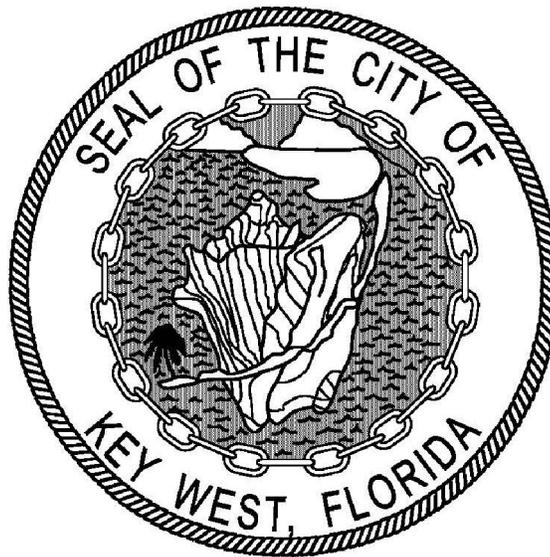


DESIGN DOCUMENTS
FOR THE CONSTRUCTION OF THE
VFD UPGRADES TO WASTEWATER
PUMP STATIONS A, B, C, D, AND DA

PREPARED FOR

CITY OF KEY WEST



VOLUME 1 OF 2
SPECIFICATIONS

For information regarding
this project, contact:

ANDREW SMYTH P.E.
6410 5th Street, Suite 2-A
Key West, FL 33040
305/294-1645

CH2MHILL[®]

CH2M HILL Project No. 476744

APRIL 2015

BID DOCUMENTS

CITY OF KEY WEST

Key West, Florida

BID DOCUMENTS

for construction of the

**VFD UPGRADES TO WASTEWATER PUMP
STATIONS A, B, C, D, AND DA**

CONSISTING OF:
BIDDING REQUIREMENTS
CONTRACT FORMS
CONDITIONS OF THE CONTRACT
TECHNICAL SPECIFICATIONS
DRAWINGS

CH2M HILL

Key West, FL

April 2015

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PART 1

PROCUREMENT REQUIREMENTS

INVITATION TO BID

Sealed Bids for the **City of Key West VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA (ITB# 15-014)**, addressed to the City of Key West, will be received at the Office of the City Clerk, City of Key West, 3126 Flagler Avenue, Key West Florida, 33040, until **3:00 p.m., local time, May 13, 2015**, and then will be publicly opened and read. Any Bids received after the time and date specified will not be considered.

Please submit two (2) originals and two (2) USB Drives with one single PDF file of the entire bid package on each USB. Bid package is to be enclosed in a sealed envelope, clearly marked on the outside **“BID FOR CONSTRUCTION OF VFD UPGRADES TO PUMP STATIONS A, B, C, D, and DA”** addressed and delivered to the City Clerk at the address noted above.

The Project proposes improvements to the City of Key West, Florida Wastewater Pump Stations A, B, C, D, and DA. The Project consists of the installation at each pump station of an electrical building on a concrete platform, installation VFDs for the existing pumps, upgrade to the existing SCADA system, site modifications, electrical and instrumentation.

Drawings and Specifications may be obtained from Demand Star by Onvia. Please contact Demand Star at www.demandstar.com or call 1-800-711-1712. Also available on the City website: www.CityofKeyWest-fl.gov.

A **Mandatory** Pre-Bid Conference will, be held in at **10:00 a.m.** on **April 27, 2015**, at the City of Key West City Manager’s Conference Room, 3132 Flagler Avenue Street, Key West, Florida, 33040.

Each Bid must be submitted on the prescribed form and accompanied by Bid security as prescribed in the Instructions to Bidders, payable to the City of Key West, Florida, in an amount not less than (5) five percent of the amount of the Bid. The Contractor shall be a licensed contractor by the State of Florida and submit proof of such with the Bid.

The Successful Bidder will be required to furnish the necessary additional bond(s) for the faithful performance of the Contract, as prescribed in the Bidding Documents. The Bidder will also be required to furnish documentation showing that they are in compliance with the licensing requirements of the State and the provisions of Chapter 66 Section 87 of the Code of Ordinances of the City of Key West. Compliance with these provisions is required before the Contractor can enter into the agreement contained in the Contract Documents. Specifically, Bidder shall demonstrate that they hold, as a minimum, the following licenses and certificates required by State Statute and local codes.

EACH BID MUST BE SUBMITTED ON THE PRESCRIBED FORM AND ACCOMPANIED BY BID SECURITY AS PRESCRIBED IN THE INSTRUCTIONS TO BIDDERS, PAYABLE TO THE CITY OF KEY WEST, FLORIDA, IN AN AMOUNT NOT LESS THAN FIVE (5) PERCENT OF THE AMOUNT BID.

THE BIDDER MUST BE A LICENSED CONTRACTOR BY THE STATE OF FLORIDA AND SUBMIT PROOF OF SUCH WITH THE BID.

The Bidder shall furnish documentation showing that he is in compliance with the licensing requirements of the provisions of Chapter 66 Section 87 of the Code of Ordinances of the City of Key West; within 10 days the following the Notice of Award and the following documentation:

1. City of Key West Tax License Receipt.

All Bid bonds, contract bonds, insurance contracts, and certificates of insurance shall be either executed by or countersigned by a licensed resident agent of the Surety or Insurance Company having his place of business in the State of Florida, and in all ways complying with the insurance laws of the State of Florida. Further, the said Surety or Insurance Company shall be duly licensed and qualified to do business in the State of Florida.

Before a Contract will be awarded for the Work contemplated herein, the City will conduct such investigation as is necessary to determine the performance record and ability of the Apparent Low Bidder to perform the size and type of work specified under this Contract. Upon request, the Bidder shall submit such information as deemed necessary by the City to evaluate the Bidder's qualifications.

For information concerning the proposed work or for appointment to visit the Site of the proposed work, contact the designated Engineer by the General Services and Utilities Department of the City of Key West.

As stated above at the time of the Bid submittal the Bidder must provide satisfactory documentation of State Licenses. The Bidder shall furnish documentation showing that they are in compliance with the licensing requirements of County, and City licenses as would be required within 10 days of the Award. The Successful Bidder must also be able to satisfy the City Attorney as to such insurance coverage and legal requirements as may be demanded by the Bid in question.

The City may reject Bids for any and/or all of the following reasons: 1) for budgetary reasons; 2) if the Bidder misstates or conceals a material fact in its Bid, 3) if the Bid does not strictly conform to the law or is non-responsive to the bid requirements; 4) if the Bid is conditional; 5) if a change of circumstances occurs making the purpose of the Bid unnecessary to the City; or 6) if such rejection is in the best interest of the City. The City may also waive any minor formalities or irregularities in any Bid.

Dated this _____ day of _____, 20_____

CITY OF KEY WEST

By _____
Jim Scholl, City Manager

END OF SECTION

STATEMENT OF NO BID #ITB 15-014

VFD UPGRADES TO WASTEWATER PUMP STSTIONS A, B, C, D, AND DA

NOTE: IF YOU DO NOT INTEND TO BID, PLEASE RETURN THIS FORM ONLY

CITY OF KEY WEST
FINANCE DEPARTMENT
P.O. BOX 1409
KEY WEST, FLORIDA 33040
ATTN: S. SNIDER

We, the undersigned have declined to bid on the above-noted Invitation to Bid for the following reason(s):

- ___ Insufficient time to respond to Invitation to Bid
- ___ Do not offer this product
- ___ Our schedule will not permit us to perform
- ___ Unable to meet specifications
- ___ Specifications unclear (please explain below)
- ___ Remove us from your "Bidder Mailing List"
- ___ Other (Please specify below)

We understand that if a "No Bid" statement is not returned, our name may be removed from the Bidder's list of the City of Key West.

COMPANY
NAME: _____

AUTHORIZED
AGENT _____

COMPANY
ADDRESS _____

DATE: _____ TELEPHONE: _____

INSTRUCTIONS TO BIDDERS

1. CONTRACT DOCUMENTS

1.1. Format: The Contract Documents are divided into parts, divisions, and sections for convenient organization and reference. Generally, there has been no attempt to divide the Specification sections into work performed by the various building trades, Work by separate subcontractors, or work required for separate facilities in the Project.

1.2. Document Interpretation:

1.2.1. The separate sections contained within these Contract Documents are intended to be mutually cooperative and to provide all details reasonably required for the execution of the proposed Work.

1.2.2. Should there be any doubt as to the meaning or intent of said Contract Documents, the Bidder should request of the Engineer, in writing (at least 6 working days prior to Bid opening) an interpretation thereof. Any interpretation or change in said Contract Documents will be made only in writing, in the form of Addenda to the Documents which will be furnished to all registered holders of Contract Documents. Bidders shall submit with their Bid, or indicate receipt of, all Addenda. The Owner will not be responsible for any other explanation or interpretations of said Documents.

1.3. Drawings: Details of construction are bound separately.

2. GENERAL DESCRIPTION OF THE PROJECT

2.1. A general description of the Work to be done is contained in the Invitation to Bid. The scope is specified in applicable parts of these Contract Documents.

3. QUALIFICATION OF CONTRACTORS

3.1. The prospective Bidders must meet the statutorily prescribed requirements before award of Contract by the Owner.

3.2. Bidders must hold or obtain all licenses or certificates required by federal, state, or local statutes, or regulations in order to Bid and perform the Work specified herein.

4. BIDDER'S UNDERSTANDING

4.1. Each Bidder must inform himself of the conditions relating to the execution of the Work, and it is assumed that he will inspect the site and make himself thoroughly familiar with all the Contract Documents. Failure to do so will not relieve the successful Bidder of his obligation to enter into a Contract and complete the contemplated Work in strict accordance with the Contract Documents. It shall be the Bidder's obligation to verify for himself and to his complete satisfaction all information concerning site and subsurface conditions.

4.2. The Owner will make available to prospective Bidders upon request and at the office of the Engineer, prior to Bid opening, any information that he may have as to subsurface conditions and surface topography at the Work Site.

4.3. Information derived from inspection of topographic maps, or from Drawings showing location of utilities and structures will not in any way relieve the Contractor from any risk, or from properly examining the Site and making such additional investigations as he may elect, or from properly fulfilling all the terms of the Contract Documents.

4.4. Each Bidder shall inform himself of, and the Bidder awarded a Contract shall comply with, federal, state, and local laws, statutes, and ordinances relative to the execution of the Work. This requirement includes, but is not limited to, applicable regulations concerning minimum wage rates, nondiscrimination in the employment of labor, protection of public and employee safety and health, environmental protection, the protection of natural resources, fire protection, burning and non-burning requirements, permits, fees, and similar subjects.

5. TYPE OF PROPOSAL

5.1. Lump Sum:

5.1.1. The Proposal for the Work is to be submitted on a lump sum basis. All items required to complete the Work specified or shown on the Drawings but not included in the Proposal shall be considered incidental to those set forth in the Proposal. Payment to the Contractor will be made on the measurement of the Work actually performed by the Contractor as specified in the Contract Documents.

6. PREPARATION OF PROPOSALS

6.1. General:

6.1.1. All blank spaces in the Bid form must be filled in for all schedules and associated parts, as required, preferably in BLACK ink. All price information shall be clearly shown in figures where required. No changes shall be made in the phraseology of the forms. In case of discrepancy between unit prices and extended totals, unit prices shall prevail.

6.1.2. Any Bid shall be deemed informal which contains omissions, erasures, alterations, or additions of any kind, or prices uncalled for, or in which any of the prices are obviously unbalanced, or which in any manner shall fail to conform to the conditions of the published Invitation to Bid.

6.1.3. Only one Bid from any individual, firm, partnership, or corporation, under the same or different names, will be considered. Should it appear to the Owner that any Bidder is interested in more than one Bid for work contemplated, all Bids in which such Bidder is interested will be rejected.

6.2. Description of Suppliers: The manufacturer name, trade name, brand name, or catalog number used in the Specifications is for the purpose of describing and establishing equipment that has been presented for this Project. Other equipment will not be accepted.

6.3. Signature: The Bidder shall sign his Bid in the blank space provided therefore. If Bidder is a corporation, the legal name of the corporation shall be set forth above, together with the signature of the officer or officers authorized to sign Contracts on behalf of the corporation. If Bidder is a partnership, the true name of the firm shall be set forth above, together with the signature of the partner or partners authorized to sign Contracts in behalf of the partnership. If signature is by an agent, other than an officer of a corporation or a member of a partnership, a notarized power-of-attorney must be on file with the Owner prior to opening of Bids or submitted with the Bid, otherwise the Bid will be regarded as not properly authorized.

6.4. Special Bidding Requirements:

6.4.1. The Bidder's attention is brought to the hiring practices and licenses and permits of the City of Key West.

6.4.2. The Bidder shall submit with his Bid his experience record showing his experience and expertise in construction of electrical systems, civil/site construction, and wastewater pumping stations. The Contractor shall also be responsible for restoration work (e.g., pavement, curbing, landscape, etc.). Such experience record shall provide at least five current or recent projects of similar work, preferably within Florida or the southeastern United States. For each project the following information shall be provided:

6.4.2.1. Description and location of work.

6.4.2.2. Contract amount.

6.4.2.3. Dates work was performed.

6.4.2.4. Owner.

6.4.2.5. Name of Owner's contact person and phone number.

6.4.2.6. Engineer.

6.4.2.7. Name of Engineer's contact person and phone number.

6.5. Attachments:

6.5.1. Bidder shall complete and submit the following forms with this Bid:

6.5.1.1. Anti-Kickback Affidavit.

6.5.1.2. Public Entity Crimes.

6.5.1.3. Key West Indemnification Form.

6.5.1.4. Disclosure of Lobbying Activities.

6.5.1.5. Non-Collusion Declaration and Compliance with 49 CFR §29.

6.5.1.6. Florida Trench Safety Act Compliance.

6.5.1.7. Suspension and Debarment Certification.

6.5.1.8. Equal Benefits for Domestic Partners Affidavit.

6.5.1.9. Cone of Silence.

6.6. Public Entity Crimes: A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a Bid on a contract to provide any goods or services to a public entity, may not submit a Bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit Bids on leases of real property to a public entity, may not be awarded or perform work as a Contractor, Supplier, Subcontractor, or consultant under a contract with any public entity and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, for CATEGORY TWO for a period of 36 months from the date of being placed on the convicted vendor list.”

6.7. City of Key West License Required: Contractor is required to have a Certified or registered Electrical Contractors City of Key West license and a Certified or Registered General Contractors City of Key West license. License fees not to exceed \$350.00. License shall be obtained within 10 (ten) days of Notice of Award.

6.8. Anti-Kickback Affidavit: The Bidder shall submit a signed and notarized Anti-Kickback Affidavit with Bid on the form provided herein.

- 6.9. Florida Trench Safety Act: The Bidders attention is directed to the enactment of the Florida Trench Safety Act which incorporates OSHA Standards 29CFRs 1926.650, Subpart P, as the state's trench excavation safety standards. The Bidder shall list separately, in the Bid, the cost of compliance with these standards on a linear footage basis and the method of compliance. The Bidder shall determine if special shoring requirements are needed. Special shoring shall be identified in the Bid. The successful Bidder is fully responsible for the design of the trench safety system and the compliance with the applicable standards for the Project.
7. STATE AND LOCAL SALES AND USE TAXES
- 7.1. Unless the Supplementary Conditions contains a statement that the Owner is exempt from state sales tax on materials incorporated into the work due to the qualification of the Work under this Contract, all state and local sales and use taxes, as required by the laws and statutes of the state and its political subdivisions, shall be paid by the Contractor. Prices quoted in the Bid shall include all nonexempt sales and use taxes, unless provision is made in the Bid form to separately itemize the tax.
8. SUBMISSION OF PROPOSALS
- 8.1. All Bids must be submitted not later than the time prescribed, at the place, and in the manner set forth in the Invitation to Bid. Bids must be made on the Bid forms provided herewith. The Bidder shall submit **TWO (2) ORIGINALS and TWO (2) USB DRIVES WITH A SINGLE PDF FILE OF THE FULL PROPOSAL** and all required bonds, attachments, and forms.
- 8.2. Each Bid must be submitted in two sealed envelope one within the other, so marked as to indicate the Bidder's name and its contents without being opened, and addressed in conformance with the instructions in the Invitation to Bid.
9. MODIFICATION OR WITHDRAWAL OF PROPOSALS
- 9.1. Prior to the time and date designated for receipt of Bids, any Bid submitted may be withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder or by telegram. If by telegram, written confirmation over the signature of the Bidder shall be mailed and postmarked on or before the date and time set for receipt of Bids. No Bid may be withdrawn after the time scheduled for opening of Bids, unless the time specified in paragraph Award of Contract of these Instructions to Bidders shall have elapsed.

