sequence of work.

CONTRACTOR'S BID FOR CONSTRUCTION OF CONTRACT NO. 5 SANITARY/LEACHATE SYSTEM REHABILITATION ROCK CUT ROAD TRANSFER STATION ONONDAGA COUNTY RESOURCE RECOVERY AGENCY 5808 ROCK CUT ROAD, JAMESVILLE, NY 13078

ARTICLE 1 - BID RECIPIENT

1.01. THIS BID IS SUBMITTED TO:

Onondaga County Resource Recovery Agency 100 Elwood Davis Road North Syracuse, NY 13212-4312 Attn: Cristina Albunio, P.E., Agency Engineer

Bids must be received via mail or hand delivered in sealed envelopes to OCRRA at the above address, and be clearly labeled "SANITARY/LEACHATE SYSTEM REHABILITATION ROCK CUT ROAD TRANSFER STATION."

The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

1.02. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 2 - BIDDER'S REPRESENTATIONS

A. Bidder has examined and carefully studied the Bidding Documents, other related data identified in the Bidding Documents, and the following Addenda, receipt of all which is hereby acknowledged:

Addendum No.	Addendum Date

- B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

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- D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) that have been identified in SC-4.02 as containing reliable "technical data", and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in SC-4.06 as
- E. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs.
- F. Based on the information and observations referred to in Paragraph 3.01.E above, Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

ARTICLE 3 - BIDDER'S CERTIFICATION

- 3.01. Bidder certifies that:
 - A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
 - B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
 - C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
 - D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Article:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

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- 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
- 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
- 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.
- 3.02. Bidder will perform the Work in accordance with the Contract Documents for the prices shown in the Bid Schedules that follow.
- 3.03. Bidder acknowledges that Bidder's price(s) constitute Bidder's sole compensation for performing all portions of the Work assigned to the specific Contractor required by the Contract Documents, and if a particular part of the Work is not listed specifically in the Bid Item Descriptions, Bidder has included that part of the Work in the Bid Item Description which it most logically belongs.

CONTRACT NO. 5

A. Schedule A: Lump Sum Bid Items: Lump sum items include all Work in the Contract Documents except items specifically identified as Unit Price Work.

Item No.	Description	Total Price	
A-1	General Construction	\$	
Subtotal (Ite	em A-1)	\$	

- B. Schedule B: Unit Price Work: Measurement and payment of Unit Price Work is defined in Section 01025, Unit Price Items.
 - 1. Unit Prices have been computed in accordance with General Conditions Article 11.03.B.
 - 2. Bidders acknowledge that estimated quantities are not guaranteed, and are solely for the purposes of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

Item No.	Description	Unit	Estimated Quantity	Unit Price	Bid Price
B-1	Removal of Debris	Gallons	15,000	\$	\$
B-2	Cleaning of Pipelines	Linear Feet	1,220	\$	\$
Subtotal (Sum of Items B-1 and B-2)					

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- C. Schedule C: Total Bid Price:
 - 1. Determination of the apparent low Bidder shall be based on the Total Bid Price determined as follows.
 - 2. All mathematical errors will be corrected. In case of a discrepancy between unit prices bid and extended totals, unit prices will govern. In case of discrepancy between the correct sum of individual bid items and the (incorrectly) calculated sum, the correct sum of individual bid items will govern.

Item No.	Total Price
Schedule A Total (Lump Sum Bid Items)	\$
Schedule B Total (Unit Price Work)	\$
TOTAL BID PRICE - CONTRACT NO. 5	\$

TOTAL BID PRICE, CONTRACT NO. 5 (in words)

ARTICLE 4 - NOT USED

ARTICLE 5 - TIME OF COMPLETION

- 5.01. Bidder agrees that the Work will be substantially completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 5.02. Bidder agrees that the Work will be substantially complete within 75 calendar days after the date that the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within 15 calendar days after the date when the Contract Times commence to run.
- 5.03. Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 6 - ATTACHMENTS TO THIS BID

- 6.01. The following documents are submitted with and made a condition of this Bid:
 - A. Required Bid Security in the form of a Bid Bond
 - B. Statement of Surety's Intent

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- C. **Bidder's Qualification Statement**
- D. List of Proposed Subcontractors
- E. Contractor's License No.: or Evidence of Bidder's Ability to Obtain a State Contractor's License
- F. Certificate of Non-Collusion
- G. **Resolution Accompanying Bid**
- Η. Conflict of Interest Affidavit
- I. Important State Finance Law Procurement Compliance Provisions
- J. Disclosure to OCRRA During Procurement Process of Prior Non-Responsibility **Determinations**

ARTICLE 7 - DEFINED TERMS

7.01. The terms used in this Bid with initial capital letters have the meanings indicated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 8 - BID SUBMITTAL

This Bid is submitted by:

If Bidder is:

An Individual Name (typed or printed):

Ву_____

(Individual's Name)

Doing business as:

A	P	a	rtr	ne	rs	sł	ni	р	

Partnership Name: _____ (SEAL)

Ву___

(Signature of general partner--attach evidence of authority to sign)

Name (typed or printed): _____

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<u>A Corporation</u> Corporation Name:			(SEAL)
State of Incorporation:			
Type (General Business, Professior	nal, Service, Lir	mited Liability):	
By		to oign)	
(Signatureattach evider	ice of authority	to sign)	
Name (typed or printed):			
Title:			
Attest: (Signature of Corpo	orate Secretary)	(CORPORATE SEAL)
Date of Qualification to do business	in State where	Project is located	d is:
<u>A Joint Venture</u> Name of Joint Venture:			
First Joint Venturer Name:			(SEAL)
By (Signature of joint venturer partr	herattach evid	lence of authority	to sign)
Name (typed or printed):			
Second Joint Venturer Name:			(SEAL)
Ву			
(Signatureattach evidence of a	authority to sigr	n)	
Name (typed or printed): Title:			
(Each joint venturer must sign. The that is a party to the joint venture sh	manner of sigr ould be in the r	ning for each indiv manner indicated	vidual, partnership and corporation above.)
Bidder's Business Address			
Phone No	Fax No		Email
SUBMITTED on	, 20		
State Contractor License No.		(if applicable)	
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SECTION 11310

SUBMERSIBLE PUMPS

PART 1 GENERAL

1.01. DESCRIPTION OF WORK

A. Furnish, install, and test submersible pumps in the Building No. 1 Pump Station and in the Holding Tank Pump Station complete with motors, pump discharge flanges, guide rails, brackets, control panels, wiring, accessories, spare parts, manufacturer's services, and all other required appurtenances in accordance with the Contract Documents.

1.02. RELATED SECTIONS

- A. Division 1 Specifications
- B. Division 2 Specifications
- C. Section 11300 PUMPING EQUIPMENT-GENERAL
- D. Division 15 Specifications.

1.03. REFERENCES

- A. American National Standards Institute (ANSI).
- B. Hydraulic Institute Standards, latest edition.
- 1.04. PERFORMANCE REQUIREMENTS
 - A. Submersible pumps shall be capable of pumping liquid with 0 to 3 percent solids without clogging.
 - B. All equipment and appurtenances installed in the wet well shall be rated for use in NEC Class I, Division 1, Groups C and D hazardous locations.
 - C. Submersible pumps shall be capable of continuous stable operation under the following conditions:

Pump Parameters	Building No. 01 Pump Station	Holding Tank Pump Station
Quantity	2	2
Impeller size	6.75 inches	6.75 inches
Drive type	Submersible	Submersible
Pumped liquid	Raw wastewater,	Raw wastewater,
	leachate	leachate
Primary design point (each unit)		
Rated flow	83 gpm	Replace in-kind
Total dynamic head	16 feet	Replace in-kind
Minimum shutoff head	19.4 feet	Replace in-kind
Minimum sphere passing size	3.0 inches	2.0 inches

1.05. SUBMITTALS

- A. Provide in accordance with Sections 01300, Submittals, and 01640, Equipment-General, and as supplemented herein. Submittals shall include, but not be limited to, the following:
 - 1. Shop Drawings
 - a. Operating characteristics and nameplate data.
 - b. Manufacturer's catalog information, descriptive literature, specifications, etc. for pumps, motors, and accessories.
 - c. Manufacturer's certified installation drawings containing all critical dimensions, piping connection sizes, weights, etc. required for installation of the equipment.
 - d. Certified pump curves.
 - e. Electrical schematics.
 - f. List of recommended spare parts other than those specified.
 - g. Motor information.
 - h. Control panel information.
 - i. Shop and field painting information.
 - j. Shop and field testing procedures, pump and piping set-up, equipment to be used and ANSI/HI testing tolerances to be followed.
 - k. Warranty.
 - 2. Performance affidavits.
 - 3. Shop test results.
 - 4. Manufacturer's installation certificate.
 - 5. Certification of equipment compliance.
 - 6. Functional Test Reports.
 - 7. Training Plans.
 - 8. Recordings of training sessions (to be completed by and coordinated with the Contractor).
 - 9. Written training reports.
- B. Provide operation and maintenance manuals and data where scheduled in Section 01640, Equipment-General.

1.06. SPARE PARTS

- A. Furnish the following spare parts for each pump in accordance with the Section 01640, Equipment–General, in clearly identified dust-proof containers:
 - 1. One set of bearings.
 - 2. One set of mechanical seals.
 - 3. One impeller bolt and wear rings.
 - 4. One seal fail relay and relay socket.
 - 5. One set of all attachment hardware complete with all gaskets and O-rings.

1.07. EQUIPMENT WARRANTIES AND SPECIAL GUARANTEES

- A. The supplier shall provide the following warranties and special guarantees in accordance with Section 01640, Equipment-General.
 - 1. The equipment manufacturer shall guarantee for a period of three years starting at the time of equipment delivery to the job site or one year starting at the time of Substantial Completion (whichever is shorter), 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. MANUFACTURERS

- A. Building No. 01 Pump Station.
 - 1. Hydromatic/Pentair S4-NVX200.
 - 2. Or Engineer-approved equal.
- B. Holding Tank Pump Station (Replacement in-kind).
 - 1. Hydromatic/Pentair NPGH500JD

2.02. OR EQUAL AND SUBSTITUTIONS

- A. In the case of an "or-equal" or a substitution, demonstrate in writing, to the satisfaction of Owner that the manufacturer has produced the specified type and size of equipment for sanitary wastewater service that has been in successful operation for a minimum period of five years prior to the Bid date.
- B. Submit information for an "or-equal" or substitution as outlined in the General Conditions and Supplementary Conditions.

2.03. EQUIPMENT DESIGN – BUILDING NO. 1 PUMP STATION

A. General

- 1. Pumps shall be wet pit mounted, submersible, non-clogging with vertical mounted, direct-connected motors and bottom inlet.
- 2. All major components of the pumping unit (including impeller, volute casing and stator housing) shall be manufactured from ASTM A48 Class 30 or 40 gray cast iron with smooth surfaces devoid of blow holes or other irregularities.
- 3. All exposed nuts and bolts shall be AISI Type 316 stainless steel.
- 4. All metal surfaces coming into contact with the pumped liquid, except for stainless steel and brass materials, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish.
- 5. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O ring contact on four sides without a specific torque limit requirement.
- B. Pump Volute Casing
 - 1. Casing shall be constructed of close-grained cast iron and shall be designed to withstand hydrostatic heads equal to 1.5 times the maximum shutoff head without leakage or undue distortion or deflection.
 - 2. The discharge connection shall match the discharge hose or base elbow for the pump assembly.

C. Impeller

- 1. Impeller shall be grey cast iron, multi-vane, recessed solids handling design and have pump-out vanes on the backside of the impeller to prevent grit and other materials collecting in the seal area. Impellers shall be dynamically balanced and capable of handling solids, scum, fibrous materials, heavy sludge, and other matter normally found in wastewater.
- D. Pump Shaft
 - 1. The shaft shall be machined from a solid 416 stainless steel forging.
 - 2. The pump shaft shall be an extension of the motor shaft. Shafts using mechanical couplings will not be acceptable.
- E. Mechanical Seals
 - 1. The pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals.
 - 2. The lower seal shall be replaced without disassembly of the seal chamber and without the use of special tools.

- 3. Pump-out vanes shall be present on the backside of the impeller to keep contaminates out of the seal area.
- F. Bearings
 - 1. An upper radial bearing and a lower thrust bearing shall be required. The bearings shall be heavy-duty single row ball bearings that are permanently lubricated by the dielectric oil that fills the motor housing.
 - 2. Bearings shall be sized to carry the loads imposed under continuous service without undue heating.
 - 3. Motor bearings shall be sealed and permanently lubricated.
 - 4. Minimum B-10 life for bearings shall be 50,000 hours at maximum operating conditions.

2.04. ACCESSORIES

- A. Power Cable
 - 1. Power cable, moisture detection sensor cable, and motor thermal overload sensor cable shall be attached together and protected by a common heavy-duty flexible protective hose. If separate instrumentation cables are required, they shall be shielded. The protective hose shall safeguard the power cable from abrasion and/or piercing objects in the liquid.
 - 2. Each pump shall be provided with a sufficient length of cable with the number and size of conductors required for the motor power leads and thermal switches to reach the junction box or manufacturer's control panel as shown on the Contract Drawings. Contractor shall field verify the required cable length prior to shop drawing submittal.
 - 3. Cable entry shall be watertight, with strain relief at the junction chamber. Strain relief and water sealing shall function separately.
- B. Moisture Detection
 - 1. Each pump shall be supplied with a leakage sensor for the detection of water in the oil casing or bottom of motor housing. Detection shall generate an alarm but shall not result in an immediate shut down of the pump.
 - 2. Pump manufacturer shall provide a sensor interface relay and compatible relay socket for each device.
- C. Discharge Assembly
 - 1. Pump manufacturer shall provide a discharge assembly. Discharge assemblies shall consist of a discharge connection claw and a discharge connection elbow.
 - 2. For pumps with a fixed base elbow discharge assembly, the pump shall be provided with a flat-faced discharge flange which shall connect to a permanently mounted discharge elbow by a simple downward motion, without rotation, guided by guide rails.

- a. The pump and discharge assembly shall be constructed so that when the pump is lowered to the discharge base/elbow, the knifing action of the vertical metal-to-metal seal provides a self-cleaning, non-sparking, explosion-proof assembly. An elastomeric profile gasket is also acceptable to prevent leakage.
- b. The discharge base/elbow shall be secured to the bottom of the wet well and support the guide rails for the pump. The base shall be sufficiently rigid to firmly support the guide rails, discharge piping, and pumping unit under all operating conditions. The diameter and drilling of the elbow outlet flange shall conform to ANSI B16.1, Class 125. The discharge base shall be coated with an epoxy coating to prevent corrosion.
- D. Pump Mounting
 - 1. Pump mounting accessories shall be made of Type 316 stainless steel and shall include a safety hook assembly.
 - 2. Pumps shall be easily removable from the space in which they operate without requiring personnel to remove bolts, nuts or other fastenings. Pumps shall be able to be lifted from the space without personnel entering or dewatering the space.
 - 3. Pump manufacturer shall provide stainless steel lifting chain of adequate length that can be securely attached to guardrail when pumps are not hooked to davit cranes.
 - 4. Manufacturer shall provide guide rails and guide rail supports to guide the pump when being raised or lowered into the tank.
 - a. The guide rails shall be Type 304 or 316 stainless steel.
 - b. The guide rails shall mount on the discharge base/elbow for the pump and shall align the pump with the discharge elbow as it is lowered into place.
 - c. A Type 316 stainless steel upper rail guide bracket shall be furnished to support and align the guide rails at the top of the sump. For rail lengths greater than 20 feet, a stainless steel intermediate rail guide bracket shall be included at the recommendation of the pump manufacturer.

E. Floats

- 1. Liquid level sensors (floats), as manufactured by Flygt, Model ENM_10, or equal, to provide signals for starting and stopping pumps, as well as wet well level indicating lights and alarms. Mercury-filled floats are not permitted. Each float shall be provided with a push-to-test pilot light to simulate float switch operation. Floats shall be provided with sufficient cable length for the application. Float elevations to be coordinated in the field during start-up. Provide a float for each of the following conditions:
 - a. Low water alarm.
 - b. All pumps off.
 - c. Lead pump on.
 - d. Lag pump on.

- e. High water alarm.
- 2. Provide all mounting hardware necessary to mount floats in the wet well per manufacturer's recommendation and per the Contract Documents.
- 3. Wire floats to the corresponding intrinsically safe barrier relays in the control panel. Verify operation. Label float conduit "intrinsically safe circuits." Only run float conductors in this conduit. Do not run conductors for pump power and sensors in the float conduit.

2.05. MOTORS AND DRIVES

- A. Motors and drives shall be furnished by the equipment supplier and shall be designed specifically for use with the equipment provided.
- B. Motors shall be oil filled and be capable of proper operation at the design conditions with an operating level of at least 12-inches of wastewater in the wet well.

ltem No.	Motor Parameters	Building No. 01 Pump Station	Holding Tank Pump Station
1	Maximum allowable motor horsepower	5 HP	7.5 HP
2	Motor Selection		
	Туре	Submersible	Submersible
	Special applications	None	None
3	Motor speed (nominal)	1,165 RPM	3,450 RPM
4	Minimum allowable motor efficiency at full speed	80 percent	80 percent
5	NEMA design	B squirrel cage	B squirrel cage
6	Duty	Continuous	Continuous
7	Insulation	Class F	Class F
8	Voltage, phase, and Hertz	460V, 3 phase, 60 Hertz	460V, 3 phase, 60 Hertz
9	Service factor	1.20	1.20
10	Motor enclosure	Submersible	Submersible
11	Protection	Motor winding thermal, motor overload protection	Motor winding thermal, motor overload protection

C. Motor Parameters

- D. Motors shall be provided with motor winding thermal protection.
- E. Motors shall be provided with motor overload protection.
- F. Motors shall be provided with a leakage sensor for the detection of water in the casing or bottom of housing.

2.06. CONTROLS

- A. Controls shall be provided as specified on the electrical drawings and as described herein.
- B. Manufacturer shall provide a complete and integrated control system for each duplex pump station supplied under this section that meets the requirements specified herein.

C. Control Panel

- 1. Control Equipment All components shall be NEMA devices; IEC equipment is not acceptable.
- 2. Furnish NEMA 4X stainless steel (UL listed) exterior enclosure epoxy coated duplex pump station control panel. Equip control panel with the following equipment:
 - a. Main Panel Disconnect UL service entrance listed circuit breaker having external operator with provision for padlocking on both "On" and "Off" positions and shall have a lock arrangement that prevents the inner door from being opened when the breaker is in the "On" position. Provide defeater. Incoming electric service shall be 480V, 3 phase, 60 Hertz.
 - b. Provide enclosure with a separate inside hinged door (dead front panel) to provide for mounting control switches, control lights and overload reset buttons. Outer door enclosure shall be dead front and have a hasp for padlock.
 - c. Start relay for pumps shall be mounted in the control panel.
 - d. Provide an individual circuit breaker for each pump. Full voltage magnetic starters shall be provided for motor starting and overloads for pumps shall be supplied to protect motors against excessive overcurrent conditions. The overload heaters shall be of the quick trip bi-metallic ambient compensated type. All starter and overload parts subject to wear shall be replaceable individually. Exterior holding tank pumps shall be 7.5 HP, 480 volt, 3 phase. Building No. 1 pumps shall be 5 HP, 480 volt, 3 phase.
 - e. A heat sensor thermostat in each motor shall be wired in series with the magnetic contactor coil to protect the motor against excessive heat. Thermostats shall reset automatically when motor cools.
 - f. Seal leak probes installed in the motors shall be connected to red signal lights on the inner panel door panel. H-O-A switches, alarm and run lights, seal leak lights, and overload reset buttons shall be mounted on the inner door panel. All lights shall be push-to-test transformer type.
 - g. A terminal strip with strap screw-type connectors shall be supplied to make all connections to the pumps. Power connections shall be made using tubular clamp-type connectors. All control connections shall be via solderless terminations.
 - h. Provide intrinsically safe barriers for connections of floats to the control panel.
 - i. Provide loss-of-power relay with separate contacts to provide an input to the local alarm light and remote alarm in the event the station loses power.
 - j. Alarm A high water level alarm shall be supplied with a flashing red alarm light in a heavy wire cage mounted on the outside of the enclosure. Alarm to be actuated by control as previously specified.
 - k. Provide a Lead-Lag Alternate relay. The relay shall have a selector switch for Pump 1 Lead Pump 2 Lag, Pump 2 Lead Pump 1 Lag, Alternate.

- I. Provide a four-channel autodialer for remote notification of alarms.
- m. Provide a 120 volt, 1 phase, 150 watt enclosure heater, thermostatically controlled.
- n. Provide a control power transformer and complement of control relays to achieve control panel operation as required.
- 3. All equipment in the enclosure shall be built and tested in accordance with the latest NEMA standards. IEC equipment not acceptable.
- 4. Manufacturer shall provide complete wiring and elementary diagram(s) depicting wiring between the duplex pump control panel, remote controls and pump motors. A final record copy shall be wrapped in a plastic enclosure and installed in a pocket inside the enclosure. All wiring shall be fully labeled at each end. All wire terminal and component connection numbers shall be shown on the wiring and elementary diagrams.
- 5. Provide the following door-mounted pilot lights, pushbuttons, and accessories (for each pump station control panel):
 - a. Individual pump Hand/Off/Auto selector switch.
 - b. Individual pump Running pilot light.
 - c. Individual pump Seal Leak pilot light.
 - d. Individual pump Motor Over-temperature pilot light.
 - e. Individual pump Overload pilot light.
 - f. Individual pump Fault Reset pushbuttons.
 - g. High Water pilot light.
 - h. Low Water pilot light.
 - i. Float push to test pilot light.
- D. Sequence of Operation
 - 1. In Hand, the pump shall operate continuously. The pump shall cease operation if a fault occurs.
 - 2. In Off, the pump shall not operate.
 - 3. In Auto, the pump shall operate based on the float setting.
 - 4. At High Water, a light shall illuminate at the control panel.
 - 5. At Low Water, a light shall illuminate at the control panel.
 - 6. At Lead Pump On float setting, the lead pump shall start operation.