10. BID SECURITY

10.1. Bids must be accompanied by cash, a certified check, or cashier's check drawn on a bank in good standing, or a Bid bond issued by a Surety authorized to issue such bonds in the state where the work is located, in the amount of 5 percent of the total amount of the Bid submitted. This Bid security shall be given as a guarantee that the Bidder will not withdraw his Bid for a period of 180 days after Bid opening, and that if awarded the Contract, the successful Bidder will execute the attached Contract and furnish properly executed Performance and Payment Bonds, each in the full amount of the Contract price within the time specified.

10.2. The Attorney-in-Fact who executes this bond in behalf of the Surety must attach a notarized copy of his power-of-attorney as evidence of his authority to bind the Surety on the date of execution of the bond. Where State Statute requires, certification by a resident agent shall also be provided.

10.3. If the Bidder elects to furnish a Bid Bond, he shall use the Bid Bond form bound herewith, or one conforming substantially thereto in form and content.

11. RETURN OF BID SECURITY

11.1. Within 15 days after the award of the Contract, the Owner will return the Bid securities to all Bidders who's Bids are not to be further considered in awarding the Contract. Retained Bid securities will be held until the Contract has been finally executed, after which all Bid securities, other than Bidders' bonds and any guarantees which have been forfeited, will be returned to the respective Bidders whose Bids they accompanied.

12. AWARD OF CONTRACT

12.1. The Award will be made under one Contract by the Owner on the basis of the Bid from the lowest, responsive, responsible Bidder. The Owner may award entire Bid or selected line items based on the City's best interest and available funds at time of Award.

12.2. Within 90 calendar days after the opening of Bids, the Owner will accept one of the Bids or will act in accordance with the following paragraphs. The acceptance of the Bid will be by written notice of award, mailed to the office designated in the Bid, or delivered to the Bidder's representative. In the event of failure of the lowest responsive, responsible Bidder to sign the Contract and provide an acceptable Performance Bond, Payment Bond, insurance certificate(s) and evidence of holding required licenses and certificates, the Owner may award the Contract to the next lowest responsive, responsible Bidder. Such award, if made, will be made within 105 days after the opening of Bids. Bidders will guarantee their Bid price(s) for up to 105 calendar days after Bid opening.

12.3. The Owner reserves the right to accept or reject any or all Bids, and to waive any informalities and irregularities in said Bids.

13. EXECUTION OF CONTRACT

13.1. The successful Bidder shall, within 10 working days after receiving Notice of Award, sign and deliver to the Owner a Contract in the form hereto attached, together with the insurance certificate examples of the bonds as required in the Contract Documents and evidence of holding required licenses and certificates. Within 10 working days after receiving the signed Contract from the successful Bidder, the Owner's authorized agent will sign the Contract. Signature by both parties constitutes execution of the Contract.

14. CONTRACT BONDS

14.1. Performance and Payment Bonds: The successful Bidder shall file with the Owner, at the time of delivery of the signed Contract, a Performance Bond and Payment Bond on the form bound herewith, each in the full amount of the Contract price in accordance with the requirements of Florida Statutes Section 255.05 or 713.23, as applicable, as security for the faithful performance of the Contract and the payment of all persons supplying labor and materials for the construction of the work, and to cover all guarantees against defective workmanship or materials, or both, during the warranty period following the date of final acceptance of the work by the Owner. The Surety furnishing this bond shall have a sound financial standing and a record of service satisfactory to the Owner, shall be authorized to do business in the State of Florida, and shall be listed on the current U.S. Department of Treasury Circular Number 570, or amendments thereto in the Federal Register, of acceptable Sureties for federal projects.

14.2. Power-of-Attorney:

14.2.1. The Attorney-in-Fact (Resident Agent in state which work is being performed) who executes this Performance and Payment Bond in behalf of the Surety must attach a notarized copy of his power-of-attorney as evidence of his authority to bind the Surety on the date of execution of the bond.

14.2.2. All Contracts, Performance and Payment Bonds, and respective powers-of-attorney will have the same date.

15. FAILURE TO EXECUTE CONTRACT AND FURNISH BOND

15.1. The Bidder who has a Contract awarded to him and who fails to promptly and properly execute the Contract or furnish the required Bonds shall forfeit the Bid security that accompanied his Bid, and the Bid security shall be retained as liquidated damages by the Owner, and it is agreed that this said sum is a fair estimate of the amount of damages the Owner will sustain in case the Bidder fails to enter into a Contract or furnish the required Bonds. Bid security deposited in the form of cash, a certified check, or cashier's check shall be subject to the same requirement as a Bid Bond.

16. TIME OF COMPLETION

16.1. The time of completion of the work to be performed under this Contract is the essence of the Contract. Delays and extensions of time may be allowed in accordance with the provisions stated in the General Conditions. The time allowed for the completion of the work authorized is stated in the Bid.

17. LOCAL PREFERENCE

17.1. City of Key West Policy of Local Preference is applied to Bids submitted by qualified local business, per City Code Section 02-798.

18. MANDATORY PRE-BID CONFERENCE

18.1. A **mandatory** Pre-Bid Conference will be held by the City of Key West **on Monday, April 27, 2015**. The meeting will take place at City Manager's Conference Room, 3132 Flagler Avenue, Key West, Florida, 33040 beginning at 10:00 a.m. The City of Key West requires attendance by all prospective Bidders. The purpose of the meeting will be to discuss particular requirements and answer questions of the prospective Bidders relative to completing this project. Bids from Bidders that do not attend this Pre-bid Conference will be considered non-responsive and not accepted for consideration of this work by the City of Key West.

END OF SECTION

NOTE TO BIDDER: Use preferably BLACK ink for completing this Bid form.

BID FORM

To: The City of Key West

Address: 3126 Flagler Avenue, Key West, Florida 33040

Project Title: ITB #15-014/ VFD Upgrades to Wastewater Pump
Stations A, B, C, D, and DA

CH2M HILL Project No.: 476744

City of Key West Project No.: SE 1101

Bidder's person to contact for additional information on this Bid:

Company Name: _____

Contact Name: _____

Telephone: _____

1. BIDDER'S DECLARATION AND UNDERSTANDING

1.1. The undersigned, hereinafter called the Bidder, declares that the only persons or parties interested in this Bid are those named herein, that this Bid is, in all respects, fair and without fraud, that it is made without collusion with any official of the Owner, and that the Bid is made without any connection or collusion with any person submitting another Bid on this Contract.

1.2. The Bidder further declares that he has carefully examined the Contract Documents for the construction of the project, that he has personally inspected the site, that he has satisfied himself as to the quantities involved, including materials and equipment, and conditions of work involved, including the fact that the description of the quantities of work and materials, as included herein, is brief and is intended only to indicate the general nature of the Work and to identify the said quantities with the detailed requirements of the Contract Documents, and that this Bid is made according to the provisions and under the terms of the Contract Documents, which Documents are hereby made a part of this Bid.

1.3. The Bidder further agrees, as evidenced by signing the Bid, that if awarded a Contract, the Florida Trench Safety Act and applicable trench safety standards will be complied with.

2. CONTRACT EXECUTION AND BONDS

2.1. The Bidder agrees that if this Bid is accepted, he will, within 10 days, not including Sundays and legal holidays, after Notice of Award, sign the Contract in the form annexed hereto, and will at that time, deliver to the Owner examples of the Performance Bond and Payment Bond required herein, and evidence of holding required licenses and certificates, and will, to the extent of his Bid, furnish all machinery, tools, apparatus, and other means of construction and do the Work and furnish all the materials necessary to complete all work as specified or indicated in the Contract Documents.

3. CERTIFICATES OF INSURANCE

3.1. Bidder agrees to furnish the Owner, before commencing the Work under this Contract, the certificates of insurance as specified in these Documents.

4. START OF CONSTRUCTION AND CONTRACT COMPLETION TIMES

4.1. The Bidder agrees to begin work within 10 calendar days after the date of the Notice to Proceed and to achieve Substantial Completion within 330 calendar days from the date when the Contract Times commence to run as provided in paragraph 2.03.A of the General Conditions, and Work will be completed and ready for final payment and acceptance in accordance with paragraph 14.07 of the General Conditions within 360 calendar days from the date when the Contract Times commence to run.

5. LIQUIDATED DAMAGES

5.1. In the event the Bidder is awarded the Contract, Owner and Bidder recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in paragraph Start of Construction and Contract Completion Times above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. Owner and Bidder also recognize the delays, expense, and difficulties involved in proving in a legal or other dispute resolution proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Bidder agree that as liquidated damages for delay (but not as a penalty) Bidder shall pay Owner \$3,000.00 per day for each day that expires after the time specified for each substantial completion.

5.2. After Substantial Completion, if Bidder neglects, refuses, or fails to complete the remaining Work within the Contract Times or any Owner-granted extension thereof, Bidder shall pay Owner \$1,000.00 for each day that expires after the time specified in paragraph Start of Construction and Contract Completion Times, above for completion and readiness for final payment. Liquidated damages shall run concurrent.

- 5.3. Owner will recover such liquidated damages by deducting the amount owed from the final payment or any retainage held by Owner.
6. ADDENDA
- 6.1. The Bidder hereby acknowledges that he has received Addenda Nos. _____, _____, _____, _____, (Bidder shall insert No. of each Addendum received) and agrees that all addenda issued are hereby made part of the Contract Documents, and the Bidder further agrees that his Bid(s) includes all impacts resulting from said addenda.
7. SALES AND USE TAXES
- 7.1. The Bidder agrees that all federal, state, and local sales and use taxes are included in the stated Bid Prices for the Work. Cash allowances DO NOT include any sales and use tax. Equipment allowance includes taxes as shown in Equipment Suppliers' Bid.
8. PUBLIC ENTITY CRIMES
- 8.1. "A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, for Category Two for a period of 36 months from the date of being placed on the convicted vendor list."
9. LUMP SUM ITEMS
- 9.1. The Bidder further proposes to accept as full payment for the Work proposed herein the amounts computed under the provisions of the Contract Documents and based on the following lump sum amounts. The Bidder agrees that the lump sums represent a true measure of labor and materials required to perform the Work, including all allowances for overhead and profit for each type and unit of work called for in these Contract Documents.

10. UNFORESEEN CONDITIONS ALLOWANCE

10.1. Bidder further agrees that the amount shown is an estimated amount to be included in the Total Base Bid for unforeseen conditions and conflicts. Bidder further acknowledges that payment will be based on actual costs as determined in conformance with the Contract Documents and as authorized by Work Change Directive. The Owner will negotiate with the Contractor how each Allowance will be spent prior to performing the work.

11. PERMIT ALLOWANCE

11.1. Bidder further acknowledges that this amount shown is an estimated amount to be included in the Total Base Bid for any Permits required by the City of Key West and any Regulatory Agency Permit(s). Bidder acknowledges that payment will be based on actual cost for the permit(s).

12. LANDSCAPE ALLOWANCE

12.1. Bidder further acknowledges that the amount shown is an estimated amount to be included in the Total Base Bid for any landscaping required by the City of Key West. Bidder further acknowledges that payment will be based on actual costs as determined in conformance with the Contract Documents and as authorized by Work Change Directive. The Owner will negotiate with the Contractor how each Allowance will be spent prior to performing the Work.

13. KEYS ENERGY SERVICE ALLOWANCE

13.1. Bidder further agrees that the amount shown is an estimated amount to be included in the Total Base Bid to cover payment to Keys Energy Service for electrical service. Bidder further acknowledges that payment will be based on actual amount paid as indicated by appropriate invoice.

Lump Sum Bid Price

A.	Pump Station A	\$_____
B.	Pump Station B	\$_____
C.	Pump Station C	\$_____
D.	Pump Station D	\$_____
E.	Pump Station DA	\$_____
F.	Unforeseen Conditions Allowance	<u>\$300,000.00</u>

G.	Permit Allowance	<u>\$250,000.00</u>
H.	Landscape Allowance	<u>\$25,000.00</u>
I.	Keys Energy Allowance	<u>\$50,000.00</u>

TOTAL BASE BID \$ _____
(Numerals)

_____ Dollars
(Amount written in words has precedence)

and _____ Cents

ADDITIVE ALTERNATE NO. 1:

This alternative is for the upgrade of fence and gate at Pump Station A from the existing chainlink fence and gate to Aluminum Fence Section: Detail 3231-430 on Drawing 090-C-501. The alternative includes all labor, equipment, and necessary appurtenances.

\$ _____

ADDITIVE ALTERNATE NO. 2:

This alternative is for the upgrade of fence and gate at Pump Station B from the existing chainlink fence and gate to Aluminum Fence Section: Detail 3231-430 on Drawing 090-C-501. The alternative includes all labor, equipment, and necessary appurtenances.

\$ _____

ADDITIVE ALTERNATE NO. 3:

This alternative is for the upgrade of fence and gate at Pump Station DA from the existing chainlink fence and gate to Aluminum Fence Section: Detail 3231-430 on Drawing 090-C-501. The alternative includes all labor, equipment, and necessary appurtenances.

\$ _____

ADDITIVE ALTERNATE NO. 4:

This alternative is for the upgrade of fence and gates at Pump Station D from the existing chainlink fence and gate to Aluminum Fence Section: Detail 3231-430 on Drawing 090-C-501. The alternative includes all labor, equipment, and necessary appurtenances. The block fence and wood fence remain and is not included.

\$ _____

Bidder

The name of the Bidder submitting this Bid is _____

_____ doing business at

Street City State Zip

which is the address to which all communications concerned with this Bid and with the Contract shall be sent.

The names of the principal officers of the corporation submitting this Bid, or of the partnership, or of all persons interested in this Bid as principals are as follows:

If Sole Proprietor or Partnership

IN WITNESS hereto the undersigned has set his (its) hand this _____ day of _____, 20_____.

Signature of Bidder

Title

If Corporation

IN WITNESS WHEREOF the undersigned corporation has caused this instrument to be executed and its seal affixed by its duly authorized officers this ___ day of _____, 20__.

(SEAL)

Name of Corporation

By: _____

Title: _____

Attest: _____
Secretary

END OF SECTION

FLORIDA BID BOND

BOND NO. _____

AMOUNT: \$ _____

KNOW ALL MEN BY THESE PRESENTS, that _____

hereinafter called the Contractor (Principal), and _____

a corporation duly organized and existing under and by virtue of the laws of the State of Florida, hereinafter called the Surety, and authorized to transact business within the State of Florida, as Surety, are held and firmly bound unto The City of Key West as Owner.

(Obligee), in the sum of: _____

_____ DOLLARS (\$ _____), for the payment for which we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS BOND IS SUCH THAT:

WHEREAS, the Principal is herewith submitting his or its Bid Proposal for Construction of the VFD Upgrades To Wastewater Pump Stations A, B, C, D, and DA, Key West, Florida, said Bid Proposal, by reference thereto, being hereby made a part hereof.

WHEREAS, the Principal contemplates submitting or has submitted a bid to the Obligee for the furnishing of all labor, materials (except those to be specifically furnished by the Owner), equipment, machinery, tools, apparatus, means of transportation for, and the performance of the work covered in the Proposal and the detailed Drawings and Specifications, entitled:

VFD UPGRADES TO WASTEWATER PUMP STATIONS A, B, C, D, AND DA

WHEREAS, it was a condition precedent to the submission of said bid that a cashier's check, certified check, or bid bond in the amount of 5 percent of the base bid be submitted with said bid as a guarantee that the Bidder would, if awarded the Contract, enter into a written Contract with the Owner for the performance of said Contract, within 10 working days after written notice having been given of the award of the Contract.

NOW, THEREFORE, the conditions of this obligation are such that if the Principal within 10 consecutive calendar days after written notice of such acceptance, enters into a written Contract with the Oblige and furnishes the Performance and Payment Bonds, each in an amount equal to 100 percent of the awarded base bid, satisfactory to the Owner, then this obligation shall be void; otherwise the sum herein stated shall be due and payable to the Oblige and the Surety herein agrees to pay said sum immediately upon demand of the Oblige in good and lawful money of the United States of America, as liquidated damages for failure thereof of said Principal.

Signed and sealed this _____ day of _____, 20_____.

Principal

By: _____

Surety

By: _____

Attorney-In-Fact

END OF SECTION

ANTI-KICKBACK AFFIDAVIT

STATE OF FLORIDA)
 : SS
COUNTY OF MONROE)

I, the undersigned hereby duly sworn, depose and say that no portion of the sum herein bid will be paid to any employees of the City of Key West as a commission, kickback, reward or gift, directly or indirectly by me or any member of my firm or by an officer of the corporation.

By: _____

Sworn and subscribed before me this
____ day of _____, 20__

NOTARY PUBLIC, State of Florida
at Large

My Commission Expires: _____

END OF SECTION

**SWORN STATEMENT UNDER SECTION 287.133(3)(A)
FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES**

*THIS FORM MUST BE SIGNED IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICER
AUTHORIZED TO ADMINISTER OATHS.*

1. This sworn statement is submitted with Bid or Proposal for VFD Upgrades to Pump Stations A, B, C, D, and DA,
City of Key West, Florida

2. This sworn statement is submitted by _____
(name of entity submitting sworn statement)

whose business address is _____

_____ and (if applicable) its Federal Employer
Identification Number (FEIN) is _____

(If the entity has no FEIN, include the Social Security Number of the individual signing this
sworn statement) _____

3. My name is _____
(please print name of individual signing)

and my relationship to the entity named above is _____

4. I understand that a “public entity crime” as defined in Paragraph 287.133(1)(g), Florida Statutes, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or with the United States, including but not limited to, any bid or contract for goods or services to be provided to any public or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, material misrepresentation.

5. I understand that “convicted” or “conviction” as defined in Paragraph 287.133(1)(b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without an adjudication guilt, in any federal or state trial court of record relating to charges brought by indictment information after July 1, 1989, as a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contendere.

6. I understand that an “affiliate” as defined in Paragraph 287.133(1)(a), Florida Statutes, means
 1. A predecessor or successor of a person convicted of a public entity crime; or
 2. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term “affiliate” includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in the management of an affiliate. The ownership by one person of shares constituting controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm’s length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

- 7. I understand that a "person" as defined in Paragraph 287.133(1)(8), Florida Statutes, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts for the provision of goods or services let by a public entity, or which otherwise transacts or applies to transact business with public entity. The term "person" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity.
- 8. Based on information and belief, the statement which I have marked below is true in relation to the entity submitting this sworn statement. (Please indicate which statement applies).

___ Neither the entity submitting this sworn statement, nor any officers, directors, executives, partners, shareholders, employees, members, or agents who are active in management of the entity, nor any affiliate of the entity have been charged with and convicted of a public entity crime subsequent to July 1, 1989, AND (Please indicate which additional statement applies.)

___ There has been a proceeding concerning the conviction before a hearing of the State of Florida, Division of Administrative Hearings. The final order entered by the hearing officer did not place the person or affiliate on the convicted vendor list. (Please attach a copy of the final order.)

___ The person or affiliate was placed on the convicted vendor list. There has been a subsequent proceeding before a hearing officer of the State of Florida, Division of Administrative Hearings. The final order entered by the hearing officer determined that it was in the public interest to remove the person or affiliate from the convicted vendor list. (Please attach a copy of the final order.)

___ The person or affiliate has not been put on the convicted vendor list. (Please describe any action taken by or pending with the Department of General Services.)

(signature)

(date)

STATE OF _____

COUNTY OF _____

PERSONALLY APPEARED BEFORE ME, the undersigned authority,

_____ who, after first being sworn by me, affixed his/her
(name of individual signing)

signature in the space provided above on this ____ of _____, 20 ____.

My commission expires:

NOTARY PUBLIC

CITY OF KEY WEST INDEMNIFICATION FORM

To the fullest extent permitted by law, the CONTRACTOR expressly agrees to indemnify and hold harmless the City of Key West, their officers, directors, agents and employees *(herein called the "indemnitees") from liabilities, damages, losses and costs, including but not limited to, reasonable attorney's fees and court costs, such legal expenses to include costs incurred in establishing the indemnification and other rights agreed to in this Paragraph, to persons or property, to the extent caused by the negligence, recklessness, or intentional wrongful misconduct of the CONTRACTOR, its Subcontractors or persons employed or utilized by them in the performance of the Contract. Claims by indemnitees for indemnification shall be limited to the amount of CONTRACTOR's insurance or \$1 million per occurrence, whichever is greater. The parties acknowledge that the amount of the indemnity required hereunder bears a reasonable commercial relationship to the Contract and it is part of the Project Specifications or the Bid Documents, if any.

The indemnification obligations under the Contract shall not be restricted in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the CONTRACTOR under Workers' Compensation acts, disability benefits acts, or other employee benefits acts, and shall extend to and include any actions brought by or in the name of any employee of the CONTRACTOR or of any third party to whom CONTRACTOR may subcontract a part or all of the Work. This indemnification shall continue beyond the date of completion of the Work.

CONTRACTOR: _____

SEAL:

Address

Signature

Print Name

Title

DATE: _____

City Ordinance Sec. 2-799
Requirements for City Contractors to Provide Equal Benefits for Domestic Partners

- (a) Definitions. For purposes of this section only, the following definitions shall apply:
- (1) **Benefits** means the following plan, program or policy provided or offered by a contractor to its employees as part of the employer's total compensation package: sick leave, bereavement leave, family medical leave, and health benefits.
 - (2) **Bid** shall mean a competitive bid procedure established by the city through the issuance of an invitation to bid, request for proposals, request for qualifications, or request for letters of interest.
 - (3) **Cash equivalent** means the amount of money paid to an employee with a domestic partner in lieu of providing benefits to the employee's domestic partner. The cash equivalent is equal to the employer's direct expense of providing benefits to an employee for his or her spouse.

The cash equivalents of the following benefits apply:

- a. For bereavement leave, cash payment for the number of days that would be allowed as paid time off for the death of a spouse. Cash payment would be in the form of the wages of the domestic partner employee for the number of days allowed.
 - b. For health benefits, the cost to the contractor of the contractor's share of the single monthly premiums that are being paid for the domestic partner employee, to be paid on a regular basis while the domestic partner employee maintains such insurance in force for himself or herself.
 - c. For family medical leave, cash payment for the number of days that would be allowed as time off for an employee to care for a spouse who has a serious health condition. Cash payment would be in the form of the wages of the domestic partner employee for the number of days allowed.
- (4) **Contract** means any written agreement, purchase order, standing order or similar instrument entered into pursuant to the award of a bid whereby the city is committed to expend or does expend funds in return for work, labor, professional services, consulting services, supplies, equipment, materials, construction, construction related services or any combination of the foregoing.
 - (5) **Contractor** means any person or persons, sole proprietorship, partnership, joint venture, corporation, or other form of doing business, that is awarded a bid and enters into a covered contract with the city, and which maintains five (5) or more full-time employees.
 - (6) **Covered contract** means a contract between the city and a contractor awarded subsequent to the date when this section becomes effective valued at over twenty thousand dollars (\$20,000).

- (7) **Domestic partner** shall mean any two adults of the same or different sex, who have registered as domestic partners with a governmental body pursuant to state or local law authorizing such registration, or with an internal registry maintained by the employer of at least one of the domestic partners. A contractor may institute an internal registry to allow for the provision of equal benefits to employees with domestic partner who do not register their partnerships pursuant to a governmental body authorizing such registration, or who are located in a jurisdiction where no such governmental domestic partnership registry exists. A contractor that institutes such registry shall not impose criteria for registration that are more stringent than those required for domestic partnership registration by the City of Key West pursuant to Chapter 38, Article V of the Key West Code of Ordinances.
- (8) **Equal benefits** mean the equality of benefits between employees with spouses and employees with domestic partners, and/or between spouses of employees and domestic partners of employees.
- (b) Equal benefits requirements.
- (1) Except where otherwise exempt or prohibited by law, a Contractor awarded a covered contract pursuant to a bid process shall provide benefits to domestic partners of its employees on the same basis as it provides benefits to employees' spouses.
 - (2) All bid requests for covered contracts which are issued on or after the effective date of this section shall include the requirement to provide equal benefits in the procurement specifications in accordance with this section.
 - (3) The city shall not enter into any covered contract unless the contractor certifies that such contractor does not discriminate in the provision of benefits between employees with domestic partners and employees with spouses and/or between the domestic partners and spouses of such employees.
 - (4) Such certification shall be in writing and shall be signed by an authorized officer of the contractor and delivered, along with a description of the contractor's employee benefits plan, to the city's procurement director prior to entering into such covered contract.
 - (5) The city manager or his/her designee shall reject a contractor's certification of compliance if he/she determines that such contractor discriminates in the provision of benefits or if the city manager or designee determines that the certification was created, or is being used for the purpose of evading the requirements of this section.

- (6) The contractor shall provide the city manager or his/her designee, access to its records for the purpose of audits and/or investigations to ascertain compliance with the provisions of this section, and upon request shall provide evidence that the contractor is in compliance with the provisions of this section upon each new bid, contract renewal, or when the city manager has received a complaint or has reason to believe the contractor may not be in compliance with the provisions of this section. This shall include but not be limited to providing the city manager or his/her designee with certified copies of all of the contractor's records pertaining to its benefits policies and its employment policies and practices.
 - (7) The contractor may not set up or use its contracting entity for the purpose of evading the requirements imposed by this section.
- (c) Mandatory contract provisions pertaining to equal benefits. Unless otherwise exempt, every covered contract shall contain language that obligates the contractor to comply with the applicable provisions of this section. The language shall include provisions for the following:
- (1) During the performance of the covered contract, the contractor certifies and represents that it will comply with this section.
 - (2) The failure of the contractor to comply with this section will be deemed to be a material breach of the covered contract.
 - (3) If the contractor fails to comply with this section, the city may terminate the covered contract and all monies due or to become due under the covered contract may be retained by the city. The city may also pursue any and all other remedies at law or in equity for any breach.
 - (4) If the city manager or his designee determines that a contractor has set up or used its contracting entity for the purpose of evading the requirements of this section, the city may terminate the covered contract.
- (d) Enforcement. If the contractor fails to comply with the provisions of this section:
- (1) The failure to comply may be deemed to be a material breach of the covered contract; or
 - (2) The city may terminate the covered contract; or
 - (3) Monies due or to become due under the covered contract may be retained by the city until compliance is achieved; or
 - (4) The city may also pursue any and all other remedies at law or in equity for any breach;
 - (5) Failure to comply with this section may also subject contractor to the procedures set forth in Division 5 of this article, entitled "Debarment of contractors from city work."

(e) Exceptions and waivers.

The provisions of this section shall not apply where:

- (1) The contractor does not provide benefits to employees' spouses.
- (2) The contractor is a religious organization, association, society or any non-profit charitable or educational institution or organization operated, supervised or controlled by or in conjunction with a religious organization, association or society.
- (3) The contractor is a governmental entity.
- (4) The sale or lease of city property.
- (5) The provision of this section would violate grant requirement, the laws, rules or regulations of federal or state law (for example, The acquisition services procured pursuant to Chapter 287.055, Florida Statutes known as the "Consultants' Competitive Negotiation Act").
- (6) Provided that the contractor does not discriminate in the provision of benefits, a contractor may also comply with this section by providing an employee with the cash equivalent of such benefits, if the city manager or his/her designee determines that either:
 - a. The contractor has made a reasonable yet unsuccessful effort to provide equal benefits. The contractor shall provide the city manager or his/her designee with sufficient proof of such inability to provide such benefit or benefits which shall include the measures taken to provide such benefits or benefits and the cash equivalent proposed, along with its certificate of compliance, as is required under this section.
- (7) The city commission waives compliance of this section in the best interest of the city, including but not limited to the following circumstances:
 - a. The covered contract is necessary to respond to an emergency.
 - b. Where only one bid response is received.
 - c. Where more than one bid response is received, but the bids demonstrate that none of the bidders can comply with the requirements of this section.
- (f) City's authority to cancel contract. Nothing in this section shall be construed to limit the city's authority to cancel or terminate a contract, deny or withdraw approval to perform a subcontract or provide supplies, issue a non-responsibility finding, issue a non-responsiveness finding, deny a person or entity prequalification, or otherwise deny a person or entity city business.
- (g) Timing of application. This section shall be applicable only to covered contracts awarded pursuant to bids which are after the date when this section becomes effective.

CITY OF KEY WEST BUSINESS LICENSE TAX RECEIPT

1. A City of Key West Business License Tax Receipt is required for this Project. Contractor must be general contractor or building contractor or engineering contractor. Fee not to exceed \$309.75.
2. A City of Key West Business License Tax Receipt also is required as for sub-contracting landscaping contractor, engineering services, and professional surveying.
3. A Business License Tax Application can be found on the City's web site.

<http://www.cityofkeywest-fl.gov/egov/docs/1162843921181.htm>

Business License Tax Application

City of Key West
City Hall Annex
PO Box 1409
Key West, FL 33041

Date Applied _____

License # _____
Phone 305-809-3955
Fax 305-809-3978

Business Type: _____

Business Name: _____

Business Location: _____

Business Owner: _____

State Licensed Qualifier (if applicable): _____

Mailing Address: _____

EIN / SS # _____ Phone # _____

Applicant name (printed) Applicant signature Date

State of Florida
County of Monroe

The foregoing instrument was acknowledged before me this ____ day of _____, 20____, by _____.

Signature of Notary Public (stamp or seal). Personally known ____
Produced id _____

- ____ Sales Tax number 3106 Flagler Ave 292-6735 City utility acct _____
- ____ Commercial garbage Waste Mgmt 296-8297 _____
- ____ Lease or deed
- ____ State License DBPR 850-487-1395 / Dept Ag 305-470-6900
- ____ Home occupation application
- ____ Fictitious Name registration Previous use _____
- ____ Corporate or LLC registration
- ____ Liability / Worker's Comp Zoning _____
- ____ Fire Inspector 292-8179
- ____ CO / final inspection on any permits Category _____ Fee \$ _____
- ____ Monroe County or local licensing

Licensed in accordance with Chapter 66, Key West Code of Ordinances

____ Approved Denied / Reason _____

Licensing Official Date

CONE OF SILENCE AFFIDAVIT

STATE OF _____)
: SS
COUNTY OF _____)

I the undersigned hereby duly sworn depose and say that all owner(s), partners, officers, directors, employees and agents representing the firm of _____ have read and understand the limitations and procedures regarding communications concerning City of Key West issued competitive solicitations pursuant to City of Key West Ordinance Section 2-773 Cone of Silence (attached).