- 7. At Lag Pump On float setting, the lag pump shall start operation.
- 8. At All Pumps Off float setting, the pumps shall cease operation.

2.07. FABRICATION REQUIREMENTS

- A. Manufacturer shall provide surface preparation and prime coating suitable for continuous long-term submergence in raw wastewater and leachate.
- B. All bolts, nuts, washers, and other fasteners shall be Type 316 stainless steel unless otherwise noted.
- C. Welds shall be continuous unless noted otherwise.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Furnish nameplates for each equipment.
 - 1. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins.
 - 2. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the equipment performance ratings.
- F. The equipment shall be tested in the manufacturer's shop in accordance with the requirements of Section 01640, Equipment–General, and as specified herein.
 - 1. Provide shop testing for each pump as detailed in Section 11300, Pumping Equipment–General, and specified herein.
 - 2. Provide certified performance tests as specified herein for all pumps and spare rotating assemblies except those specified to be witness tested.
 - 3. Certified Performance Testing
 - a. Run pump at full speed rating point prior to start of any testing.
 - b. Full Speed Tests
 - Test pumps at the conditions specified and indicated and take not less than five operating points between shutoff and runout. Test points must be at the conditions specified and indicated.
 - 2) Take readings to determine flow, differential pressure, rpm, horsepower, and efficiency.
 - Operate each pump for not less than one hour and take readings to determine that the pump will operate as specified and indicated without cavitation.
- G. Engineer and Owner reserve the right to witness the shop test on each pump at their own expense before the pumps are assembled for shipment to the project site. The pump manufacturer shall give Engineer ample notice of these tests so that Engineer can arrange to witness the tests.

- H. The manufacturers shall submit certified copies of the test data to Engineer and receive approval of the test data before shipment of the pumps to the site. Include results of factory testing in the O&M Manual.
- I. Final acceptance of the equipment will be dependent upon the satisfactory operation and performance after installation.

PART 3 EXECUTION

3.01. EQUIPMENT INSTALLATION

- A. Install in accordance with the Contract Documents and the manufacturer's written instructions.
- B. No modifications to equipment shall be made without the written consent of the manufacturer and approval of Engineer.
- C. Contractor shall provide all fittings and appurtenances necessary to connect to equipment and as necessary for a complete installation. Contractor shall field verify dimensions with manufacturer prior to submittal review. Contractor shall field verify all dimensions and elevations. Contractor is responsible to resolve all discrepancies with the manufacturer at no cost to the Owner.
- D. Furnish all necessary materials (including lubricants, chemicals, etc.) and equipment (including measuring devices, etc.) for testing and startup.
- E. Provide surface preparation and field painting.
- F. All bolts, nuts, washers, and other fasteners shall be Type 316 stainless steel unless otherwise noted.
- G. Anchor rods (bolts) shall be Type 316 SS HILTI-style adhesive anchors.
- H. Backpaint aluminum in contact with painted or galvanized steel or concrete with 5 mils of Tnemec Series 66-Gray, Hi-Build Epoxoline or DuPont 25P Epoxy.
- I. Isolate dissimilar metals by backpainting or with dielectric using stainless steel fasteners.

3.02. TESTING AND STARTUP

- A. Testing and startup shall be performed in accordance with Section 01650, Starting of Systems, and as specified herein unless otherwise noted.
 - 1. Functional testing.
 - 2. Startup
- B. All testing shall be done in the presence of the Engineer and the equipment manufacturer or their approved representative.
- C. Functional testing shall demonstrate the following:
 - 1. That the units have been properly installed and are in proper alignment.

- 2. That the units operate without overheating or overloading of any parts and without objectionable vibration.
- 3. That there are no mechanical defects in any of the parts.
- 4. That the pumps can deliver the specified flow rate and quantity at the rated speed. All Functional Tests shall be conducted with clean water unless otherwise noted. Contractor shall provide all temporary flow measurement devices as necessary to achieve accurate measurement of the pumped flow during the field tests.
- 5. That the pumps can pass the size of solids specified and the type of liquid for which the pumps are to be used.
- D. During Functional Testing, readings of all essential data shall be recorded at a minimum of four operating points. Data taken shall include suction and discharge pressure, flow, pump speed, and motor amperage. All field testing information shall be summarized in a report and submitted to Engineer for approval. Deviation of actual data from specified performance criteria shall not exceed <u>+3</u> percent.
- 3.03. SERVICES OF MANUFACTURER'S REPRESENTATIVE
 - A. Provide services of the equipment manufacturer or their approval representative in accordance with Section 01640, Equipment-General, and as specified herein.
 - B. A qualified representative of the equipment manufacturer shall be on site for the following activities:
 - 1. Functional testing.
 - 2. Startup
 - 3. Training.
 - 4. As necessary to provide submittals in accordance with Article 1.05.

END OF SECTION

SECTION 16055

ELECTRICAL WORK

PART 1 GENERAL

1.01. SECTION INCLUDES

- A. General work description and requirements for electrical work included in this contract.
- B. Raceways, fittings and boxes.
- C. Conductors and accessories.
- D. Wiring devices.
- E. Grounding.
- F. Disconnect and safety switches.
- G. Electrical supports, anchors, and fasteners.
- H. Nameplates and labels.
- I. Equipment testing.
- J. Spare devices.

1.02. RELATED SECTIONS

- A. Section 01010 SUMMARY OF WORK
- B. Section 01019 CONTRACT CONSIDERATIONS
- C. Section 01026 LUMP SUM ITEMS
- D. Section 01039 COORDINATION AND MEETINGS
- E. Section 01300 SUBMITTALS
- F. Section 01400 QUALITY CONTROL
- G. Section 01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS
- H. Section 01600 MATERIAL AND EQUIPMENT
- I. Section 01700 CONTRACT CLOSEOUT
- J. Section 02112 PAVEMENT CUTTING
- K. Section 02222 EXCAVATING
- L. Section 02228 COMPACTION

1.03. GENERAL REQUIREMENTS

- A. All work shall be subject to applicable sections of these specifications, not necessarily the aforementioned related sections.
- B. Examination of Premises
 - 1. Before submitting a proposal, the Contractor shall examine all Drawings and specifications relating to work of all trades to determine scope and relation to other work.
 - 2. Ascertain access to site, available storage, and delivery facilities.
 - 3. Before commencing work, verify all governing dimensions and examine all adjacent work at site and/or buildings.
 - 4. Some equipment or material items may be special order items having long order times and shall be ordered well in advance of installation. Unavailability due to long lead times or special orders is not an excuse for not providing the specified items.

1.04. SCOPE OF WORK

- A. The principal items of electrical work include, but are not necessarily limited to, the following:
 - 1. Provide all electrical power, control, instrumentation, ductbanks, communication, including exposed and concealed raceway systems, conductors, cables, fittings, special control, wiring devices, distribution equipment except when specifically provided under other contracts, overcurrent protection, terminations, connections, and interconnections, and all related appurtenances to provide a complete and operating electrical system.
 - 2. Provide all system and equipment grounding in conformance with the requirements of these specifications and the National Electrical Code (NEC).
 - 3. Provide electrical labels, signs, and nameplates per this section.
 - 4. Install all electrical equipment, conduit, wire, conductors, cable, connections, etc., required for complete and operating systems.
 - 5. Coordinate work with the work of others for timely completion of the work of this contract.
 - 6. Repair, fill and/or patch surfaces of all building components including walls, floors, ceilings, and roofs damaged or left open or bare as a result of the electrical work.
 - 7. Have an Owner-approved third-party inspecting agency inspect electrical installation. Submit a final certificate approving all work to the Engineer prior to final acceptance of the electrical work.
 - 8. See Section 01700, Contract Closeout, for additional requirements for record drawings, operation and maintenance manual, final testing and inspection, and guarantees and warranties.

- 9. Provide all materials, equipment, and labor required for complete and operating electrical power, telephone service and distribution, and instrumentation wiring systems.
- 10. Provide all telephone conduit and wiring except cables specifically called out to be furnished and/or installed by others.
- 11. Perform all trenching, backfilling, compaction, restoration of surfaces, dewatering (as required), ductbank fabrication, and pole installation required for grounding system, electric services and distribution, telephone system, and instrumentation.

1.05. CODES AND STANDARDS

- A. Reference to various codes and standards are a minimum installation requirements standard. In case(s) of discrepancy between the Contract Documents and the NEC, the stricter requirement shall apply.
- B. All work, equipment, and materials furnished shall conform with the existing rules, requirements, and specifications of the Insurance Rating Organization having jurisdiction; the NEC; the National Electric Manufacturer's Association (NEMA); the Underwriters Laboratories (U.L.); and the respective utilities.
- C. All material and equipment shall bear the inspection labels of Underwriters Laboratories, unless otherwise allowed by the Engineer in writing and if the material and equipment is of the class inspected by said laboratories. All labeling shall be for the intended usage.
- D. The Contractor shall be held responsible for adherence to all rules, requirements, and specifications as set forth above. Any additional work or material necessary for adherence will not be allowed as an extra, but shall be included in the bid price. Ignorance of any rule, requirement, or specification shall not be allowed as an excuse for non-conformity. Acceptance by the Owner or Engineer does not relieve the Contractor from the expense involved for the correction of any errors which may exist in the drawings submitted or in the satisfactory operation of any equipment.

1.06. SUBMITTALS

- A. Submit shop drawings under provisions of Section 01300, Submittals.
- B. The Engineer's approval shall be obtained for all equipment and material for which shop drawings are required before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. Provide submittals for all conduit, wire, cable, boxes other than device boxes, enclosures, fittings, hangers, supports, outlets, high and medium voltage splices, disconnect switches, lighting fixtures, ballasts, starters, overloads, overcurrent devices, panelboards, control and starter panels, outlets, seal-offs, and all other electrical equipment as listed in other sections.