Sworn and subscribed before me this

_____ day of _____, 20__.

NOTARY PUBLIC, State of _____ at Large

My Commission Expires: _____

Sec. 2-773. Cone of Silence

(a) Definitions. For purposes of this section, reference to one gender shall include the other, use of the plural shall include the singular, and use of the singular shall include the plural. The following definitions apply unless the context in which the word or phrase is used requires a different definition:

- 1) *Competitive Solicitation* means a formal process by the City of Key West relating to the acquisition of goods or services, which process is intended to provide an equal and open opportunity to qualified persons and entities to be selected to provide the goods or services. Competitive Solicitation shall include request for proposals ("RFP"), request for qualifications ("RFQ"), request for letters of interest ("RFLI"), invitation to bid ("ITB") or any other advertised solicitation.
- 2) *Cone of Silence* means a period of time during which there is a prohibition on communication regarding a particular Competitive Solicitation.
- 3) *Evaluation or Selection Committee* means a group of persons appointed or designated by the City to evaluate, rank, select, or make a recommendation regarding a Vendor or the Vendor's response to the Competitive Solicitation. A member of such a committee shall be deemed a city official for the purposes of subsection (c) below.
- 4) *Vendor* means a person or entity that has entered into or that desires to enter into a contract with the City of Key West or that seeks an award from the City to provide goods, perform a service, render an opinion or advice, or make a recommendation related to a Competitive Solicitation for compensation or other consideration.
- 5) *Vendor's Representative* means an owner, individual, employee, partner, officer, or member of the board of directors of a Vendor, or a consultant, lobbyist, or actual or potential subcontractor or sub consultant who acts at the behest of a Vendor in communicating regarding a Competitive Solicitation.

(b) Prohibited Communications: A Cone of Silence shall be in effect during the course of a Competitive Solicitation and prohibit:

- 1) Any communication regarding a particular Competitive Solicitation between a potential Vendor or Vendor's Representative and the City's administrative staff including, but not limited to, the city manager and his or her staff;
- 2) Any communication regarding a particular Competitive Solicitation between a potential Vendor or Vendor's Representative and the Mayor, City Commissioners, or their respective staff;

- 3) Any communication regarding a particular Competitive Solicitation between a potential Vendor or Vendor's Representative and any member of a City evaluation and/or selection committee therefore; and
- 4) Any communication regarding a particular Competitive Solicitation between the Mayor, City Commissioners, or their respective staff, and a member of a City evaluation and/or selection committee therefore.

(c) Permitted Communications: Notwithstanding the foregoing, nothing contained herein shall prohibit:

- 1) Communication between members of the public who are not Vendors or a Vendor's representative and any city employee, official or member of the City Commission;
- 2) Communications in writing at any time with any city employee, official or member of the City Commission, unless specifically prohibited by the applicable Competitive Solicitation.

(A) However, any written communication must be filed with the City Clerk. Any City employee, official or member of the City Commission receiving or making any written communication must immediately file it with the City Clerk.

(B) The City Clerk shall include all written communication as part of the agenda item when publishing information related to a particular Competitive Solicitation.

- 3) Oral communications at duly noticed pre-bid conferences;
- 4) Oral presentations before publically noticed evaluation and/or selection committees;
- 5) Contract discussions during any duly noticed public meeting;
- 6) Public presentations made to the City Commission or advisory body thereof during any duly noticed public meeting;
- 7) Contract negotiations with city staff following the award of a Competitive Solicitation by the City Commission; or
- 8) Purchases exempt from the competitive process pursuant to section 2-797 of these Code of Ordinances.

(d) Procedure

- 1) The Cone of Silence shall be imposed upon each Competitive Solicitation at the time of Public Notice of such solicitation as provided by section 2-826 of this Code. Public notice of the Cone of Silence shall be included in the notice of the Competitive Solicitation. The city manager shall issue a written notice of the release of each Competitive Solicitation to the affected departments, with a copy thereof to each Commission member, and shall include in any public solicitation for goods and services a statement disclosing the requirements of this ordinance.
- 2) The Cone of Silence shall terminate at the time the City Commission or other authorized body makes final award or gives final approval of a contract, rejects all bids or responses to the Competitive Solicitation, or takes other action which ends the Competitive Solicitation.
- 3) Any City employee, official or member of the City Commission that is approached concerning a Competitive Solicitation while the Cone of Silence is in effect shall notify such individual of the prohibitions contained in this section. While the Cone of Silence is in effect, any City employee, official or member of the City Commission who is the recipient of any oral communication by a potential Vendor or Vendor's Representative in violation of this section shall create a written record of the event. The record shall indicate the date of such communication, the persons with whom such communication occurred, and a general summation of the communication.

(e) Violations/penalties and procedures.

- 1) A sworn complaint alleging a violation of this ordinance may be filed with the City Attorney's office. In each such instance, an initial investigation shall be performed to determine the existence of a violation. If a violation is found to exist, the penalties and process shall be as provided in section 1-15 of this Code.
- 2) In addition to the penalties described herein and otherwise provided by law, a violation of this ordinance shall render the Competitive Solicitation void at the discretion of the City Commission.
- 3) Any person who violates a provision of this section shall be prohibited from serving on a City of Key West advisory board, evaluation and/or selection committee.
- 4) In addition to any other penalty provided by law, violation of any provision of this ordinance by a City of Key West employee shall subject said employee to disciplinary action up to and including dismissal.

- 5) If a Vendor is determined to have violated the provisions of this section on two more occasions it shall constitute evidence under City Code section 2-834 that the Vendor is not properly qualified to carry out the obligations or to complete the work contemplated by any new Competitive Solicitation. The City's Purchasing Agent shall also commence any available debarment from city work proceeding that may be available upon a finding of two or more violations by a Vendor of this section.

**LOCAL VENDOR CERTIFICATION PURSUANT TO CKW ORDINANCE 09-22
SECTION 2-798**

The undersigned, as a duly authorized representative of the vendor listed herein, certifies to the best of his/her knowledge and belief, that the vendor meets the definition of a "Local Business." For purposes of this section, "local business" shall mean a business which:

- a. Principle address as registered with the FL Department of State located within 30 miles of the boundaries of the city, listed with the chief licensing official as having a business tax receipt with its principle address within 30 miles of the boundaries of the city for at least one year immediately prior to the issuance of the solicitation.
- b. Maintains a workforce of at least 50 percent of its employees from the city or within 30 miles of its boundaries.
- c. Having paid all current license taxes and any other fees due the city at least 24 hours prior to the publication of the call for bids or request for proposals.
 - Not a local vendor pursuant to Ordinance 09-22 Section 2-798
 - Qualifies as a local vendor pursuant to Ordinance 09-22 Section 2-798

If you qualify, please complete the following in support of the self certification & submit copies of your County and City business licenses. Failure to provide the information requested will result in denial of certification as a local business.

Business Name _____ Phone: _____
 Current Local Address: _____ Fax: _____
 (P.O Box numbers may not be used to establish status)
 Length of time at this address _____

 Signature of Authorized Representative _____ Date _____

STATE OF _____
 COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, 20____.
 By _____, of _____
 (Name of officer or agent, title of officer or agent) (Name of corporation acknowledging)
 or has produced _____ as identification
 (type of identification)

 Signature of Notary

 Print, Type or Stamp Name of Notary

 Title or Rank

Return Completed form with
 Supporting documents to:
 City of Key West Purchasing

BIDDER'S CHECKLIST

(Note: The purpose of this checklist is to serve as a reminder of major items to be addressed in submitting a Bid and is not intended to be all inclusive. It does not alleviate the Bidder from the responsibility of becoming familiar with all aspects of the Contract Documents and proper completion and submission of their Bid.)

1. All Contract Documents thoroughly read and understood. []
2. All blank spaces in Bid Form filled in, using black ink. []
3. Total and unit prices added correctly. []
4. Addenda acknowledged. []
5. Subcontractors are named as indicated in the Bid Form. []
6. Experience record included. []
7. Bid signed by authorized officer. []
8. Bid Bond completed and executed, including power-of-attorney dated the same date as Bid Bond. []
9. Bidder familiar with federal, state, and local laws, ordinances, rules and regulations affecting performance of the work. []
10. Bidder, if successful, able to obtain and/or demonstrate possession of required licenses and certificates within (10) ten calendar days after receiving a Notice of Award. []
11. Bid submitted intact with the volume containing the Bidding Requirements, Contract Forms, and Conditions of the Contract and two (2) originals and two (2) USB drives; each containing a single complete PDF file. []
12. Bid Documents submitted in sealed envelope and addressed and labeled in conformance with the instructions in the Invitation to Bid. []
13. Bidder must provide satisfactory documentation of State Licenses. []
14. Anti-Kickback Affidavit signed by authorized officer. []
15. Public Entity Crimes Statement signed by authorized officer. []
16. Key West Indemnification Form signed by authorized officer. []
17. Disclosure of Lobbying Activities Form signed by authorized officer. []
18. Non-Collusion Declaration and Compliance with 49 CFR §29 signed by authorized officer. []
19. Florida Trench Safety Act Compliance signed by authorized officer. []
20. Suspension and Debarment Certification signed by authorized officer. []

- 21. Equal Benefits for Domestic Partners Affidavit signed by authorized officer. []
- 23. Cone of Silence Affidavit signed by authorized officer. []

END OF SECTION

DISCLOSURE OF LOBBYING ACTIVITIES

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure.)

<p>1. Type of Federal Action:</p> <input type="checkbox"/> <p>a. contract b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance</p>	<p>2. Status of Federal Action:</p> <input type="checkbox"/> <p>a. bid/offer/application b. initial award c. post-award</p>	<p>3. Report Type:</p> <input type="checkbox"/> <p>a. initial filing b. material change</p> <p>For Material Change Only:</p> <p>year _____ quarter _____ date of last report _____</p>
<p>4. Name and Address of Reporting Entity:</p> <input type="checkbox"/> Prime <input type="checkbox"/> Subawardee Tier _____, if known: <p>Congressional District, if known:</p>	<p>5. If Reporting Entity in No. 4 is Subawardee, Enter Name and Address of Prime:</p> <p>Congressional District, if known:</p>	
<p>6. Federal Department/Agency:</p>	<p>7. Federal Program Name/Description:</p> <p>CFDA Number, if applicable: _____</p>	
<p>8. Federal Action Number, if known:</p>	<p>9. Award Amount, if known:</p> <p>\$ _____</p>	

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

- 1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.**
- 2. Identify the status of the covered Federal action.**
- 3. Identify the appropriate classification of this report. If this is a follow up report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by the reporting entity for this covered Federal action.**
- 4. Enter the full name, address, city, state and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.**
- 5. If the organization filing the report in item 4 checks "Subawardee", then enter the full name, address, city, state and zip code of the prime Federal recipient. Include Congressional District, if known.**
- 6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.**
- 7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.**

8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, state and zip code of the lobbying entity engaged by the reporting entity identified in item 4 to influence the covered Federal action.

(b) Enter the full names of the individual(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).
11. The certifying official shall sign and date the form, print his/her name, title and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 30 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, D.C. 20503.

Form DEP 55-221 (01/01)

**NON-COLLUSION DECLARATION AND
COMPLIANCE WITH 49 CFR §29.**

ITEM/SEGMENT NO.: _____
 F.A.P. NO.: _____
 PARCEL NO.: _____
 COUNTY OF: _____
 BID LETTING OF: _____, _____

I, _____, hereby
(NAME)
 declare that I am _____ of _____
(TITLE) (FIRM)
 Of _____
(CITY AND STATE)

and that I am the person responsible within my firm for the final decision as to the price(s) and amount of this Bid on this State Project.

I further declare that:

1. The prices(s) and amount of this bid have been arrived at independently, without consultation, communication or agreement, for the purpose of restricting competition with any other contractor, bidder or potential bidder.

2. Neither the price(s) nor the amount of this bid have been disclosed to any other firm or person who is a bidder or potential bidder on this project, and will not be so disclosed prior to the bid opening.

3. No attempt has been made or will be made to solicit, cause or induce any other firm or person to refrain from bidding on this project, or to submit a bid higher than the bid of this firm, or any intentionally high or non-competitive bid or other form of complementary bid.

4. The bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary bid.

5. My firm has not offered or entered into a subcontract or agreement regarding the purchase of materials or services from any firm or person, or offered, promised or paid cash or anything of value to any firm or person, whether in connection with this or any other project, in consideration for an agreement or promise by any firm or person to refrain from bidding or to submit a complementary bid on this project.

6. My firm has not accepted or been promised any subcontract or agreement regarding the sale of materials or services to any firm or person, and has not been promised or paid cash or anything of value by any firm or person, whether in connection with this or any other project, in consideration for my firm's submitting a complementary bid, or agreeing to do so, on this project.

7. I have made a diligent inquiry of all members, officers, employees, and agents of my firm with responsibilities relating to the preparation, approval or submission of my firm's bid on this project and have been advised by each of them that he or she has not participated in any communication, consultation, discussion, agreement, collusion, act or other conduct inconsistent with any of the statements and representations made in this Declaration.

8. As required by Section 337.165, Florida Statutes, the firm has fully informed the Department of Transportation in writing of all convictions of the firm, its affiliates (as defined in Section 337.165(l)(a), Florida Statutes), and all directors, officers, and employees of the firm and its affiliates for violation of state or federal antitrust laws with respect to a public contract or for violation of any state or federal law involving fraud, bribery, collusion, conspiracy or material misrepresentation with respect to a public contract. This includes disclosure of the names of current employees of the firm or affiliates who were convicted of contract crimes while in the employ of another company.

9. I certify that, except as noted below, neither my firm nor any person associated therewith in the capacity of owner, partner, director, officer, principal, investigator, project director, manager, auditor, and/or position involving the administration of Federal funds:

(a) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions, as defined in 49 CFR §29.110(a), by any Federal department or agency;

(b) has within a three-year period preceding this certification been convicted of or had a civil judgment rendered against him or her for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a Federal, State or local government transaction or public contract; violation of Federal or State antitrust statutes; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property;

(c) is presently indicted for or otherwise criminally or civilly charged by a Federal, State or local governmental entity with commission of any of the offenses enumerated in paragraph 9(b) of this certification; and

(d) has within a three-year period preceding this certification had one or more Federal, State or local government public transactions terminated for cause or default..

10. I(We), certify that I(We), shall not knowingly enter into any transaction with any subcontractor, material supplier, or vendor who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this contract by any Federal Agency unless authorized by the Department.

Where I am unable to declare or certify as to any of the statements contained in the above stated paragraphs numbered (1) through (10), I have provided an explanation in the "Exceptions" portion below or by attached separate sheet.

EXCEPTIONS:

(Any exception listed above will not necessarily result in denial of award, but will be considered in determining bidder responsibility. For any exception noted, indicate to whom it applies, initiating agency and dates of agency action.

Providing false information may result in criminal prosecution and/or administrative sanctions.)

I declare under penalty of perjury that the foregoing is true and correct.

CONTRACTOR: (Seal)

BY: _____ WITNESS: _____
NAME AND TITLE PRINTED

BY: _____ WITNESS: _____
SIGNATURE

Executed on this _____ day of _____, _____

**FAILURE TO FULLY COMPLETE AND EXECUTE THIS DOCUMENT
MAY RESULT IN THE BID BEING DECLARED NONRESPONSIVE**

FLORIDA TRENCH SAFETY ACT COMPLIANCE
Trench Excavation Safety System and Shoring

CERTIFICATION

All excavation, trenching, and related sheeting, bracing, etc. on this project shall conform to the requirements of the Florida Trench Safety Act (90-96, CS/SB 2626), which incorporates by reference, OSHA’s excavation safety standards, 29 CFR 1926.650 Subpart P including all subsequent revisions or updates to the these standards.

By submission of this bid and subsequent execution of this Contract, the undersigned certifies compliance with the above mentioned standards and further stipulates that all costs associated with this compliance are detailed below as well as included in their lump sum bid amount.

Summary of Costs:

Trench Safety Measure	Units	Quantity	Unit Cost	Extended Cost
A. _____	_____	_____	_____	_____
B. _____	_____	_____	_____	_____

Signature

Date

STATE OF _____

COUNTY OF _____

PERSONALLY APPEARED BEFORE ME, the undersigned authority,

_____, who, after first being sworn by me affixed his /her signature in the space,

provided above on the _____ day of _____, 20__.

Notary Public

(Seal)

MY COMMISSION EXPIRES: _____

SUSPENSION AND DEBARMENT CERTIFICATION

CERTIFICATION REGARDING DEBARMENTS, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION-LOWER TIER FEDERALLY FUNDED TRANSACTIONS

1. The undersigned hereby certifies that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

2. The undersigned also certifies that it and its principals:

(a) Have not within a three-year period preceding this certification been convicted of or had a civil judgment rendered

against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

(b) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 2.(a) of this Certification; and

(c) Have not within a three-year period preceding this certification had one or more public transactions (Federal, State or local) terminated for cause or default.

3. Where the undersigned is unable to certify to any of the statements in this certification, an explanation shall be attached to this certification.

Dated this day of, 20 .

By _____

Authorized Signature/Contractor

Typed Name/Title

Contractor's Firm Name

Street Address

Building, Suite Number

City/State/Zip Code

Area Code/Telephone Number

PART 2

CONTRACTING REQUIREMENTS

AGREEMENT

This Agreement, made and entered into this _____ day of _____, 20_____.

by and between the City of Key West, hereinafter called the "Owner," and
 _____ hereinafter called the "Contractor".

WITNESSETH:

The Contractor, in consideration of the sum to be paid him by the Owner and of the covenants and agreements herein contained, hereby agrees at his own proper cost and expense to do all the work and furnish all the materials, tools, labor, and all appliances, machinery, and appurtenances for Construction of the "VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA", to the extent of the Bid made by the Contractor, dated the _____ day of _____, 20_____, all in full compliance with the Contract Documents referred to herein.

The BIDDING REQUIREMENTS, including the signed copy of the Bid, the CONTRACT FORMS, the CONDITIONS OF THE CONTRACT, the SPECIFICATIONS, and the DRAWINGS, for "VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA," dated _____, 20_____, are hereby referred to and by reference made a part of this Contract as fully and completely as if the same were fully set forth herein and are mutually cooperative therewith.

In consideration of the performance of the Work as set forth in these Contract Documents, the Owner agrees to pay to the Contractor the amount bid in the Bid as adjusted in accordance with the Contract Documents, or as otherwise herein provided, and to make such payments in the manner and at the times provided in the Contract Documents.

The Contractor agrees to complete the Work within the time specified and to accept as full payment hereunder the amounts computed as determined by the Contract Documents and based on the said Bid.

The Contractor agrees to remedy all defects appearing in the work or developing in the materials furnished and the workmanship performed under this Contract during the warranty period after the date of final acceptance of the Work by the Owner, and further agrees to indemnify and save the Owner harmless from any costs encountered in remedying such defects.

It is agreed that the Project, based upon the Bid, shall be substantially complete within 330 consecutive calendar days from the date the Notice to Proceed is issued, and will be totally completed and ready for final payment and acceptance within 360 consecutive calendar days from the date the Notice to Proceed is issued.

Liquidated Damages: The Contractor recognizes that time is of the essence and that the Owner will suffer financial loss if the Work is not completed within the times specified in paragraph above, plus any extensions thereof allowed in accordance with Article 12, of the General Conditions.

Owner and Contractor also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by the Owner, if the Work is not completed on time. Accordingly, instead of requiring any such proof, the Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay the Owner (\$3,000.00) for each day that expires after the time specified for each substantial completion. After Substantial Completion if Contractor shall neglect, refuse or fail to complete the remaining Work within the Contract time or any proper extension thereof granted by the Owner, Contractor shall pay the Owner (\$1,000.00) for each day that expires after the time specified for completion and readiness for final payment. Liquidated damages shall run concurrent.

IN WITNESS WHEREOF, we, the parties hereto, each herewith subscribe the same this _____ day of _____, A.D., 20_____.

CITY OF KEY WEST

By: _____

Title: _____

Contractor:

By: _____

Title: _____

Approved as to Form

Attorney for Owner

END OF SECTION

PERFORMANCE BOND

BOND NO. _____
AMOUNT: \$ _____

KNOW ALL MEN BY THESE PRESENTS, that in accordance with Florida Statutes Section 255.05, _____ with offices at _____ hereinafter called the Contractor (Principal), and

_____ with offices at _____ a corporation duly organized and existing under and by virtue of the laws of the State of Florida, hereinafter called the Surety, and authorized to transact business within the State of Florida, as Surety, are held and firmly bound unto **CITY OF KEY WEST**, represented by its _____, hereinafter called the City (Obligee), in the sum of:

_____ DOLLARS (\$), lawful money of the United States of America, for the payment of which, well and truly be made to the City, the Contractor and the Surety bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the Contractor has executed and entered into the “VFD Upgrades To Wastewater Pump Stations A, B, C, D, and DA” Contract hereto attached, with the City, dated _____, 20____, to furnish at their own cost, charges, and expense all the necessary materials, equipment, and/or labor in strict and express accordance with said Contract and the Contract Documents as defined therein, all of which is made a part of said Contract by certain terms and conditions in said Contract more particularly mentioned, which Contract, consisting of the various Contract Documents is made a part of this Bond as fully and completely as if said Contract Documents were set forth herein;

NOW THEREFORE, the conditions of this obligation are such that if the above bounden Contractor:

- 1. Shall in all respects comply with the terms and conditions of said Contract and his obligation there under, including the Contract Documents (which include the plans, drawings, specifications, and conditions as prepared by the City, invitation to bid, instructions to bidders, the Contractor’s bid as accepted by the above City, the bid and contract performance and payment bonds, and all addenda, if any, issued prior to the opening of bids), being made a part of this bond by reference, at the times and in the manner prescribed in the contract; and

2. Promptly makes payments to all claimants, as defined in Section 255.05(1), Florida Statutes, supplying Principal with labor, materials, or supplies, used directly or indirectly by Principal in the prosecution of the work provided for in the contract; and

3. Pays City all losses, costs, expenses, damages, attorney's fees, including appellate proceedings, injury or loss of whatever kind and however arising including, without limitation, delay damages to which said City may be subject by reason of any wrongdoing, misconduct, want of care or skill, negligence, failure of performance, breach, failure to petition within the prescribed time, or default, including patent infringements, on the part of said Contractor, his agents or employees, in the execution or performance of said Contract; and

4. Performs the guarantee of all work and materials furnished under the contract for the time specified in the contract, then this obligation shall be void; otherwise, to remain in full force and effect for the term of said Contract.

AND, the said Surety for value received, hereby stipulates and agrees that no change involving any extension of time, or addition to the terms of the Contract Documents, or to the work to be performed, or materials to be furnished there under shall affect said obligation of said Surety on this Bond, and the said Surety does hereby waive notice of any such changes, extension of time, alterations, or additions of the terms of the Contract Documents, or to the Work.

Any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in Section 255.05(2), Florida Statutes.

IN WITNESS WHEREOF, the above parties bonded together have executed this instrument this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR

By: _____ (SEAL)

ATTEST

SURETY

By: _____ (SEAL)

ATTEST

END OF SECTION

PAYMENT BOND**BOND NO.** _____**AMOUNT: \$** _____

KNOW ALL MEN BY THESE PRESENTS, that in accordance with Florida Statutes Section 255.05, _____

with offices at _____ hereinafter called the Contractor, (Principal), and _____

with offices at _____

a corporation duly organized and existing under and by virtue of the laws of the State of _____, hereinafter called the Surety, and authorized to transact business within the State of Florida, as Surety, are held and firmly bound City of Key West, represented by its _____, hereinafter called the City (Obligee), in the sum of: DOLLARS (\$), lawful money of the United States of America, for the payment of which, well and truly be made to the City, and the Contractor and the Surety bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the Contractor has executed and entered into a certain Contract for the “VFD Upgrades To Wastewater Pump Stations A, B, C, D, and DA” attached hereto, with the City, dated _____, 20_____, to furnish at their own cost, charges, and expense the necessary materials, equipment, and/or labor in strict and express accordance with said Contract and the plans, drawings (if any), and specifications prepared by the City, all of which is made a part of said Contract by certain terms and conditions in said Contract more particularly mentioned, which Contract, consisting of the various Contract Documents specifically mentioned herein and relative hereto, is made a part of this Bond as fully and completely as if said Contract Documents were set forth herein.

NOW THEREFORE, the conditions of this obligation are such that if the above bounden Contractor shall in all respects comply with the terms and conditions of said Contract and his obligation thereunder, including the Contract Documents (which include the plans, drawings, specifications, and conditions prepared by the City, invitation to bid, instructions to bidders, the Contractor’s bid as accepted by the City, the bid and contract and payment bonds, and all addenda, if any, issued prior to the opening of bids), and further that if said Contractor shall promptly make payments to all persons supplying materials, equipment, and/or labor, used directly or indirectly by said Contractor or subcontractors in the prosecution of the work for said contract in accordance with Florida Statutes, Section 255.05 or Section 713.23, then this obligation shall be void; otherwise

to remain in full force and effect for the term of said contract, including and all guarantee periods as specifically mentioned in said Contract Documents.

AND, the said Surety for value received, hereby stipulates and agrees that no change involving any extension of time, or addition to the terms of the Contract or to the work to be performed, or materials to be furnished thereunder, or in the Contract Documents and specifications accompanying the said contract shall affect said obligation of said Surety on this Bond, and the said Surety does hereby waive notice of any such changes, extension of time, alternations, or additions of the terms of the Contract, or to the work, to the Contract Documents, or to the specifications.

Claimant shall give written notice to the Contractor and the Surety as required by Section 255.05 or Section 713.23, Florida Statutes. Any action instituted against the Contractor or Surety under this bond for payment must be in accordance with the notice and time limitation provisions in Section 255.05(2) or Section 713.23, Florida Statutes.

IN WITNESS WHEREOF, the above parties bounded together have executed this instrument this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR

By: _____ (SEAL)

ATTEST

SURETY

By: _____(SEAL)

ATTEST

END OF SECTION



City of Key West
P.O. Box 1409
Key West, FL 33041

Notice of Award

Date: _____

Project Number: _____

Owner: City of Key West
Company: City of Key West
Address: Office of the City Clerk
Address: City of Key West P.O. Box 1409
Key West, FL 33041-1409

Project Name: **VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA**

Dear:

At a meeting of the City of Key West Commission held on _____, 20____, **COMPANY NAME** was awarded the contract for **VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA**. The total Contract amount shall not exceed \$ _____.

Enclosed please find three copies of the Contract Documents for your execution. Please complete the necessary pages, affixing signatures, notary and / or corporate seals, etc. where necessary and return to this office by **DATE**. Also, you need to be mobilized on **DATE**, and remit a bill to the City of Key West by **DATE**.

The Certificate of Insurance must be attached to the documents; one original and two copies are acceptable.

Powers – of – Attorney must be submitted in each bond document, an original and two copies are permissible.

A copy of your City of Key West Business License Tax Receipt, must be attached, (subcontractors City Of Key West Business License Tax Receipt) and one copy in PDF on disc.

Sincerely,

John Paul Castro
Utilities Director
cc: Cheri Smith, City Clerk
Project File

CERTIFICATE OF SUBSTANTIAL COMPLETION

Project: VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA

Project No. _____

DATE OF ISSUANCE _____

CITY _____

CITY'S CONTRACT NO. _____

CONTRACTOR _____ ENGINEER _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

TO: _____
CITY

And To _____
CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representatives of City, Contractor, and Engineer and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by Contractor within ____ days of the above date of Substantial Completion.

EJCDC No. 1910-8-D (1990 Edition)
Prepared by the Engineers Joint Contract Documents Committee and endorsed by the Associated General Contractors of America

END OF SECTION

CERTIFICATE OF FINAL COMPLETION

Project: VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA

Project No. _____

Date of Issuance: _____

City _____

Contractor _____ Engineer _____

~~~~~  
This Certificate of Completion applies to all Work under the Contract Documents. \_\_\_\_\_  
~~~~~

The Work to which this Certificate applies has been inspected by authorized representatives of City and Engineer, and that Work is hereby declared to be complete in accordance with the Contract Documents on

DATE OF COMPLETION

Executed by ENGINEER on _____, (Date)

ENGINEER

By: _____
(Authorized Signature)

CONTRACTOR accepts this Certificate of Completion on _____, (DATE)

CONTRACTOR

By: _____

CITY accepts this Certificate of Completion on _____, (DATE)

CITY

By: _____
(Authorized Signature)

END OF SECTION

NOTICE TO PROCEED

Date: _____, 20__

Project No: _____

Contractor: _____

Address: _____

Project: VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA

Project No.

You are hereby notified to commence Work on _____, 20__ for the VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA and all related Work, as designated by the City in accordance with the Contract made with the City of Key West on the _____ day of _____, 20__. The amount of time to complete the Work is three hundred- sixty (360) consecutive calendar days and should be fully completed on or before _____.

Sincerely,

Project Manager

Receipt of this NOTICE TO PROCEED is hereby acknowledged this, the _____ day of _____, 20__.

CONTRACTOR: _____

By: _____

TITLE: _____

DATE: _____

Please return one (1) copy of this notice to:

CH2M HILL
6410 5th Street
Suite 2A
Key West, FL 33040

PAYMENT APPLICATION AND CERTIFICATE

Application No.: _____ of _____ Date: _____
Period From: _____ to _____, 20____. Sheet: _____ of _____

Project: VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA
Project No.: _____

Contractor: _____

Original Contract Sum \$ _____
Contract Modifications Approved in Previous Applications
Additions \$ _____ Deductions: \$ _____
Contract Modifications Approved this Period (List Contract Modifications Nos. ____)
Additions \$ _____ Deductions: \$ _____

- 1. Net Change by Contract Modifications (sum of lines 2 and 3) \$ _____
- 2. Revised Contract Amount (Sum of Lines 1 and 4) \$ _____
- 3. Total Value of Work to Date (Estimate Attached) \$ _____
- 4. Percent Project Complete (Line 6 / Line 5 x 100) = _____ %
- 5. Total Materials on Hand (Listing Attached) \$ _____
- 6. Subtotal-Work Completed and Stored (Sum of Lines 6 and 8) \$ _____
- 7. Total Retainage (_____ % x Line 9) \$ _____
- 8. Total Earned to Date, Less Retainage (Line 9 less Line 10) \$ _____
- 9. Less Previous Certificates for Payments
(item 11 from Previous Application) \$ _____
- 10. Current Payment Due (Line 11 less Line 12) \$ _____
- 11. Amount paid to Subcontractors Previous Pay Application \$ _____

The undersigned Contractor certifies that the Work covered by this Application for Payment has been completed in accordance with the Contract Documents that the current payment shown herein is now due, and that title for all Work, materials, and equipment covered in this Application will pass to the City free and clear of all liens at the time of payment.

Contractor By Date

I hereby acknowledge that the material and labor involved on the above estimate is correct to the best of my knowledge, information and belief, and payment on same is due Contractor.

Project Manager Date

END OF SECTION

CERTIFICATE OF FINAL PAYMENT

Date: _____
Page: 1 of 2

Payment Application No.: _____

Period From: _____ to _____

Project: VFD Upgrades to Wastewater Pump Stations A, B, C, D, and DA

Project No.: _____

Contractor: _____

I hereby acknowledge that this Contract has been completed in substantial compliance with the items of the Agreement, Specifications, and Plans, As-Builts, Work Change Directives, and Field Orders. I, therefore, request acceptance of the Work and processing of this final estimate as showing the total amount of money due in compliance with the terms of the Contract.

I, _____, certify to the Owner that the Contractor met the Grant requirements provided in the Contract Documents.

Contractor: _____

Address: _____

With the acceptance of this final payment, we, the Contractor, release the Owner and the Engineer and their agents, from all claims and liability to us, the Contractor, for all things done or furnished in connection with the Work, and every act of the Owner and others relating to, or arising, out of the Work.