1.07. RECORD DRAWINGS

A. In addition to the requirements of Section 01700, Contract Closeout, regarding record drawings, prepare and submit marked-up field record drawings, which shall include all addenda items and changes made during construction, to the Engineer prior to final acceptance. Additionally, submit record drawings consisting of the following three types of drawings:

- Elementary or Schematic Diagrams All control schematics and elementary diagrams. Those constructed as shown on Contract Drawings need only be verified on the marked-up field set. For those that changed, submit preliminary revised schematic and elementary diagrams for the Engineer's review. Once reviewed and approved, these diagrams shall be drafted on 24-inch by 30-inch sheets and added as "__A" sheets.
- 2. Block Diagrams Prepare and submit fully labeled block diagrams, showing all pointto-point connections giving conduit size and fill (each conductor number, size, and color listed) showing all junctions boxes, pullboxes, panels, etc., together with terminal numbers at all conductor terminations. Initially, hand sketches on 8-1/2-inch by 11-inch sheets can be submitted for review. Once reviewed and approved, these designs shall be drafted on 24-inch by 36-inch sheets with suitable title block data. Block diagrams are to be updated to reflect all final connections (connections labeled) or other changes. When there is more than one sheet of block diagrams, an index shall be included to indicate on which sheet the respective pieces of equipment can be found. See sample attached to end of this section.
- 3. Contractor's As-built Drawings Provide one 24-inch by 36-inch copies of electrical as-built drawings of the Contract Drawings with all field notes and comments to illustrate actual construction conditions. As-built drawings shall include all addenda items issued during bidding and all other changes to the documents that occurred during construction. Drawing to be titled "Contractor's As-built Drawing, Prepared by: <u>(name of Contactor , Date Issued:</u>"

Electronic copies of the as-bid set of Contract Drawings will be provided to the Contractor for use in record drawing preparation. Contractor shall modify the as-bid set of drawings for record drawings. All drawings shall be prepared using AutoCAD drafting; no paste-on information will be allowed.

- B. Submit a final record drawing copy on 24-inch by 36-inch vellum for the Engineer's review.
- C. "A" drawings shall be prepared (24-inch by 36-inch) showing all concealed conduit including ductbanks that cannot be shown clearly on the marked-up field set. All underground conduit routings and ductbanks shall be dimensioned from aboveground structures. All manholes, handholes, pullboxes, and bends without structures shall have at least two ties.
- D. Once final approval of the drawings with corrections is provided to the Contractor, all final drawings shall be provided on a compact disc and produced using the computer-aided drafting system, AutoCAD 2013, as a minimum. Later revisions shall be saved as this version.

1.08. EQUIPMENT PROTECTION

- A. Equipment and material shall be delivered to the site in new, unused condition in original packaging. Contractor shall be responsible to store equipment and protect against damage, theft, dirt, moisture and temperature extremes.
- B. All switchboards, programmable logic controllers, variable frequency drive, and instrumentation to be transported under this contract shall be shipped to and from the site in enclosed, weathertight, sealed containers in a manner designed to protect the units against damaging stress caused by sudden acceleration or deceleration. An indicating meter, such as "Drop-N-Tell," designed to indicate any sudden impacts that exceed the unit's rating shall be shipped with and fixed to each assembly or its packing crate. Upon arrival of each shipment at the project site, the meter shall be examined in the presence of representatives

of the Engineer, the Contractor, and the equipment manufacturer. If the acceleration indicates the package exceeded the limits of the meter, the assembly or subassembly shall be dismantled and completely inspected. All damage shall be corrected before the equipment is incorporated into the work. The Contractor shall bear all cost arising out of dismantling, inspection, repair, and reassembly, including engineering costs. The meters shall be sized for three times the weight of the packaged item.

- C. During the installation of equipment, controls, controllers, circuit protective devices, etc., these items shall be protected against entry of foreign matter and be vacuum cleaned both inside and outside before testing and operation.
- D. Damaged equipment, as determined by the Owner and/or the Engineer, shall either be repaired to new condition or replaced with new equipment.
- E. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or similar protective cover.

1.09. EQUIPMENT INSTALLATION AND REQUIREMENTS

A. The locations of equipment, fixtures, outlets and similar devices shown on the Contract Drawings are approximate only.

Equipment shall be installed as close as practical to locations shown on the Drawings. Where Contractor supplied equipment sizes differ from that anticipated on the Drawings, the Contractor shall prepare and submit to the Engineer new "to scale" layouts showing new equipment locations for approval.

- B. Equipment Provided Under Other Divisions
 - 1. Reasonable effort has been made to show the actual locations and sizes of the equipment to be provided under other sections of the specifications and installed by other trades for the project. These locations shall be considered approximate, but suitable for preparation of the Contractor's bid. These locations are not necessarily final locations. Contractor shall verify equipment size and location with the installing trades before rough in and obtain the applicable shop drawing information to enable the electrical trade(s) to furnish and install electrical service to the equipment.
 - 2. The Contractor and/or the electrical installer(s) shall coordinate the exact locations of all equipment, receptacles, box-outs, sleeves and similar items required for the completion of electrical work with the structural, architectural, mechanical or other work.
 - 3. The wiring configuration of equipment provided by other divisions will vary, depending on the manufacturer used. Specific wire connections to equipment provided by other divisions are not shown in these documents. The electrical installer(s) shall coordinate the wire connections with the division supplying the equipment.
 - 4. No additional compensation will be made for relocations, reconnections or additional work required as a result of the failure of the Contractor and/or the electrical installer(s) to fully coordinate the work of all trades.

- C. Inaccessible Equipment
 - 1. Where the Engineer determines that the Contractor or his subcontractors has installed equipment that is not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as required by the Engineer at the Contractor's expense.
 - 2. "Conveniently accessible" is defined as reachable without the use of ladders, without climbing over or crawling under obstacles such as equipment, structures, piping and ductwork. Equipment shall be installed at the heights as specified in other Sections of these specifications, except any readout devices shall be installed so that the centerline of the readout is 5 feet 0 inches above finish floor.
- D. Equipment and Material Equipment and material shall be designed to assure satisfactory operation and operating life for environmental conditions where being installed. These specifications, the NEC, and other code requirements shall apply to the installation in areas requiring special protection; i.e., hazardous, wet or corrosive area/location, and weatherproof construction.
- E. Classified Areas
 - 1. General Enclosures for classified areas shall be as specified in this section.
 - 2. Hazardous Areas
 - a. In the areas designated as hazardous and where explosionproof work is shown or specified, all work shall meet the requirements of the NEC for the classification of that location.
 - b. Equipment enclosures shall be approved for use in the atmosphere of the area in which they are installed, i.e., Class I, Division 1, Group D; Class I, Division 2, Group D atmospheres.
 - Wet Locations Where installed outdoors or in areas designated as wet locations, all work shall meet the requirements of these specifications and of the NEC for wet locations.
 - 4. Corrosive Areas All equipment shall be corrosion resistant in areas so designated unless specified otherwise.
- F. Rigging and Moving Equipment Contractor and his subcontractors shall exercise extreme care and caution in moving and installing equipment. Skilled riggers shall be employed to move any equipment over 300 lbs. or of sufficient bulk. Proper falsework, skids, blocking, runways, supports of new or existing work, or other devices shall be employed when moving or placing equipment.
- G. Diagrammatic Drawings
 - 1. Circuit diagrams shown are diagrammatic and functional only and are not intended to show exact circuit or wiring layouts, number of fittings or other installation details. The Contractor shall furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.
 - 2. Circuits beyond their pushbutton and control device and conduits containing lighting circuits beyond panelboards are not always shown or scheduled.

- 3. The number of conductors shown is not necessarily the correct number required. Contractor shall install as many conductors as are required for the complete and satisfactory operation of all systems.
- H. Conductor Sizing Conductor sizes are shown for equipment branch circuits extending less than 100 feet from power source. Refer to schedule in this section for sizing conductors on circuits more than 100 feet long. Conduit sizes shall change accordingly.

PART 2 MATERIALS AND EXECUTION

2.01. RACEWAYS, FITTINGS AND BOXES

- A. Raceways
 - 1. Type A Rigid Galvanized Steel Conduit (RGS)
 - a. This conduit shall be used for all interior, above-slab systems for incoming electrical and telephone services both above and below grade to first enclosure inside building
 - b. Description Hot dipped galvanized rigid steel conduit, shall conform to ASA C80-1.
 - c. Manufacturers
 - 1) Allied
 - 2) Wheatland.
 - 3) Republic.
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
 - 2. Type B Rigid Aluminum Conduit
 - a. Application Exposed on outside tanks.
 - b. Description Rigid aluminum conduit, shall conform to ASA C80-5.
 - c. Manufacturers
 - 1) Allied.
 - 2) Republic.
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.

- 3. Type D Rigid Non-metallic Conduit Schedule 40 (Polyvinyl Chloride [PVC])
 - a. This conduit shall be used in ductbanks and above slabs in corrosive areas This type conduit shall be not used for stub-ups from ductbanks. Stub-ups shall be Type D-1.
 - b. Description Rigid, non-metallic conduit shall be rigid PVC, Schedule 40 and shall conform to Federal Specifications W-C-1094 and Underwriters Laboratories, Inc. Standard UL-651.
 - c. Manufacturers
 - 1) Pittsburgh Standard (RobRoy Industries).
 - 2) Allied.
 - 3) Carlon
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 4. Type D-1 Rigid Non-metallic Conduit Schedule 80 (PVC)
 - a. Application For interior ductbank stub-ups from 24 inches below slab up to the connected interior devices and interior corrosive areas (except for signal and instrumentation systems, which shall be Type E and or ground conductor protection.
 - b. Description Rigid, non-metallic conduit, shall be rigid PVC, Schedule 80, and shall conform to Federal Specifications W-C-1094 and Underwriters Laboratories, Inc. Standard UL-651.
 - c. Manufacturers
 - 1) Pittsburgh Standard (RobRoy Industries).
 - 2) Allied.
 - 3) Carlon
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 5. Type E PVC-Coated Rigid Steel Conduit With an Interior Urethane Coating
 - a. Application For signal or instrumentation conduit systems in interior corrosive areas.
 - b. Description PVC-coated, rigid steel conduit. Shall conform to Federal Specification WWC-581d and be coated with a heat polymerizing adhesive prior to plastic coating. PVC coating shall be applied by plastisol method. The interior coating shall be a factory-applied two-part 2 mil thick chemically cured hot dipped urethane coating. The conduit shall conform to NEMA Standard No. RNI-1986.

- c. Manufacturers
 - 1) Pittsburgh Standard (RobRoy Industries).
 - 2) OCAL
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 6. Type H Explosionproof, Flexible Conduit
 - a. Application For use in hazardous areas as final connection to lighting, heating and ventilating equipment, motors, and other vibrating equipment.
 - b. Description Explosionproof, flexible conduit shall be flexible core with bronze braid covering and steel end fittings.
 - c. Manufacturers
 - 1) Crouse-Hinds.
 - 2) Appleton.
 - 3) Killark.
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 7. Type J Surface Metal Raceway
 - a. Application For use where conductor must be run exposed on existing walls in finished areas.
 - b. Description Surface metal raceway shall be painted steel with snap-on covers, sized as required for conductors enclosed.
 - c. Manufacturers
 - 1) Wiremold Company.
 - 2) Walker division of Butler Manufacturing Company.
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 8. Type K General Purpose Auxiliary Gutters
 - a. Application For use as called for on the Contract Drawings inside and in a non-classified area only.
 - b. Description General purpose auxiliary gutters or wireways shall be formed, heavy gage sheet steel, hinged cover with captive screw closure, steel covers, bonderized with baked enamel finish.