Signature

Date

Title

Sworn and subscribed before me this _____ day of _____, 20____

NOTARY PUBLIC, State of Florida at Large

My Commission Expires:

Accepted By:

Project Manager

Date

Owner:

By: _____

Date

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

ACEC

AMERICAN COUNCIL OF ENGINEERING COMPANIES



ASCE American Society
of Civil Engineers

P/E National Society of
Professional Engineers
Professional Engineers in Private Practice

AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

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A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by



CONSTRUCTION SPECIFICATIONS INSTITUTE

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*—The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work*—See Paragraph 11.01 for definition.

17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *Engineer*—The individual or entity named as such in the Agreement.

20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

21. *General Requirements*—Sections of Division 1 of the Specifications.

22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*—Polychlorinated biphenyls.

31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.

47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

49. *Unit Price Work*—Work to be paid for on the basis of unit prices.

50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided

under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 Terminology

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:

- a. does not conform to the Contract Documents; or
- b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
- c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the

Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees,

from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

- a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not

specifically incorporated by reference in the Contract Documents); or

- b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;
2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or
3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

**ARTICLE 4 – AVAILABILITY OF LANDS;
SUBSURFACE AND PHYSICAL CONDITIONS;
HAZARDOUS ENVIRONMENTAL CONDITIONS;
REFERENCE POINTS**

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as

necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any “technical data” on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

5. then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer’s Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner’s obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer’s findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor’s cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor’s making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and

shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous

Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to

be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of

authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's

liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of

whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

a. Such insurance shall remain in effect for two years after final payment.

b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the

interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and

Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of

Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to

Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water,

sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by

Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

- a) perform adequately the functions and achieve the results called for by the general design,
- b) be similar in substance to that specified, and
- c) be suited to the same use as that specified;

2) will state:

- a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,
- b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
- c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

- a) all variations of the proposed substitute item from that specified, and
- b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. Engineer's Evaluation: Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. Engineer's Cost Reimbursement: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. Contractor's Expense: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members,

partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. Removal of Debris During Performance of the Work: During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. Cleaning: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. Loading Structures: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with

applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Submit number of copies specified in the General Requirements.
- b. Data shown on the Shop Drawings will be complete with respect to quantities,

dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

- a. Submit number of Samples specified in the Specifications.
- b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

- a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
- b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
- c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
- d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and

procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. Engineer's Review:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. Resubmittal Procedures:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected

copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but

without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;
2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include,

without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and

temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the

estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 Change of Contract Price

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be

Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise

impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or
2. correct such defective Work; or
3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such

correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all

materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract

Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently

discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. Reduction in Payment:

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

c. there are other items entitling Owner to a set-off against the amount recommended; or

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to

Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected)

reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify

Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

- a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
- b. consent of the surety, if any, to final payment;
- c. a list of all Claims against Owner that Contractor believes are unsettled; and
- d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien

rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of

Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become

final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or
2. agrees with the other party to submit the Claim to another dispute resolution process; or
3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 Giving Notice

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 Computation of Times

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 Headings

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTARY CONDITIONS

REVISIONS AND ADDITIONS TO THE GENERAL CONDITIONS

The General Conditions are hereby revised as follows:

ARTICLE 1.01.A.19 "Engineer"

Add the following:

Wherever in these Documents the word "Engineer" appears, it shall be understood to mean the Construction Manager and their authorized representatives, acting either directly or indirectly as authorized agents of the Owner.

ARTICLE 1.01.A.29 "Owner"

Add the following:

Wherever in these Documents the word "Owner" appears, it shall be understood to mean the City of Key West whose address is 3140 Flagler Street, Key West, Florida 33040

SC-1.01.A.45. Supplement paragraph 1.01.A.43 of the General Conditions as follows:

Substantial Completion is further defined as (i) that degree of completion of the Project's operating facilities or systems sufficient to provide Owner the full time, uninterrupted, and continuous beneficial operation of the Work; and (ii) all required functional, performance and acceptance or startup testing has been successfully demonstrated for all components, devices, equipment, and instrumentation and control to the satisfaction of Engineer in accordance with the requirements of the Specifications.

SC-1.01.A.52. Add a new paragraph immediately following paragraph 1.01.A.52 of the General Conditions as follows:

1.01.A.53. *Specialist*—The term Specialist refers to a person, partnership, firm, or corporation of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the Contract Documents, or otherwise performing Work required by the Contract Documents. Where the Specifications require the installation by a Specialist, that term shall also be deemed to mean either the manufacturer of the item, a person, partnership, firm, or corporation licensed by the manufacturer, or a person, partnership, firm, or corporation who will perform the Work under the manufacturer's direct supervision.

SC-2.03.A. Delete the third sentence of paragraph 2.03.A *Commencement of Contract Times: Notice to Proceed* of the General Conditions in its entirety.

ARTICLE 4.05 "REFERENCE POINTS"

Add the following:

It will be the Contractor's responsibility to layout the work and to transfer elevations from benchmarks. Where new construction connects to existing facilities, the Contractor shall check and establish the exact location prior to construction of the facilities.

The Contractor shall furnish all surveys, labor, and equipment, including setting all alignment and gradient, grade stakes, batter boards, and everything necessary to lay out his work. The Contractor shall be responsible for maintaining and re-establishing at his expense, all control points. After completion of his construction, he shall reset all permanent monuments at their original locations and elevations.

All layout work may be checked by the Engineer, and the Contractor shall furnish all necessary labor, equipment, and materials, and shall cooperate and assist the Engineer in making such checks.

The dimensions for lines and elevations for grades of the structures, appurtenances, and utilities will be shown on Drawings, together with other pertinent information required for laying out the work. If site conditions vary from those indicated, the Contractor shall notify the Engineer immediately, who will make any minor adjustment as required.

ARTICLE 5.03 "CERTIFICATES OF INSURANCE"

5.03.B. Delete 5.03.B in its entirety.

ARTICLE 5.04 "CONTRACTOR'S LIABILITY INSURANCE"

5.04.A and 5.04.B Delete 5.04.A and 5.04.B in their entirety and Add the following:

A. CONTRACTOR is to secure, pay for, and file with the City of Key West, prior to commencing any work under the Contract, all certificates for Workers' Compensation, Public Liability, and Property Damage Liability Insurance and such other insurance coverages as may be required by specifications and addenda thereto, in at least the following minimum amounts with specification amounts to prevail if greater than minimum amounts indicated. Notwithstanding any other provision of the Contract, the CONTRACTOR shall provide the minimum limits of liability insurance coverages as follows:

Auto Liability	\$1,000,000	Combined Single Limit
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General Liability	\$2,000,000	Aggregate (Per Project)
	\$2,000,000	Products Aggregate
	\$1,000,000	Any One Occurrence
	\$1,000,000	Personal Injury
	\$ 300,000	Fire Damage/Legal
Additional Umbrella Liability	\$2,000,000	Occurrence/Aggregate

- B. CONTRACTOR shall furnish an original Certificate of Insurance indicating, and such policy providing coverage to, City of Key West named as "Additional Insured" on PRIMARY and NON CONTRIBUTORY basis utilizing an ISO standard endorsement at least as broad as CG 2010 (11/85) or its Equivalent, (COMBINATION of CG 20 10 07 04 and CG 20 37 07 04, providing coverage for completed operations is acceptable) INCLUDING a "Waiver of Subrogation" clause in favor of City of Key West on all policies. CONTRACTOR will maintain the General Liability and Umbrella Liability insurance coverages summarized above with coverage continuing in full force including the "additional insured" endorsement until at least 3 years beyond completion and delivery of the work contracted herein.
- C. Notwithstanding any other provision of the Contract, the CONTRACTOR shall maintain complete Workers' Compensation coverage for each and every employee, principal, officer, representative, or agent of the CONTRACTOR who is performing any labor, services, or material under the Contract. Further, CONTRACTOR shall additionally maintain the following minimum limits of coverage:
- | | |
|--|-------------|
| Bodily Injury Each Accident | \$1,000,000 |
| Bodily Injury by Disease Each Employee | \$1,000,000 |
| Bodily Injury by Disease Policy Limit | \$1,000,000 |
- D. The work being done is on or near a navigable waterway, CONTRACTOR's Workers' Compensation policy shall be endorsed to provide USL&H Act (WC 00 01 06 A) and Jones Act (WC 00 02 01 A) coverage as specified by the City of Key West. CONTRACTOR shall provide the City of Key West with a Certificate of Insurance verifying compliance with the workman's compensation coverage as set forth herein and shall provide as often as required by the City of Key West such certification which shall also show the insurance company, policy number, effective and expiration date, and the limits of workman's compensation coverage under each policy.
- E. CONTRACTOR's insurance policies shall be endorsed to give 30 days' written notice to the City of Key West in the event of cancellation or material change, using form CG 02 24, or its equivalent.

- F. Certificates of Insurance submitted to the City of Key West will not be accepted without copies of the endorsements being requested. This includes additional insured endorsements, cancellation/material change notice endorsements, and waivers of subrogation. Copies of USL&H Act and Jones Act endorsements will also be required if necessary. PLEASE ADVISE YOUR INSURANCE AGENT ACCORDINGLY.
- G. CONTRACTOR will comply with any and all safety regulations required by any agency or regulatory body including but not limited to OSHA. CONTRACTOR will notify City of Key West immediately by telephone at (305) 809-3811 of any accident or injury to anyone that occurs on the jobsite and is related to any of the work being performed by the CONTRACTOR.
- H. SAMPLE ENDORSEMENTS REQUIRED BY ARTICLE 34 ARE INCLUDED IN BID PACKAGE AS EXHIBITS A-F to these supplementary conditions.
- I. INDEMNIFICATION
 - 1. To the fullest extent permitted by law, the CONTRACTOR expressly agrees to indemnify and hold harmless the City of Key West, their officers, directors, agents and employees (herein called the "indemnitees") from liabilities, damages, losses and costs, including but not limited to, reasonable attorney's fees and court costs, such legal expenses to include costs incurred in establishing the indemnification and other rights agreed to in this Paragraph, to persons or property, to the extent caused by the negligence, recklessness, or intentional wrongful misconduct of the CONTRACTOR, its Subcontractors or persons employed or utilized by them in the performance of the Contract. Claims by indemnitees for indemnification shall be limited to the amount of CONTRACTOR's insurance or \$1 million per occurrence, whichever is greater. The parties acknowledge that the amount of the indemnity required hereunder bears a reasonable commercial relationship to the Contract and it is part of the project specifications or the bid documents, if any.

2. The indemnification obligations under the Contract shall not be restricted in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the CONTRACTOR under Workers' Compensation acts, disability benefits acts, or other employee benefits acts, and shall extend to and include any actions brought by or in the name of any employee of the CONTRACTOR or of any third party to whom CONTRACTOR may subcontract a part or all of the Work. This indemnification shall continue beyond the date of completion of the work.

J. SURETY AND INSURER QUALIFICATIONS

1. All bonds, insurance contracts, and certificates of insurance shall be either executed by or countersigned by a licensed resident agent of the Surety or insurance company, having his place of business in the State of Florida, and in all ways complying with the insurance laws of the State of Florida. Further, the said Surety or insurance company shall be duly licensed and qualified to do business in the State of Florida.

ARTICLE 5.04 "CONTRACTOR'S LIABILITY INSURANCE"

Include the City of Key West and CH2M HILL as additional insureds.

ARTICLE 5.05 "OWNER'S LIABILITY INSURANCE"

5.05 Delete Article 5.05 in its entirety.

ARTICLE 5.06 "PROPERTY INSURANCE"

5.06 Delete Article 5.06 in its entirety.

ARTICLE 5.07 "WAIVER OF RIGHTS"

5.07.A. Delete Article 5.07.A in its entirety and Replace with the following:

- A. CONTRACTOR waives all rights against the OWNER, respective of officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all rights against the Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insured or additional insured (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) under such policies for losses and damages so accused.

5.07.B. Delete Article 5.07.B. in its entirety.

5.07.C. Delete Article 5.07.C. in its entirety

ARTICLE 5.08 "RECEIPT AND APPLICATION OF INSURANCE PROCEEDS"

Delete Article 5.08 in its entirety.

ARTICLE 5.09 "ACCEPTANCE OF BONDS AND INSURANCE"

Delete 5.09 in its entirety and replace with the following:

If Owner has any objection to the coverage afforded by Contractor or other provisions of the bonds or insurance required to be purchased and maintained by the Contractor in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the Owner shall so notify the Contractor in writing within 7 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Contractor shall provide to the Owner such additional information in respect of insurance as Owner may reasonable request. If Contractor does not purchase or maintain all of the bonds and insurance required of Contractor by the Contract Documents, owner shall notify Contractor in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the Contractor may elect to obtain equivalent bonds or insurance to protect Owner's interest at the expense of the Contractor who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

ARTICLE 5.10 "Partial Utilization, Acknowledgement of Property Insurer"

Delete Article 5.10 in its entirety.

ARTICLE 6.09 "LAWS AND REGULATIONS"

Add the following:

The Contractor shall comply with the City of Key West Noise Ordinance.

ARTICLE 6.09 "LAWS AND REGULATIONS"

Add the following subarticles:

Within 10 days of Notice of Award, the successful Bidder must represent that he holds all applicable state, county, and City of Key West licenses and permits required to do business as a contractor with respect to the work described in the Contract Documents.

Further, the successful Bidder must, within 10 days of Notice of Award, furnish documentation showing that, as a minimum, he has complied with the provisions of Chapter 91 of the Code of Ordinances of the City of Key West in order to enter into the Agreement contained in the Contract Documents.

Specifically, within 10 days after Notice of Award, the successful Bidder must demonstrate that he holds, as a minimum, the following licenses and certificates:

- A. All licenses or certificates required by federal, state, or local statutes or regulations.
- B. Holds a valid Certificate of Competency issued by the Public Service Director of the Building and Zoning Department which shall be valid throughout the Contract time.
- C. Holds a valid occupational license issued by the City of Key West.

FOLLOWING ARTICLE 6.09 "LAWS AND REGULATIONS"

Add the following Article:

HISTORIC PRESERVATION

The Contractor shall comply with Florida's Archives and Historic Act (Florida Statutes, Chapter 267) and the regulations of the local historic preservation board as applicable and protect against the potential loss or destruction of significant historical or archaeological data, sites, and properties in connection with the project.

ARTICLE 6.13 "SAFETY AND PROTECTION"

Add the following Subarticle:

OCCUPATIONAL SAFETY AND HEALTH

The Contractor and its Sub-Contractors shall observe and comply with all applicable local, state, and federal occupational safety and health regulations during the prosecution of work under this Contract. In addition, full compliance by the Contractor with the U.S. Department of Labor's Occupational Safety and Health Standards, as established in Public Law 91-596, will be required under the terms of this Contract.

ARTICLE 6.20 "INDEMNIFICATION"

Delete Article 6.20 in its entirety and replace with the following:

- A. To the fullest extent permitted by law, the CONTRACTOR expressly agrees to indemnify and hold harmless the City of Key West, their officers, directors, agents and employees (herein called the "indemnitees") from liabilities, damages, losses and costs, including but not limited to, reasonable attorney's fees and court costs, such legal expenses to include costs incurred in establishing the indemnification and other rights agreed to in this Paragraph, to persons or property, to the extent caused by the negligence, recklessness, or intentional wrongful misconduct of the CONTRACTOR, its Subcontractors or persons employed or utilized by them in the performance of the Contract. Claims by indemnitees for indemnification shall be limited to the amount of CONTRACTOR's insurance or \$1 million per occurrence, whichever is greater. The parties acknowledge that the amount of the indemnity required hereunder bears a reasonable commercial relationship to the Contract and it is part of the project specifications or the bid documents, if any.

- B. The indemnification obligations under the Contract shall not be restricted in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the CONTRACTOR under Workers' Compensation acts, disability benefits acts, or other employee benefits acts, and shall extend to and include any actions brought by or in the name of any employee of the CONTRACTOR or of any third party to whom CONTRACTOR may subcontract a part or all of the Work. This indemnification shall continue beyond the date of completion of the work.

ARTICLE 13.03 "TESTS AND INSPECTIONS"

SC-13.03.B Delete 13.03.B in its entirety and insert the following:

Contractor shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents.

SC-13.03.D. Supplement paragraph 13.03.D of the General Conditions as follows:

Tests required by Contract Documents to be performed by Contractor that require test certificates be submitted to Owner or Engineer for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required, testing laboratories or agencies shall meet following applicable requirements:

13.03.D.1. "Recommended Requirements for Independent Laboratory Qualification," published by the American Council of Independent Laboratories.

13.03.D.2. Basic requirements of ASTM E329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction" as applicable.

13.03.D.3. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

ARTICLE 13.07 "CORRECTION PERIOD"

13.07.A. Change the first sentence from "If within one year after the date of Substantial Completion..." TO "If within five years after the date of Substantial Completion..."

13.07.D. Change the sentence from "...will be extended for an additional period of one year after such corrections or removal..." TO "...will be extended for an additional period of five years after such correction or removal..."

ARTICLE 14 "PAYMENTS TO CONTRACTOR AND COMPLETION"

Add the following to the end of Subarticle 14.02.B.1:

Add the following subarticles:

14.02.B1.1 The Owner will deduct from the estimate, and retain as part security, 10 percent of the amount earned for work satisfactorily completed. A deduction and retainage of 10 percent will be made on the estimated amount earned for approved items of material delivered to and properly stored at the jobsite but not incorporated into the work.

14.02.B1.2 After deducting the retainage and the amount of all previous partial payments made to the Contractor from the amount earned, the amount due will be made payable to the Contractor. Recommendations for payment received by the Owner less than 40 days prior to the scheduled day for payment will not be processed or paid until the following month.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSION – LOWER TIER COVERED TRANSACTIONS

Note: This certification/clause has been extracted from Appendix B to 40 CFR Part 32 and is applicable to all goods and services (including construction) contracts and subcontracts with a price equaling or exceeding \$25,000 and in all solicitations for such contracts and subcontracts.

Instructions for Certification:

1. By signing and submitting this Proposal, the prospective lower tier participant is providing the certification set out below.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to which this Proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms “covered transaction,” “debarred,” “suspended,” “ineligible,” “lower tier covered transaction,” “participant,” “person,” “primary covered transaction,” “principal,” “proposal,” and “voluntarily excluded,” as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this Proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this Proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

6. The prospective lower tier participant further agrees by submitting this Proposal that it will include this clause titled “Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions,” without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

SUPPLEMENTS

- A. The supplements listed below, following “END OF SECTION,” are part of this Specification.
 1. Attachment A: Certificate of Liability Insurance.
 2. Attachment B: Additional Insured-Owner’s, Lessees or Contractors-Scheduled Person or Organization.
 3. Attachment C: Additional Insured-Owner’s, Lessees or Contractors-Completed Operations.
 4. Attachment D: Earlier Notice of Cancellation Provided by Us.
 5. Attachment E: Waiver of Transfer of Rights of Recovery Against Others to Us.
 6. Attachment F: Waiver of Our Right to Recover from Others Endorsement.

END OF SECTION

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED – OWNERS, LESSEES OR
CONTRACTORS – SCHEDULED PERSON OR
ORGANIZATION**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s):	Location(s) Of Covered Operations
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

A. Section II – Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by:

1. Your acts or omissions; or
2. The acts or omissions of those acting on your behalf;

in the performance of your ongoing operations for the additional insured(s) at the location(s) designated above.

B. With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

This insurance does not apply to "bodily injury" or "property damage" occurring after:

1. All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or
2. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 37 07 04

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED – OWNERS, LESSEES OR
CONTRACTORS – COMPLETED OPERATIONS**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s):	Location And Description Of Completed Operations
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

Section II – Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury" or "property damage" caused, in whole or in part, by "your work" at the location designated and described in the schedule of this endorsement performed for that additional insured and included in the "products-completed operations hazard".

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**EARLIER NOTICE OF CANCELLATION
PROVIDED BY US**

Number of Days Notice 30

For any statutorily permitted reason **other than nonpayment of premium**, the number of days required for notice of cancellation is increased to the number of days shown in the Schedule above.

If this policy is cancelled by us we will send the Named Insured and any party listed in the following schedule notice of cancellation based on the number of days notice shown above.

Schedule

Name of Person or Organization

Mailing Address

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 24 04 05 09

WAIVER OF TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART
PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART

SCHEDULE

Name Of Person Or Organization:
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

The following is added to Paragraph 8. **Transfer Of Rights Of Recovery Against Others To Us** of Section IV – Conditions:

We waive any right of recovery we may have against the person or organization shown in the Schedule above because of payments we make for injury or damage arising out of your ongoing operations or "your work" done under a contract with that person or organization and included in the "products-completed operations hazard". This waiver applies only to the person or organization shown in the Schedule above.

WAIVER OF OUR RIGHT TO RECOVER FROM OTHERS ENDORSEMENT

We have the right to recover our payments from anyone liable for an injury covered by this policy. We will not enforce our right against the person or organization named in the Schedule. (This agreement applies only to the extent that you perform work under a written contract that requires you to obtain this agreement from us.)

This agreement shall not operate directly or indirectly to benefit anyone not named in the Schedule.

Schedule

This endorsement changes the policy to which it is attached and is effective on the date issued unless otherwise stated.

(The information below is required only when this endorsement is issued subsequent to preparation of the policy.)

Endorsement
Insured

Effective Policy No.

Endorsement No.
Premium

Insurance Company

Countersigned by _____

WC 00 03 13
(Ed. 4-84)

PART 3

SPECIFICATIONS

**SECTION 01 01 00
GENERAL REQUIREMENTS**

PART 1 PROJECT DESCRIPTION

1.01 GENERAL

- A. A brief description of the Work is stated in the Invitation to Bid. To determine the full scope of the Project or any particular part of the Project, coordinate the applicable information in the several parts of these Contract Documents.
- B. The Work under this Contract shall be performed by the Contractor as required by the Owner. Work will be authorized in the form of a Notice to Proceed issued to the Contractor. The Contractor shall complete all Work in the Contract within the number of calendar days stipulated in the Contract unless an extension in the time of completion is granted by the Engineer, as stated in the Instructions to Bidders. Upon completion of the Work and compliance with applicable provisions in the Contract Documents, the Contractor will receive final payment for all Work done.
- C. The following additional information, though not all-inclusive, is given to assist contractors in their evaluation of the Work required to meet the Project objectives.
- D. This Project will provide Owner with an electrical building at five wastewater pump stations with VFDs for the existing pumps and an upgraded SCADA.
- E. The Contractor shall become familiar with the existing operating conditions of the Owner's sanitary pump station and collection facilities and take such into consideration in planning and scheduling Work. No extra claims shall be made for Work required to achieve conditions beyond those obtainable under normal operation of the existing sanitary facilities necessary to accomplish the Work.
- F. The Contractor shall be responsible for providing a licensed surveyor registered in the State of Florida. Surveyor shall verify all benchmarks used during survey.

PART 2 SEQUENCE OF OPERATIONS

2.01 SCHEDULING

A. General:

1. Submit estimated progress schedule and preliminary schedule of submittals in duplicate to Engineer. Updated progress schedules and submittal schedules shall be submitted with each partial pay request.
2. Revise and resubmit as specified, and identify all changes made from previous schedule submittal.

B. Construction Schedule:

1. Within 10 days following approval of the Shop Drawings and after establishment of equipment delivery dates the Contractor shall provide a bar chart analysis of the required construction Work for the Project. All activities should be shown along with the required time to do the Work in a proper and continuous sequence of operation and without delays.
2. Show complete sequence of construction by activity, identifying Work of separate stages, and other logically grouped activities. Indicate dates for early and late start, early and late finish, float, and duration.
3. Any contingency within the schedule (i.e., a difference in time between the Project's early completion and required Contract completion date) and the float in the overall Project schedule will belong to the Project and not to the parties to the Contract. Contractor shall not sequester shared float through such strategies as extending duration estimates to consume available float time, extensive crew/resource sequencing, etc.
4. Provide a workable plan for monitoring the progress of all elements of the Work, establish the critical elements of Work, and forecast potential problems in maintaining the specified completion dates.

C. Schedule of Submittals:

1. Schedule of Submittals: Indicate submittals required by Specification section number with brief description, starting and completion dates for respective submittal preparation, and submittal review by Engineer.
2. Indicate product manufacture and delivery dates.

- D.** Plan the Work and carry it out with minimum interference to the operation of the existing facilities. Prior to starting the Work, confer with the Engineer and Owner's representative to develop an approved Work schedule which will permit the facilities to function normally as practical. It may be necessary to do certain parts of the construction Work outside normal working hours in order to avoid undesirable conditions. The Contractor shall do this Work at such times, and at no additional cost to the Owner. Do not make connections between existing Work and new Work until necessary inspection and tests

have been completed on the new Work and it is found to conform in all respects to the requirements of the Contract Documents.

- E. No Work shall be started until the Contractor has received approved shop Drawings, established material/delivery dates for all equipment, and received approval of the construction schedule from the Engineer. The Contractor shall have sufficient manpower, equipment, and material to complete the Project. No Work shall commence without express consent of the Engineer.

2.02 COORDINATION

- A. Contractors shall cooperate in the coordination of their separate activities in a manner that will provide the least interference with the Owner's operations and other contractors and utility companies working in the area, and in the interfacing and connection of the separate elements of the overall Project Work.
- B. If any difficulty or dispute should arise in the accomplishment of the above, the problem shall be brought immediately to the attention of the Engineer.
- C. All contractors working on the Site are subject to this requirement for cooperation and all shall abide by the Engineer's decision in resolving Project coordination problems without additional cost to the Owner.
- D. Contractor may be asked to stop Work during Special Events. All material and equipment shall be totally off all streets by 5:00 p.m. the day before. Contractor is responsible to obtain a schedule of Special Events from the Owner.

2.03 SHUTDOWN OF EXISTING OPERATIONS OR UTILITIES

- A. Continuous operation of the Owner's existing wastewater system are of critical importance. The Contractor's Work shall not result in the interruption of stormwater disposal, sewage, water, or solid waste service to any customers.
- B. Contractor will need to keep the wastewater pump stations in operation during construction.
- C. Any Work that requires the temporary shutdown of any existing operations or utilities shall be planned in detail with appropriate scheduling of the Work and coordinated with the utility, Owner, and Engineer. Advance notice shall be given in order that the utility, Owner, and Engineer may witness the shutdown, tie-in, and startup. The temporary shutdown must be approved by the Owner. All tie in and bypass operations shall be the responsibility of the Contractor and are considered incidental to the cost of construction and provided at no additional cost to the Owner.

- D. All materials and equipment (including emergency equipment) necessary to expedite the tie-in shall be on hand prior to the shutdown of existing services or utilities.

2.04 OPERATION OF EXISTING SYSTEM PROHIBITED

- A. At no time undertake to close off any utility lines or open valves or take any other action which would affect the operation of the existing utility systems, except as specifically required by the Drawings and Specifications and after approval is granted by the Owner or Facility Owner. Request approval 5 working days in advance of the time that interruption of the existing system is required. Florida Key Aqueduct Authority (FKAA) water valves can be operated only by FKAA personnel.

2.05 PROGRESS OF PIPELINE CONSTRUCTION

- A. No excavated material shall be cast on streets or adjacent sidewalks.
- B. Cleanup construction debris, excess excavation, excess materials, and completely restore fences, mailboxes, ditches, culverts, signposts, and similar items immediately following the final backfilling.

PART 3 SITE CONDITIONS

3.01 SITE INVESTIGATION AND REPRESENTATION

- A. The Contractor acknowledges satisfaction as to the general nature and location of the Work, the general and local conditions, particularly those bearing upon availability of transportation, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, or similar physical conditions, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, and all other matters which can in any way affect the Work or the cost thereof under this Contract.
- B. Failure by the Contractor to become acquainted with the physical conditions and all the available information will not relieve the Contractor from responsibility for properly estimating the difficulty or cost of successfully performing the Work.
- C. The Contractor warrants that as a result of examination and investigation of all the aforesaid data, the Contractor can perform the Work in a good and workmanlike manner and to the satisfaction of the Owner. The Owner assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this Contract, unless (1) such representations are expressly stated in the Contract, and (2) the Contract expressly provides that the responsibility therefore is assumed by the Owner.

3.02 INFORMATION ONSITE CONDITIONS

- A. General: Any information obtained by the Engineer regarding Site conditions, subsurface information, groundwater elevations, existing construction of Site facilities as applicable, and similar data will be available for inspection at the office of the Engineer upon request. Such information is offered as supplementary information only. Neither the Engineer nor the Owner assumes any responsibility for the completeness or interpretation of such supplementary information.

3.03 UTILITIES

- A. The Contractor shall be responsible for determining, at his cost, the locations of all utilities within the Project area, and shall be responsible for contacting each utility for location and notification prior to commencing Work.

3.04 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

- A. Where the Contractor's operations could cause damage or inconvenience to utilities, telephone, television, power, water, or sewer systems, the operations shall be suspended until all arrangements necessary for the protection of these utilities and services have been made by the Contractor with the owner of the utility affected.
- B. Notify all utility offices which are affected by the construction operation at least 48 hours in advance. Under no circumstances expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for all existing underground utilities.
- C. The Contractor shall be solely and directly responsible to the Owner and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.
- D. Neither the Owner nor its officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the Work.
- E. In the event of interruption to domestic water, sewer, storm drain, or other utility services as a result of accidental breakage due to construction operations, promptly notify the proper authority. Cooperate with said authority in restoration of service as promptly as possible and bear all costs of repair. In no case shall interruption of any water or utility service be allowed to exist outside working hours unless prior approval is granted.

- F. In the event the Contractor encounters water service lines that interfere with trenching, he may, by obtaining prior approval of the property owner, Florida Keys Aqueduct Authority, or Fire Department as applicable, and the Engineer, cut the service, dig through, and restore the service with similar and equal materials at the Contractor's expense.
- G. The Contractor shall replace, at his own expense, all existing utilities or structures removed or damaged during construction, unless otherwise provided for in these Contract documents or ordered by the Engineer.

3.05 INTERFERING STRUCTURES

- A. Take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground.
- B. Protect underground and aboveground existing structures from damage, whether or not they lie within the limits of the easements obtained by the Owner. Where such existing fences, gates, sheds, buildings, or any other structure must be removed in order to properly carry out the construction, or are damaged during construction, restore to their original condition to the satisfaction of the property owner involved at the Contractor's own expense. Notify the Engineer of any damaged underground structure, and make repairs or replacements before backfilling.
- C. Without additional compensation, the Contractor may remove and replace in a condition as good as or better than original, such small miscellaneous structures as fences, mailboxes, and signposts that interfere with the Contractor's operations.

3.06 FIELD RELOCATION

- A. During the progress of construction, it is expected that minor relocations of the work will be necessary. Such relocations shall be made only by direction of the Engineer. If existing structures are encountered which prevent the construction, and which are not properly shown on any Contract Drawings, notify the Engineer before continuing with the construction in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing structures. If the Contractor shall fail to so notify the Engineer when an existing structure is encountered, and shall proceed with the construction despite this interference, he shall do so at his own risk.