- c. Manufacturers
 - 1) Square D.
 - 2) General Electric.
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 9. Type K-1 Oil-tight and Gasketed Auxiliary Gutters
 - a. Application For use as called for on the Contract Drawings in exterior and wet locations.
 - b. Description Oil-tight gasketed hinged cover lay-in 14 gauge epoxy painted sheet steel with neoprene gasket and pull latches.
 - c. Manufacturers
 - 1) Square D Model Class 5120.
 - 2) Substitutions Under provisions of Section 01600, Materials and Equipment.
- B. Conduit Fittings
 - 1. Weatherhead Cast type of non-ferrous metal or malleable iron thoroughly coated inside and outside with metallic zinc or cadmium; provide with heavy threaded hubs to fit the conduit required.
 - 2. All Fittings Cast-type material and coatings shall match conduit system it is to be used with.
 - 3. Covers shall be of the same material as the fittings to which they are attached. Provide gaskets for exterior use and for interior wet areas.
- C. Expansion/Deflection Fittings
 - 1. Material shall match conduit system it is to be used with, designed for 4-inch movement.
 - 2. Coupling shall compensate for the following movements:
 - a. Axial expansion or contraction.
 - b. Angular misalignment.
 - c. Parallel misalignment.
- D. Access Fitting and Pulling Fitting Of the same construction as conduit fittings. Provide cover gasket for interior wet locations and exterior areas. For corrosive areas, use PVC or fiberglass boxes.

- E. Boxes
 - 1. Outlet and Device Of the same construction as conduit fittings. Provide cover gasket in wet locations.
 - 2. Junction and Pullboxes Of the same construction as conduit fittings. Up to 100 cubic inches. Larger interior non-classified area boxes shall be galvanized with hinged covers. Exterior and interior wet, non-corrosive areas shall be stainless steel. Provide cover gasket in wet or corrosive locations. Provide terminal strips for joining conductors in boxes over 100 cubic inches.
- F. Elbows Factory made by same manufacturer as couplings or conduit. Material to match conduit system it is to be used with.
- G. Miscellaneous
 - 1. Nipples, Locknuts, and Bushings Factory made; material to match conduit system it is to be used with.
- H. Conduit and Core Hole Sealing Mechanical link type with elastomeric links joined by stainless steel bolts which also serve to expand the seal. Manufacturer Thunderline Corporation, Model "Linkseal." Shall be fire rated when used in fire walls.

2.02. CONDUCTORS AND ACCESSORIES

- A. Conductors: Application Material Manufacturers
 - 1. Metal Clad Cable
 - a. Application For use in drops to devices in block walls or finished areas.
 - b. Description ANSI/NFPA 70, Type MC.
 - c. Conductor Stranded copper.
 - d. Insulation Voltage Rating 600 volts.
 - e. Insulation Temperature Rating 90 degrees C.
 - f. Insulation Material Cross-linked polyethylene or thermoplastic.
 - g. Armor Material Steel.
 - h. Armor Design Interlocked metal tape.
 - i. Jacket PVC.
 - j. Phase Identification Colored or print marked insulation.
 - k. Ground Conductor Stranded copper sized per NEC.
 - I. Manufacturers
 - 1) The Okonite Company Model 112-31.

- 2) Southwire Duraclad. Armorclad.
- 3) Anixter Model 7A.
- 4) Substitutions Under provisions of Section 01600, Materials and Equipment
- 2. Multi-Conductor Power and Control Cable
 - a. Application For use in place of building wire and cable when powering three-phase equipment or for consolidating the number of power and control cables between two locations.
 - b. Description Multi-conductor, Type TC cable.
 - 1) Conductor Stranded copper.
 - 2) Insulation Voltage Rating 600 volts.
 - 3) Insulation Material PVC with phase indicators for individual conductors and nylon or PVC for overall jacket.
 - c. Manufacturers
 - 1) Anixter Model 3G.
 - 2) Cablec Model AP14321.
 - 3) Belden Tray cable.
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 3. Building Wire and Cable
 - a. Application For general use for all conductor applications unless specifically called out otherwise. Not for use in manufactured control panels, service entrance cable, power distribution cable, and submersible cable.
 - b. Description Single conductor insulated wire type as indicated below.
 - 1) Conductor Stranded copper only.
 - 2) Insulation Voltage Rating 600 volts.
 - 3) Insulation Type Type THHW/THWN for feeders and branch circuits.
 - 4) Insulation Material PVC or thermoplastic with nylon overall jacket.
 - c. Manufacturers
 - 1) Triangle PWC, Inc. Model TP-220TH, TP-230TN.
 - 2) Anixter Model 6G.

- 3) Okonite Model 116-67.
- 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 4. Telecommunication Cable (for Interior Use)
 - a. Application For use where called for on Contract Drawings.
 - b. Description Multi-conductor cable, insulated and twisted into pairs.
 - 1) Conductor Solid copper, minimum Size 24.
 - 2) Insulation Material Color coded PVC for individual conductors and PVC for overall jacket.
 - 3) Rip Cord If available.
 - 4) Outer Jacket PVC.
 - c. Manufacturers
 - 1) Anixter Inside wiring, Model CAT 3 Type CMR.
 - 2) Belden CAT 3, Model 1232A1.
 - 3) General Cable CAT 3 UTP Type CMR.
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 5. Telecommunication Cable for Underground Ductbank Installations
 - a. Description Multi-conductor cable. Insulated conductor is twisted into pairs for installation in ductbanks.
 - b. Conductor Minimum size No. 24 solid, annealed, bare copper.
 - c. Insulation Color coded, polyethylene or polypropylene.
 - d. Units Pairs stranded into units.
 - e. Cover Wire bundle covered with non-hyroscopic tape.
 - f. Sheath Aluminum shield.
 - g. Jacket Polyethylene; marked at foot intervals.
 - h. Manufacturers
 - 1) Anixter Type RUS/REA PE-89.
 - 2) General Cable Type RUS (REA) P-89AL.

- 3) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 6. Submersible Motor Conductors
 - a. Description Submersible, non-hazardous, extra heavy usage.
 - b. Conductor Stranded copper.
 - c. Insulation Voltage Rating 600 volts.
 - d. Insulation EPD and CP or EP (ethylene propylene) with phase indicators.
 - e. Manufacturers
 - 1) Anixter Model 4 PC.
 - 2) Okonite.
 - 3) Cable supplied with and as part of the manufacturer's standard product offering.
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 7. Bonding and Grounding Conductors
 - a. Application For use as needed to meet the requirements of this specification as shown on the Drawings and the NEC for bonding and grounding.
 - b. Description Multi-conductor cable, insulated conductor is twisted into pairs.
 - 1) Conductor Bare copper wire.
 - 2) Stranding Solid ASTM B-1 for Sizes No. 8 and smaller. Stranded ASTM B8 for Sizes No. 6 and larger.
 - Grounding system conductor from inside equipment to grounding rods or plates and under ductbanks shall be tin-plated. Note: This is a special item; order well in advance of installation.
 - c. Manufacturers
 - 1) Anixter Model 1A or 1B.
 - 2) Cablec Molded "bare and coated copper conductors" listed under Section 7, "Special Purpose Cables."
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.

- 8. Control Panel Wire
 - a. Application For use in all manufactured or custom built control panels and motor control centers.
 - b. Description 90 degrees C machine tool wire.
 - 1) Conductor Minimum Size AWG #16, 19 strand.
 - 2) Insulation PVC, 2/64-inch for 600 V service.
 - c. Manufacturers
 - 1) Carol Catalog Series 7600.
 - 2) Anixter Catalog Series 6W.
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment
- B. Wire Terminations and Connectors
 - 1. General
 - a. Connector material shall be compatible with the wire that it is to be used with.
 - b. Connectors made of aluminum shall not be used with copper conductors.
 - c. Connectors listed below are for use with copper wire. Connectors to be used with aluminum wire shall be of the same general type and construction as those listed below, but shall be suitable for use with aluminum conductors.
 - 2. Terminal Block Manufacture
 - a. Control Wiring
 - 1) Buchanan Model 0241.
 - 2) Connectron Model NSS3.
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.
 - b. Equipment Power Wiring
 - 1) Buchanan Model 416.
 - 2) Connectron Model NC3.
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.

- 3. Two-Way Splices
 - a. Description Tubular compression type for conductors 1/0 and larger. Rated 600 VAC and uninsulated.
 - b. Manufacturer
 - 1) Burndy Model YS-L "Hylink."
 - 2) Thomas & Betts Model 545.
 - 3) 3M Model 10000.
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 4. Crimp Connectors
 - a. Description For branch circuit connections, other than lighting and receptacle circuits.
 - b. Manufacturer
 - 1) Ideal Series 30; Model 410, 411, 412 with Model 415 and 417 insulator.
 - 2) Thomas & Betts Model PT66M,
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 5. Bus or Lug Terminals, Manufacturer 600 VAC, Crimp Type
 - a. Burndy "HYLUG" Catalog, Series YA.
 - b. Ideal Catalog Series CCL and CC.
 - c. Substitutions Under provisions of Section 01600, Materials and Equipment.
- 6. Terminal Strip Connectors
 - a. Description For control and instrumentation connections to terminal strips. Locking fork, vinyl, self-insulated, crimp-type connectors or tubular clamp type.
 - b. Manufacturers
 - 1) Burndy "VINYLUG" Types TP-LF and BA-EL.
 - 2) Thomas & Betts Catalog Series 18RA, 14RB, and 10RC.
 - 3) Ideal Series 83-7.

- 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 7. Wire Nuts
 - a. For Unclassified Areas Hexagonal-shaped for use with a nut driver, compact swept-wings, ribbed cap, UL-listed for 600V with temperature rating of 105 degrees C (221 degrees F).
 - 1) Ideal Models 341 and 342.
 - 2) 3M Models 212, 312, and 512.
 - 3) Buchanan Models B-1, B-2, and B-4.
 - 4) Substitutions Under provisions of Section 01600, Materials and Equipment.
 - b. For Wet, Corrosive, and Hazardous Areas Compact swept-wings, ribbed cap, filled with non-hardening sealant, UL listed for 600V with temperature rating of 105 degrees C (221 degrees F).
 - 1) Ideal Model DB Plus.
 - 2) Buchanan Model BTS2 and BTS4.
 - 3) Substitutions Under provisions of Section 01600, Materials and Equipment.
- 8. Bolted Wire Connectors Mechanical connectors for all combination of copper and aluminum conductors. Connectors shall be of a compact high-strength design, tinplated copper alloy, two-piece connector, and shall utilize two hex head bolts.
 - a. Burndy Model KVSU.
 - b. Ideal.
 - c. ILSCO Corp.
 - d. Substitutions Under provisions of Section 01600, Materials and Equipment.

2.03. GROUNDING

- A. Install ground system as shown on the Contract Drawings by installing driven ground rods into the ground a minimum of 12 inches below grade. Where rods cannot be driven due to rock formations, install grounding plates below groundwater level of a minimum of 6 feet below grade. Depth of the system conductors is to be 30 inches minimum. Use approved mechanical connections to rods. Ground rods shall be steel core copper jacketed rods; 3/4-inch diameter by 10 feet long. See paragraph 2.02.A.7 herein.
- B. Size of grounding and bonding conductors shall be as shown but not smaller than required by the NEC, Articles 250-66 and 250-122.

2.04. DISCONNECT AND SAFETY SWITCHES

- A. Definitions
 - 1. Disconnect Switches Non-fusible switches.
 - 2. Safety Switches Fusible switches.
- B. Characteristics
 - 1. Heavy-duty type construction.
 - 2. Number of poles shall be equal to the number of current carrying conductors.
 - 3. Lockable in "off" or "open" and in the "on" or "closed" position.
 - 4. Quick-make, quick-break switch mechanism.
 - 5. Dual cover interlock to prevent opening of the switch door when handle is in the "on" position, and to prevent closing of switch mechanism with the door open. Provide a defeat mechanism.
 - 6. Visible blade construction.
 - 7. Single throw unless noted otherwise.
 - 8. All main service disconnects shall come with a AR Type" fuse rejection kit.
- C. Ratings
 - 1. 600 volts for 480V systems and 240 volts for 208V systems. Ampere or horsepower rating as shown or required.
 - 2. RMS symmetrical interrupting rating shall be 100,000 amperes for main service, 10,000 amperes otherwise.
 - 3. Lugs shall be rated and U.L. listed for 60 degrees C and 75 degrees C wires.
- D. Enclosures
 - 1. U.L. listed.
 - 2. NEMA 4X stainless steel for exterior and wet locations; NEMA 4X non-metallic for corrosive areas; all others NEMA 12.
 - 3. Provide with enclosure-mounted handle operator, operating through approximately 180-degree arc.
- E. Fuses Dual element RK1 current limiting type, time delay. Bussman Low-Peak LPN-RK or equal.
- F. Manufacturers Heavy-duty Square D Class 3110; General Electric Type TH; Westinghouse Type H-600; or equal.

2.05. ELECTRICAL SUPPORTS, ANCHORS, AND FASTENERS

A. General

- 1. Materials and Finishes Provide products which incorporate corrosion resistance adequate for the conditions in which they are to be installed.
- 2. The following materials are not acceptable: spring steel clips, spring steel clamps, powder-actuated anchors, and expansion anchors of any kind.

B. Electrical Channel

- 1. For Non-classified Areas Hot dipped galvanized channel. Manufacturers: Kindorf, Uni-Strut, B-line, Globe.
- 2. For Wet Areas Stainless steel, Type 316. Manufacturers: Uni-Strut, B-lineFor Corrosive Areas – Non-metallic (fiberglass). Manufacturers: Robroy Industries, Enduro, Aickinstrut, Strut Tech.
- 3. For Hazardous Areas PVC-coated, hot dipped galvanized with black finish. Manufacturers: B-Line, Perma-Cote, Occidental Coating Company, Robroy Industries.
- 4. For Exterior Locations Stainless steel, Type 316. Manufacturers: Uni-Strut, B-line.
- C. Conduit Clamps
 - 1. Two or more conduits run parallel for a distance of more than 5 feet shall be supported from electrical channel by steel conduit straps. Straps shall be PVC coated in all classified and exterior applications.
 - 2. All conduits that do not meet the above criteria shall be supported using cast malleable iron clamp and mating malleable iron clamp backer-spacer (two-piece clamp). Clamp back shall be thick enough to provide 1/4-inch standoff from conduit to wall. Clamp and spacer shall be PVC coated for all classified and exterior applications. Stamped metal or two-piece PVC clamps are not acceptable.

2.06. NAMEPLATES AND LABELS

- A. Nameplates
 - 1. Material Rigid laminated plastic.
 - 2. Lettering Height 5/16-inch high.
 - 3. Lettering Color White.
 - 4. Background Color Black.
- B. Labels
 - 1. Self-debossing, aluminum foil type.
 - 2. Typewritten or preprinted black legends on white background.

- 3. Permanent Pressure-Sensitive Adhesive Provide high temperature adhesive for labels on heat producing devices.
- 4. Use preprinted sleeve type for conductors. Label at each termination or splice.
- 5. Manufacturers Seton or equal.
- C. Equipment and Control Identification
 - 1. In addition to the requirements of the NEC, install an identification label which will clearly indicate information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchgear and motor control assemblies, control devices and other significant equipment.
 - 2. Provide nameplates for all electrical equipment and controls.
 - 3. Attach nameplates with stainless steel or other non-corrosive metallic rivets or screws.
 - 4. Provide a nameplate at each remote switch or control device when the controlled function is not readily identifiable.
 - 5. All wiring except primary service conductors shall have each end of the conductor labeled. Label wires at each junction box.

2.07. SPARE DEVICES

- A. Provide the following spare devices:
 - 1. Two main fuses (installed in service switch enclosure).
 - 2. One each of all other fuses.
 - 3. One spare 20-amp, single-pole branch breaker, installed in panelboard.
 - 4. Two spare bulbs of each type, store in a NEMA 12 enclosure 16-inch by 16-inch by 8-inch minimum. Provide two full width/depth adjustable shelves.

PART 3 EXECUTION

3.01. CONDUIT INSTALLATION

- A. Conduit System Fabrication
 - 1. All interior conduit shall be installed exposed. No conduit shall be in or under slabs No conduits within walls where the walls are below grade, i.e., in basements or galleries.
 - 2. No conduit shall be run on the exterior face of any structure unless specifically shown exposed or approved by the Engineer prior to installation.

- 3. Conduit Defects All conduit runs, cuts in coatings, to be free of indentations, elliptical sections, blisters, and other defects. Repair or replace damaged conduit sections as instructed by the Engineer.
- 4. Conduit Cutting Cut all conduit ends square and remove all burrs. Cut conduit ends exactly to avoid excessive penetration into boxes.
- 5. Expansion Joints Provide approved conduit expansion joints wherever conduit crosses a structural expansion joint; is attached between two separate structures; the conduit run is 50 feet or more in a single length for Types B, C, D, and D-1 conduit or 100 feet or more for Types A and E; or wherever shown or specified. Support conduit on each side of the expansion joint.
- 6. Preparation for Conductor Installation Prior to pulling cables in any conduit system, thoroughly clean the inside of each length of conduit by swabbing or the use of compressed air to remove all foreign matter. Then temporarily plug the ends of each conduit to prevent the entrance of dirt or foreign matter.
- 7. Couplings
 - a. Tightly butt ends of conduit into the couplings.
 - b. In exposed work only, where standard couplings cannot be used, only uniontype couplings are permitted or as otherwise acceptable to the Owner.
- 8. Cutting of Structures Keep the cutting of walls or floors for conduit to a minimum. Where such cutting is absolutely necessary, take care so as not to weaken the walls or floor involved. Do not cut beams or other structural supports under any condition.
- 9. Connection to Devices Conduit attachment to all electrical equipment, such as sheet steel junction boxes, pullboxes, switches, etc., to be made with approved fittings with non-metallic bushings. All Type C conduits shall use compression fittings only. Set screw fittings are not acceptable.
- 10. Conduit Bends and Elbows
 - a. Rigid Metallic Conduit Systems (Types A, B, C, and E)
 - 1) Heating metal conduit to facilitate bending is strictly prohibited.
 - 2) Field bending metal conduit is permitted as follows:
 - a) Types A, B, and E Up to and including 3/4-inch size.
 - b) Type C Up to and including 1-1/4-inch size.
 - 3) For all rigid metal conduit larger than that above, use manufactured elbows or use hydraulic one-shot bender to fabricate bends.
 - 4) Make all bends with radius no less than NEC requirement.
 - b. Rigid Non-Metallic Systems (Types D, D-1, DB, and EB)
 - 1) Join non-metallic conduit using cement as recommended by manufacturer. Wipe non-metallic conduit with appropriate cleaner,

then dry before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

- 2) Field bending of Types D and D-1 conduit is permitted only if a "hot box" is used.
- 3) Make all bends with radius no less than NEC requirement.
- 4) Kinked or crimped conduit bends are not acceptable. Remove and replace all such bends.
- 11. Routing of Conduits Keep the number of bends, offsets, and crossovers to a minimum; however, not more than three 90-degree elbows or equivalent bends up to 270 degrees is to be installed in any run between pulling or access fittings.
- 12. Structural Make holes around conduit or cables watertight or gastight via silicone or acrylic latex masonry sealant upon completion of conduit or cable system.
- B. Conduit Size Minimum conduit sizes shall be as follows unless specifically shown otherwise:
 - 1. 3/4-inch for exposed locations (includes those areas above drop ceiling of lay-in tiles)
 - 2. 1-inch for any concealed conduit in walls or within or beneath slabs.
 - 3. 2-inch for any conduit in ductbanks (unless specifically shown otherwise).
- C. Changes in Conduit Sizes Made at pull or junction boxes except where specifically shown via a pull fitting.
- D. Conduit and Sleeve Sealing
 - 1. Seal inside of conduit (after installing and testing conductors) where passing through exterior walls or walls containing vapor seals or required to be gastight. Sealing may be accomplished by locating junction or approved sealing fitting at wall and filling with an approved waterproof electrical putty or sealing compound. Seal around all interior conduit passing through floor and wall boxouts.
 - 2. Where driptight and watertight NEMA 4X and 12 installations are required, use only watertight hubs for top or side entry. Locknuts with gaskets are not acceptable. Conduits entering the top of electrical equipment are to either be sealed or located in such a manner as to prevent water from entering the equipment through the conduit system. Install conduit for ease of sealing.
 - 3. Provide boxouts sleeves where conduit passes through poured-in-place concrete floors or walls. Core drill all other concrete walls, new or existing. Make cores sleeves 1-inch minimum, larger than O.D. of conduit.
- E. Interior Walls
 - 1. Non-Fire Rated Walls
 - a. Between Unclassified Areas
 - 1) No Drop Ceiling or Below Drop Ceiling Use core drilled holes.

- 2) Above Drop Ceiling
 - a) Air Handling Space Core drill holes and seal around conduit.
 - b) Not Air Handling Space Box out wall for conduits.
- b. Between Classified or Classified/Unclassified Areas
 - 1) Use core drilled hole. In masonry wall, seal with non-shrink grout to within 3/4-inch of wall face. Seal gastight and watertight with silicone acrylic latex masonry sealant. Fill hollow masonry voids with grout.

In concrete wall, seal around conduit with modular neoprene links and stainless steel compression bolts.

- 2. Fire-Rated Wall Seals Refer to Contract Drawings for location of fire-rated walls.
- F. Access Fittings
 - 1. May be used as required to facilitate installation of conductors or where shown.
 - 2. Provide access fittings or conductors, as manufacturer recommends so as not to damage conductor or insulation during conductor pulling operations.
- G. Pull and Junction Boxes All pull and junction boxes shall be installed where shown or specified. Additional boxes may be installed as required to facilitate installation of conduit system. See also paragraph 2.01.E.2.
- H. Stamped Boxes Only for Type C conduits mounted above ceilings.

3.02. CONDUCTOR INSTALLATION

- A. Installation
 - 1. Install products in accordance with manufacturers' instructions.
 - 2. Do not pull thermoplastic wire at temperatures below 35 degrees F.
 - 3. Protect exposed cable from damage.
 - 4. Provide Kellem support grips when electrical cables hang in a vertical, sloping, or horizontal position.
 - 5. Neatly train and lace wiring inside boxes, equipment, and panelboards.
 - 6. Install electrical circuit loadings as designed on Contract Drawings unless approved otherwise by Engineer.
 - 7. Where instrumentation cables are installed in panels, etc., the Contractor shall arrange wiring to provide maximum clearance between instrumentation cables and other conductors. Instrumentation cables shall not be installed in the same bundle with conductors of other circuits.

- 8. Intrinsically safe conductors shall be in separate conduits both inside and outside enclosure and shall be terminated on terminal strips with barriers. Barriers are to physically isolate intrinsically safe conductors from non-intrinsically safe conductors.
- 9. Installation in Concrete Manholes and Handholes Neatly bundle conductors and train them around the outside (long way around) of the enclosure. Support conductors from hooks or cable supports inside of enclosure.
- 10. Wiring Diagrams
 - a. Any wiring diagrams shown on plans for hookup of equipment furnished by others are approximate and are for bidding purposes only.
 - b. Obtain wiring diagrams, certified correct for the job, from respective supplier for all equipment and systems furnished by them.
 - c. Install all work in accordance with certified wiring diagrams.
- 11. Electrical Trade to provide all power, control, and signal wiring and conduits between system components (including installation of any conductors supplied by other trades), including final connections to labeled terminal strips integral in equipment, as shown on Drawings, and in accordance with approved manufacturer's wiring diagrams. Exception is for certain HVAC conduit and wiring where specifically shown or specified to be by HVAC trade.
- B. Color Coding
 - 1. Provide color coding for all service, feeder, branch, control, fire alarm, and signaling circuit conductors.
 - 2. Grounded Conductor Color Coding in New Installations
 - a. Ground Green.
 - b. Neutrals White for 120V systems; gray for 277V systems.*

*Exception - Where neutrals of more than one system are installed in the same raceway or box, each neutral shall be white or gray with a different colored (not green) stripe.

3. In addition to existing facilities, ungrounded conductors in different voltage systems shall match the existing system and/or be as follows:

a.	120/208-volt, 3 phase:	Phase A - Black
	120/240*	Phase B - Red
		Phase C - Blue

*For high ("wild" or red) leg delta system, the high leg shall be orange.

b.	277/480-volt, 3 phase:	Phase A - Brown
		Phase B - Orange
		Phase C - Yellow

c. 120/208 or 120/240 -volt, single phase: Red and black

- d. DC Power Positive Lead Red. - Negative Lead - Black.
- e. DC Control All blue.
- f. 120-volt Control Wiring Single conductor AC control wire shall be red, except a wire entering a motor control center compartment or control panel which is an interlock shall be color coded yellow.
- g. 24-volt Control Wiring Orange.
- h. Neutral (Grounded Conductor) White or gray.
- i. Grounding Conductor Green.
- C. Conductor Sizing
 - 1. Conductor sizes that are shown for equipment branch circuits are the minimum sizes allowed. Refer to schedule in paragraph 3.02.C.2.c. below for sizing conductors on circuits longer than the minimum length shown for the various voltages. Adjust conduit sizes accordingly.
 - 2. Wiring shown without size to be sized by one of the following methods, whichever is larger. No additional payment will be made for oversized conduit or conductor.
 - a. Power and Lighting Circuits Minimum size No. 12 AWG. Quantity as required for proper operation. Use 3/4-inch conduit types as required for the area where conduit is installed.
 - b. Control Circuits Minimum size No. 14 AWG. Quantity as required for proper operation, use 3/4-inch conduit, type as required for the area where conduit is installed.
 - c. Increase minimum size conductors for 20 ampere single phase circuits where distance between power source and item served exceeds noted length in accordance with the following table. No more than 2 percent voltage drop of all branch circuits at equipment's rated full load current is permitted.

120 volts	100' to 150'	#10	151' to 225'	#8	226' up	#6
208/240 volts	100' to 175'	#10	175' to 250'	#8	251' up	#6
265/277 volts	125' to 200'	#10	201' to 300'	#8	301' up	#6
460/480 volts	225' to 350'	#10	351' to 525'	#8	526' up	#6

- d. Minimum size of branch circuits over 20 amps per requirements of NEC Tables 310.16 thru 310.31.
- 3. Neutral Wire To be equal to ungrounded wires unless otherwise shown or where connecting computers; neutral at least one size larger than ungrounded wires.
- 4. Ground Wire Minimum size as required by the NEC Table 250-122.
- D. Spare Conductors Wherever groups of control and instrumentation conductors are required, provide the following minimum numbers of spare conductors. As required, Contractor shall

increase conduit sizes shown to accommodate spare conductors. Terminate at terminal strips on both ends and mark as spare and indicate the location of opposite end.

Conductors	Spares
Up to 10	4
11 to 17	6
19 and over	8

3.03. CONDUCTOR STRANDING

A. All conductors shall be stranded except for interior lighting and receptacle circuits #10 and smaller.

3.04. CONNECTORS AND TERMINATIONS

- A. Use manufacturer's standard lugs for connection of conductors to equipment panel or devices.
- B. Use UL approved wire nuts for lighting and receptacle circuits and for other circuits, compression connectors for connection of conductors to other conductors.
- C. Terminal Board Terminations All interconnecting instrumentation wiring to terminal boards and strips to be made with insulated crimp type connectors (locking fork type). Stranded wire is not to be directly connected to terminals without the use of connectors unless the terminations are specifically made to accept bare stranded wire, i.e., tubular clamp-type termination. No loose strands shall be permitted outside of the connector, whichever is utilized.
- D. Motor Connections
 - 1. Motors Less Than 1 HP Use wire nut appropriate for the environment where the motor is located.
 - 2. Motors From 1 to 20 HP Use branch circuit crimp-type connectors.
 - 3. Motors Above 20 HP Use bolted wire connectors. Insulate the connector with insulating putty to at least 7/64 inch and tape the insulated connection with two layers half lapped of neoprene splicing tape.
- E. Splicing Make splices in accessible locations and in junction boxes. No splices will be permitted in pulling fittings or MCC wiring spaces.

3.05. GROUNDING

- A. Maintain electrical integrity of conduit system throughout. Provide bonding jumpers at fittings as required; jumpers to be no longer than required. Provide separate ground wire for all conduit systems and where grounding integrity is doubtful.
- B. Basic intent of grounding specification is that grounding conductor be completely separate from system neutral and that neutral only be connected to ground at the main service grounding point. Run equipment ground independently back to main service ground. Use separate insulated (green) grounding conductors for all grounding conductors. Where ground passes through panels and disconnects, braze ground lugs to panel or disconnect housings. Isolate neutral bus or lug from ground. Ground all conduits at each panel.

C. Shielding to be continuous and grounded at one point only unless otherwise required by equipment manufacturer's recommendations.

3.06. ELECTRICAL SUPPORTS, ANCHORS, AND FASTENERS

- A. General
 - 1. Do not drill or cut structural members.
 - 2. Obtain the Engineer's written approval of any drilling or cutting on the structure.
 - 3. Welding as a means of support is prohibited.
 - 4. Provide materials, sizes, and types of anchors, fasteners, and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products and designing system supports.
 - 5. All fasteners shall be stainless steel.
- B. Support of Boxes, Control Panels, Starters, Disconnects, and Other Similar Enclosures
 - 1. Support boxes independent of raceway using fittings designed for the application.
 - 2. The use of tie wires, section of conduit, section of pipe, scrap metal, etc., as supporting means is strictly prohibited.
 - 3. When called for on Drawings, install on existing plywood or aluminum mounting panels or stands.
 - 4. Enclosures not called to be mounted on plywood or aluminum panels or stands to be supported by 1/2-inch stainless steel electrical channel.
- C. Support of Raceways
 - 1. General Perform a thorough review of all shop drawings related to work. Determine how equipment, raceway, etc., are to be supported, mounted, or suspended, while providing:
 - a. Extra bolts, inserts, pipe stands, brackets, or any other items required for proper support.
 - b. Supporting accessories where required, whether or not shown on the Drawings.
 - 2. Support all raceways only with approved fittings. Do not hang supporting devices from any but structural members without approval of the Engineer. Deflection of any conduit shall not exceed 1/100th of span. Support all riser conduit at each floor. Rowls shall not be used.
 - a. Secure individual runs of conduit with one-hole, two-piece, PVC-coated malleable iron clamps. Stamped steel conduit straps or PVC clamps are not acceptable. Where a single conduit is hung from above, use stainless steel hanger rods and electrical channel.

- b. Secure multiple runs of conduit to stainless steel electrical channel with stainless steel supports.
- c. Raceway supports shall be spaced at intervals to meet NEC requirements. Provide supports at all bends and pull fittings.
- 3. Use stainless steel adhesive anchors on concrete or masonry walls for loads of 75 lbs. or more. For loads less than 75 lbs., drilled anchors may be used. Use precast inserts on poured-in-place concrete when installed. Use lag screws or through bolts on wood.
- 4. Install supports in a manner that does not interfere with or weaken the bolts when attaching to structural steel.
- 5. Provide standoffs for all conduit; mount conduit 1/4-inch off walls.
- 6. The use of wire is prohibited, except when conduit is installed in concrete structures and then just to secure conduit to rebar.
- 7. Provide rods, channels, angles or other structural shape to suspend conduit away from building structures.

3.07. EQUIPMENT TESTING (600 VOLTS AND BELOW)

- A. Megohmmeter Tests
 - 1. Conduct megohmmeter tests of the insulation resistance of all power and control wiring incoming service feeders. The results will be accepted when the megger shows the insulation resistance to be not less than one megohm per 100 volts at 20 degrees C using a 500-volt megger. Time of test to be one minute each between all conductors in same enclosure and each conductor and ground.
 - 2. Conduct megohmmeter testing (Insulation Resistance Test) after the cables are in place and just prior to final terminations. Record all data and submit to the Engineer. See Exhibit A at the end of this section.
- B. Operational Perform operational test to determine that all components including controls, protective and switching devices and auxiliary associated equipment are in operable condition and can function as described and shown on relevant specifications, operating instructions and drawings. Provide a tabulation of all breaker trip settings.
- C. Final Operational Check Provide a check of each item in each system to determine that it is set for proper operation. With the Engineer present, operate each system in a test run of appropriate duration to demonstrate compliance with performance requirements. If final corrections or adjustments are required, conduct additional test runs to make the final corrections or adjustments of systems refining and improving performances where possible. These additional test runs shall include noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Provide testing or inspection devices to permit observation of actual system performance are accessible. A final test run shall be conducted with both the Owner and Engineer present to demonstrate the complete system operation and to describe to the Owner the full functionality of each system.

- D. Test ground system with a ground resistivity meter. Ground is acceptable with a resistance to ground of 5 ohms or less. Test to be performed a minimum of 90 days after ground system installation. If test reading is larger than 5 ohms, add rods to the system until a read of less than 5 ohms is obtained. Provide written test data and a certification of the completed test.
- E. Cleaning and Lubrication After final performance test run of each electrical system, clean system both externally and internally, comply with manufacturer's instructions for lubrication of both power and hand operated equipment, and remove excess lubrication. Touch up minor damage to factory-painted finishes and other painting specified as electrical work. Refinish work where damage is extensive.

3.08. EQUIPMENT AND DEVICE MOUNTING HEIGHTS

- A. Mounting heights are as follows, unless otherwise noted:
 - 1. Switches 45 inches to the center.
 - 2. Enclosed Starters or Circuit Breakers
 - a. Wall Mounted 66 inches to top.
 - b. Interior Mounting Stand/Exterior Not on Tank 36 inches to center of operating handle for equipment less than 60 inches high.
 - c. Exterior Mounting on Tanks 36 inches to center.
 - 3. Panelboards 66 inches to top.
 - 4. Control Panels 72 inches to top.

(continued)

<u>EXHIBIT A</u>

TESTING AND INSPECTION ELECTRICAL INSULATION TEST RECORD INSULATION RESISTANCE TEST

		РНА	SE TO GNI	D. MEG O	HMS	PHASE TO PHASE MEG OHMS						
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END OF SECTION

Rock Cut Road Transfer Station Sanitary/Leachate System Rehabilitation 11123638.3 16055-31 ELECTRICAL WORK Addendum No. 1, Attachment No. 3

 SUMMARY OF WORK: PRESSIRE GLANALE RESTRICT DRAMAGE LINES FROM THE GRATES IN THE RUOP BRANES TO THE SAME STATE PROVIDES AND T	 SUMMARY OF WORK: PRESENCE CLEAR ALL EXCITUD DARAGE LINES FROM THE GATES IN THE FLOOR LINES: TO THE MARK THE SAME USES TO THE MARK THE MARK THE SAME USES TO THE MARK THE MARK THE MARK THE MARK THE SAME USES TO THE MARK T			w w
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					Underground facilities, structures, and utilities have been plotted from available surveys and records, and therefore their locations must be considered approximate only. There may be others, the existence of which is
					presently not known.
1	ADDENDUM NO. 1 - ADDED PIPE SIZES	IDG	BLS	08/2019	It is violation of New York State education law for any person, unless acting under the direction of a licensed professional engineer, to alter an item on
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Plot Date: 9 August 2019 - 4:07 PM

Plotted By: Ivan Gomez

Filename: G:\111\11123638 OCRRA TRANSFER STATION FEASIBILITY\TECH\Additional Work\Leachate System Upgrade\OCRRA - Leachate System Upgrade_07-26-2019.dwg





NOTES:

- 1. CONTACTS- A NORMALLY OPEN, NORMALLY CLOSED MECHANICAL MICRO SWITCH SPDT SWITCHES ARE NOT ACCEPTABLE.
- 2. CABLE- TYPE STO OR SJO CABLE OF SUFFICIENT LENGTH TO REACH THE FIRST JUNCTION BOX WITH A MINIMUM CONDUCTOR SIZE OF #18AWG.
- 3. SUFFICIENT EXCESS CABLE SHALL BE PROVIDED WITH EACH LIQUID LEVEL SENSOR TO

- 6. NUMBER OF FLOATS SHOWN ON THIS TYPICAL IS NOT NECESSARILY THE NUMBER REQUIRED FOR THE APPLICATION. REFER TO THE SCHEMATIC DIAGRAMS AND SPECIFICATION.





					Notes Underground facilities, structures, and utilities have been plotted from available surveys and records, and therefore their locations must be considered approximate only. There may be others, the existence of which is presently not known.	Bar is origin 0	
1	ADDENDUM NO.1	EPP	BLS	08/2019	It is violation of New York State education law for any person, unless acting under the direction of a licensed professional engineer, to alter an item on	Reuse of Documents	
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Plot Date: 6 August 2019 - 10:03 AM

Plotted By: Ed Partridg

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Drawn	E. PARTRIDGE	Designer	E. F
Drafting Check	T. DEVINE	Design Check	T. C
Project Director	J. HEATH	Date	08/2
This docum construction construction	nent shall not be used for unless signed and sealed for .	Scale	AS



HORIZONTAL WALL MOUNT

CONDUIT SUPPORT DETAIL

EXISTING CONC WALL

NEW CONDUIT SUPPORT 4'-0" OC -

NEW CONDUIT & CONDUIT STRAP

NEW CONDUIT &

CONDUIT STRAP

SCALE: NTS

ADJUST ITS VERTICAL POSITION 1 FOOT OF ITS ORIGINAL SETTING. 4. PROVIDE STAINLESS STEEL MOUNTING BRACKETS TO SUPPORT ALL FLOAT SWITCHES.

5. MANUFACTURER - FLYGT MODEL ENM-10, CONTEGRA FS-90, OR EQUAL.

(SINGLE BREAK) TOTALLY ENCAPSULATED IN EPOXY OR POLYURETHANE. MERCURY

3/16" STAINLESS STEEL CHAIN - TY-RAP TYP.

WEIGHT TYP.

FRAME OF ACCESS HATCH 1-5/8"STAINLESS STEEL ELECTRICAL CHANNEL





EPP

Drawn

BLS

Approved

08/2019

Date

Plot Date: 6 August 2019 - 10:04 AM

Issue

Plotted By: Ed Partridge

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It is violation of New York State education law for any person, unless acting under the direction of a licensed professional engineer, to alter an item on this drawing in anyway. If an item is altered, the altering engineer shall affix	Reuse of Documents This document and the ideas and designs incorporated herein, as an instrument of professional service, is the		GHD Consulting Services Inc. One Remington Park Drive	Project J. HEATH Director	Date 08
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ION FEASIBILITY/CADD/Drawings/Final Design/OCRRA 2017/Electrical/Pump S	Stations\111-23638-F003 dwg				



Plot Date: 6 August 2019 - 10:06 AM

Plotted By: Ed Partridge



- 1. POWER FOR BUILDING NO. 1 PUMP STATION WILL NOT BE AVAILABLE UNTIL BUILDING NO. 3 AND 4 ELECTRICAL INFRASTRUCTURE WORK IS INSTALLED AND ENERGIZED.
- 2. BUILDING NO. 1 PUMP STATION POWER TO BE ON BACK-UP POWER.

Drawn E. PARTRIDGE Designer E. PARTRI Bar is one inch on original size sheet Drafting T. DEVINE Design T. DEVINE 0 1" Check Check roject J. HEATH Date 08/2019 GHD Consulting Services Inc. Director PA OVE One Remington Park Drive 10:00 Cazenovia NY 13035 USA This document shall not be used for construction unless signed and sealed for Scale NOT TO SC **T** 1 315 679 5800 **F** 1 315 679 5801 **W** www.ghd.com © 2019 GHD construction.

		OCRRA	
RIDGE	Client ON Project DC		TY RESOURCE RECOVERY AGENCY
=	Title SA	NITARY/LEACH	ATE SYSTEM REHABILITATION -
	PA Project No.	RTIAL EXISTING	AND PROPOSED ONE-LINE DIAGRAMS
CALE	Original Size ANSI D	Sheet No. E004	Addendum No. 1, Attachment No. 7



SCALE: 1/4" =1'-0"

SCALE 1/4"=1'-0" AT ORIGINAL SIZE Notes Underground facilities, structures, and utilities have been plotted from available surveys and records, and therefore their locations must be considered approximate only. There may be others, the existence of which is presently not known. It is violation of New York State education law for any person, unless acting Reuse of Documents 1 ADDENDUM NO.1 EPP BLS 08/2019 under the direction of a licensed professional engineer, to alter an item on | This document and the ideas and designs incorporated this drawing in anyway. If an item is altered, the altering engineer shall affix herein, as an instrument of professional service, is the 0 FOR BIDDING EPP BLS 08/2019 to the item his/her seal and the notation "altered by" followed by his/her property of GHD and shall not be reused in whole or in part signature and date of such alteration and a specific description of the for any other project without GHD's written authorization. Drawn Issue Date alteration. Approved Plot Date: 6 August 2019 - 10:07 AM Plotted By: Ed Partridge Filename: G:\111\11123638 OCRRA TRANSFER STATION FEASIBILITY\CADD\Drawings\Final Design\OCRRA 2017\Electrical\Pump Stations\111-23638-E005.dwg

2'-0" 4'-0" 6'-0" 8'-0"





THIRD FLOOR PLAN NOTES:

- 1. POWER FOR BUILDING NO. 1 PUMP STATION WILL NOT BE AVAILABLE UNTIL BUILDING NO. 3 AND 4 ELECTRICAL INFRASTRUCTURE WORK IS INSTALLED AND ENERGIZED.
- 2. BUILDING NO. 1 PUMP STATION POWER TO BE ON BACK-UP POWER.
- 3. SEE PARTIAL PROPOSED ONE-LINE DIAGRAM ON SHEET E-004 FOR WIRING CONNECTIVITY OF BUILDING NO. 1 PUMP STATION DISCONNECT SWITCH.
- 4. TELECOM LANDING ZONE AND MOUNTING STAND WILL NOT BE AVAILABLE UNTIL BUILDING 3 AND 4, AND SCALES ARE SUBSTANTIALLY COMPLETE. COORDINATE WITH OWNER FOR BUILDING NO.1 PUMP STATION ALARMING DIALER ACTIVATION IF REQUIRED PRIOR TO LANDING ZONE AVAILABILITY.



ARTRIDGE	Client ON		RESOURCE RECOVERY AGENCY	
EVINE		NITARY/LEACHAT	E SYSTEM REHABILITATION -	
019	BL Project No.	JILDING 1 THIRD FL	OOR ELECTRICAL ROOM PLAN	5
= 1'-0"	Original Size ANSI D	Sheet No. E005	Addendum No. 1, Attachment No.). 8