3.07 EASEMENTS

- A. Where portions of the Work are located on public or private property, easements and permits will be obtained by the Owner, except as otherwise noted in these Specifications. Easements will provide for the use of property for construction purposes to the extent indicated on the easements. Copies of these easements and permits are available upon request to the Owner. It shall

be the Contractor's responsibility to determine the adequacy of the easement obtained in every case and to abide by all requirements and provisions of the easement. The Contractor shall confine his construction operations to within the easement limits or street right-of-way limits or make special arrangements with the property owners or appropriate public agency for the additional area required. Any damage to property, either inside or outside the limits of the easements provided by the Owner or street rights-of-way, shall be the responsibility of the Contractor as specified herein. The Contractor shall remove, protect, and replace all fences or other items encountered on public or private property. Before final payment will be authorized by the Engineer, the Contractor will be required to furnish the Owner with written releases from property owners or public agencies where side agreements or special easements have been made by the Contractor or where the Contractor's operations, for any reason, have not been kept within the construction right-of-way obtained by the Owner or the street right-of-way.

- B. It is anticipated that the required easements and permits will be obtained before construction is started. However, should the procurement of any easement or permit be delayed, the Contractor shall schedule and perform the Work around these areas until such a time as the easement or permit has been secured.

3.08 PROTECTED VEGETATION

- A. Trees and shrubs are regulated and protected in Key West. All trimming and pruning shall be done in accordance with City guidelines. This Work will be considered incidental to the Project costs. Contractor shall obtain such guidelines and gain approvals before commencing Work.

PART 4 TEMPORARY CONSTRUCTION UTILITIES AND FACILITIES

4.01 TEMPORARY WATER

- A. The Contractor shall make his own arrangements to obtain suitable water and shall pay all costs.

4.02 TEMPORARY ELECTRIC POWER

- A. The Contractor shall make arrangements to obtain and pay for electrical power used until final acceptance by the Owner.

4.03 SAFETY REQUIREMENTS FOR TEMPORARY ELECTRIC POWER

- A. Temporary electric power installation shall meet the construction safety requirements of OSHA, state and other governing agencies.

4.04 SANITARY FACILITIES

- A. The Contractor shall provide and maintain sanitary facilities for his employees and his subcontractors that will comply with the regulations of the local and state departments of health and as directed by the Engineer.

4.05 STORAGE OF MATERIALS

- A. Materials shall be stored based on manufacturer's instructions including pre- and post-storage meggering as to ensure the preservation of their quality and fitness for the Work. When considered necessary they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without the written permission of the Owner or lessee.
- B. Delicate instruments and materials subject to vandalism shall be placed under locked cover and, if necessary, provided with temperature control as recommended by the manufacturer.

PART 5 SALVAGE OF MATERIALS

5.01 MATERIAL TO BE SALVAGED

- A. Materials to be salvaged include: None.

PART 6 SAFETY AND CONVENIENCE

6.01 SAFETY EQUIPMENT

- A. The Contractor shall do all Work necessary to protect the general public from hazards, including, but not limited to, surface irregularities or unramped grade changes in pedestrian sidewalk or walkway, and trenches or excavations in roadway. Barricades, lanterns, and proper signs shall be furnished in sufficient amount to safeguard the public and the Work. All barricades and signs shall be clean and serviceable, in the opinion of the Engineer.
- B. During construction, the Contractor shall construct and at all times maintain satisfactory and substantial temporary chain link fencing, solid fencing, railing, barricades or steel plates, as applicable, at all openings, obstructions, or other hazards in streets, sidewalks, floors, roofs, and walkways. All such barriers shall have adequate warning lights as necessary, or required, for safety. All lights shall be regularly maintained, and in a fully operational state at all times.

6.02 ACCIDENT REPORTS

- A. In addition, the Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on, or adjacent to, the Site, giving full details and statements of witnesses. If death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the Engineer.
- B. If a claim is made by anyone against the contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

6.03 SAFE ACCESS BY FEDERAL, STATE, AND LOCAL GOVERNMENT OFFICIALS

- A. Authorized representatives of the state, federal, or local governmental agencies, shall at all times have safe access to the Work, and the Contractor shall provide proper facilities for such access and inspection.

6.04 TRAFFIC MAINTENANCE AND SAFETY

- A. Provide traffic maintenance plans where required by federal, state, county, or local agencies having jurisdiction.
- B. Comply with all rules and regulations of the state, county, and city authorities regarding closing or restricting the use of public streets or highways. No public or private road shall be closed, except by express permission of the Owner. Conduct the Work so as to assure the least possible obstruction to traffic and normal commercial pursuits. Protect all obstructions within traveled roadways by installing approved signs, barricades, and lights where necessary for the safety of the public. The convenience of the general public and residents adjacent to the Project, and the protection of persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.

6.05 PROTECTION OF PROPERTY

- A. Protect stored materials located adjacent to the proposed Work. Notify property owners affected by the construction at least 48 hours in advance of the time construction begins. During construction operations, construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to his residence or place of business for a period exceeding 8 hours, unless the Contractor has made special arrangements with the affected persons.
- B. The Contractor shall identify and isolate his Work zone in such a manner as to exclude all personnel not employed by him, the Engineer, and the Owner.

6.06 FIRE PREVENTION AND PROTECTION

- A. The Contractor shall perform all Work in a fire-safe manner. He shall supply and maintain on the Site adequate fire-fighting equipment capable of extinguishing incipient fires. The Contractor shall comply with applicable federal, state, and local fire-prevention regulations. Where these regulations do not apply, applicable parts of the National Fire Prevention Standard for Safeguarding Building Construction Operations (NFPA No. 241) shall be followed.

6.07 ACCESS FOR POLICE, FIRE, AND POSTAL SERVICE

- A. Notify the fire department and police department before closing any street or portion thereof. No closing shall be made without the Owner's approval. Notify said departments when the streets are again passable for emergency vehicles. Do not block off emergency vehicle access to consecutive arterial crossings or dead-end streets, in excess of 300 linear feet, without special written permission from the fire department. Conduct operations with the least interference to fire equipment access, and at no time prevent such access.
- B. The Contractor shall leave a night emergency telephone number or numbers with the police department, the Engineer, and the Owner, so that contact may be made easily at all times in case of barricade and flare trouble or other emergencies.
- C. Maintain postal service facilities in accordance with the requirements of the U.S. Postal Service. Move mailboxes to temporary locations designated by the U. S. Postal Service, and at the completion of the Work in each area, replace them in their original location and in a condition satisfactory to the U.S. Postal Service.

6.08 CLEANUP PROCEDURES FOR HURRICANE WARNINGS AND HURRICANE WATCHES

- A. In the event that the National Oceanographic and Atmospheric Administration (NOAA), issues a hurricane watch for the Florida Keys, the Engineer will contact the Contractor informing him that the watch has been established within 4 hours of the notice. The Contractor shall implement the approved plan and schedule describing how and when the Contractor will remove all unnecessary items from the Work area and tie down all remaining supplies and barricades in the event that a hurricane warning is issued. If a warning is issued, the Contractor shall remove all unnecessary items from the Work area(s) and shall tie down all movable (under 200 pounds) objects. The Engineer will determine “necessary” items. The Owner will not be liable for any financial hardship or delays caused as a result of demobilization or remobilization due to the above.

PART 7 PRESERVATION, RESTORATION, AND CLEANUP

7.01 SITE RESTORATION AND CLEANUP

- A. At all times during the Work, keep the premises clean and orderly, and upon completion of the Work, repair all damage caused by equipment and leave the Project free of rubbish or excess materials of any kind.
- B. Stockpile excavated materials in a manner that will cause the least damage to adjacent lawns, grassed areas, gardens, shrubbery, or fences, regardless of whether these are on private property, or on state, county, or city rights-of-way. Remove all excavated materials from grassed and planted areas, and leave these surfaces in a condition equivalent to their original condition.
- C. All existing drainage ditches and culverts shall be reopened and graded and natural drainage restored. Restore culverts broken or damaged to their original condition and location as an incidental cost of construction.
- D. Upon completion of backfilling operations, hand-rake and drag all former grassed and planted areas, leaving all disturbed areas free from rocks, gravel, clay, or any other foreign material. The finished surface shall conform to the original surface, and shall be free-draining and free from holes, ruts, rough spots, or other surface features detrimental to a seeded area.

7.02 FINISHING OF SITE, BORROW, AND STORAGE AREAS

- A. Upon completion of the Project, all areas used by the Contractor shall be properly cleared of all temporary structures, rubbish, and waste materials and properly graded to drain and blend in with the abutting property. Areas used for the deposit of waste materials shall be finished to properly drain and blend with the surrounding terrain.

7.03 STREET CLEANUP DURING CONSTRUCTION

- A. Thoroughly clean all spilled dirt, gravel, or other foreign material caused by the construction operations from all streets and roads at the conclusion of each day's operation. Sidewalks, unless under construction, shall be kept clear of material, and available for pedestrian use at all times.

7.04 DUST PREVENTION

- A. Give all unpaved streets, roads, detours, haul roads or disturbed areas used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

7.05 PRESERVATION OF IRRIGATION AND DRAINAGE DITCHES, AND INLETS

- A. After backfilling of the trenches, restore all irrigation and storm drain ditches destroyed, damaged, or otherwise modified during construction to a condition equivalent, in the opinion of the Engineer, to the condition of the ditch before construction. Ditches so reconstructed shall be built in their original locations. All inlets shall be periodically cleaned and kept free of siltation.

PART 8 SUBMITTALS DURING CONSTRUCTION

8.01 RECORD DRAWINGS

- A. The Contractor shall maintain a complete set of record Drawings to show any items which differ from those shown on Drawings. Such Drawings shall be updated daily and submitted each month with the partial pay request. Final record Drawings will be required before substantial completion can be certified and final payment can be made.
- B. The Contractor shall keep the Engineer apprised on a weekly basis, by providing Drawing mark-ups of the items that differ.
- C. All elevations and coordinates shall be verified by a licensed surveyor. The surveyor shall certify the Record Drawings.

PART 9 PRE- AND POST-CONSTRUCTION VIDEO RECORDINGS

9.01 GENERAL

- A. The Contractor shall provide color videos showing the pre-construction Site, and the post-construction Site. The videos shall be in digital (DVD) format, the video shall indicate on the DVD the date, job title, and brief description of the video and location where the video was taken. Video shall be subject to review and approval by Engineer. Two copies of the video DVD (including the original) shall be delivered to the Engineer as follows:
1. A video shall be taken of the preconstruction conditions, as well as all storage and staging areas, and the property adjacent to the construction Sites. Particular emphasis should be directed to roadway conditions as well as all right-of-way features that will be affected by the construction.
 2. A video shall be taken of the post-construction conditions and their adjacent properties. Particular emphasis should be directed to roadway conditions as well as all right-of-way features that were affected by the construction.
- B. The Following shall be Included with the Video Documentation:
1. Coverage is required within and adjacent to the right-of-way, and easements, and storage, and staging areas where the Work is being constructed.
 2. Documentation of the conditions of the adjacent properties or any affected structures as a result of the impending construction.
 3. Certification as to date Work done and by whom.
 4. All videos shall be keyed to the construction Drawings.
- C. Pre-Construction and Post-Construction on Videos shall be Submitted as Follows:
1. Pre-construction videos shall be presented to the Owner at the pre-construction conference.
 2. Post-construction videos shall be submitted prior to final Project closeout. This submittal is contingent to final payment.

END OF SECTION

**SECTION 01 11 00
SUMMARY OF WORK**

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project proposes improvements to the City of Key West, Florida Wastewater Pump Stations A, B, C, D, and DA. The Project consists of the installation at each pump station of an electrical building on a concrete platform, installation VFDs for the existing pumps, upgrade to the existing SCADA system, site modifications, electrical and instrumentation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 29 00
PAYMENT PROCEDURES**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Informational Submittals:
1. Schedule of Values: Submit on Contractor's standard form.
 2. Schedule of Estimated Progress Payments:
 - a. Submit with initially acceptable Schedule of Values.
 - b. Submit adjustments thereto with Application for Payment.
 3. Application for Payment.
 4. Final Application for Payment.

1.02 ALLOWANCES

- A. Consult with Engineer in selection of products or services. Obtain proposals from Suppliers and offer recommendations.
- B. Allowances will be administered in accordance with Paragraph 11.02 of General Conditions.
- C. Submit, with application for payment, invoice showing date of purchase, from whom the purchase was made, the date of delivery of the product or service, and the price, including delivery to the Site and applicable taxes.

1.03 SCHEDULE OF VALUES

- A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.
- B. Upon request of Engineer, provide documentation to support the accuracy of the Schedule of Values.
- C. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Form.
- D. Lump Sum Work:
1. Reflect specified contingency allowances and alternates, as applicable.
 2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.

- E. An unbalanced or front-end loaded schedule will not be acceptable.
- F. Summation of the complete Schedule of Values representing all the Work shall equal the Contract Price.

1.04 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

- A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.
- B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.05 APPLICATION FOR PAYMENT

- A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor.
- B. Use detailed Application for Payment Form provided by Owner.
- C. Provide separate form for each schedule as applicable.
- D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.
- E. Include separate line item for each Change Order and Work Change Directive executed prior to date of submission. Provide further breakdown of such as requested by Engineer.
- F. Preparation:
 - 1. Round values to nearest dollar.
 - 2. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Engineer.

1.06 PAYMENT

- A. Payment for all Lump Sum Work shown or specified in Contract Documents is included in the Contract Price. Payment will be based on a percentage complete basis for each line item of the accepted Schedule of Values.

1.07 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS**A. Payment will not be made for following:**

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by Owner.
6. Material remaining on hand after completion of Work.

1.08 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

- A. **Partial Payment:** No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings and preliminary operation and maintenance data is acceptable to Engineer.
- B. **Final Payment:** Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION (NOT USED)****END OF SECTION**

**SECTION 01 31 19
PROJECT MEETINGS**

PART 1 GENERAL

1.01 GENERAL

- A. Engineer will schedule physical arrangements for meetings throughout progress of Work, prepare meeting agenda with regular participant input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes within 5 days after each meeting to participants and parties affected by meeting decisions.

1.02 PRECONSTRUCTION CONFERENCE

- A. Contractor shall be prepared to discuss the following subjects, as a minimum:

1. Required schedules (Preliminary Construction Schedule, Schedule of Values, Submittal).
2. Status of Bonds and insurance.
3. Sequencing of critical path work items.
4. Progress payment procedures.
5. Project changes and clarification procedures.
6. Use of site, access, office and storage areas, security and temporary facilities.
7. Major product delivery and priorities.
8. Contractor's safety plan and representative.
9. Preliminary Hurricane Evaluation Plan.

- B. Attendees will Include:

1. Owner's representatives.
2. Contractor's office representative.
3. Contractor's resident superintendent.
4. Contractor's quality control representative.
5. Subcontractors' representatives whom Contractor may desire or Engineer may request to attend.
6. Engineer's representatives.
7. Others as appropriate.

1.03 PROGRESS MEETINGS

- A. Engineer will schedule regular progress meetings at Site, conducted monthly to review Work progress, progress schedule, Shop Drawing and Sample submissions schedule, Application for Payment, contract modifications, and other matters needing discussion and resolution.
- B. Attendees will Include:
 - 1. Owner's representative(s), as appropriate.
 - 2. Contractor, Subcontractors, and Suppliers, as appropriate.
 - 3. Engineer's representative(s).
 - 4. Others as appropriate.

1.04 QUALITY CONTROL AND COORDINATION MEETINGS

- A. Scheduled by Engineer on regular basis and as necessary to review test and inspection reports, and other matters relating to quality control of Work and work of other contractors.
- B. Attendees will Include:
 - 1. Contractor.
 - 2. Contractor's designated quality control representative.
 - 3. Subcontractors and Suppliers, as necessary.
 - 4. Engineer's representatives.

1.05 PREINSTALLATION MEETINGS

- A. When required in individual Specification sections, convene at Site prior to commencing Work of that Section.
- B. Require attendance of entities directly affecting, or affected by, Work of that Section.
- C. Notify Engineer 4 days in advance of meeting date.
- D. Provide suggested agenda to Engineer to include reviewing conditions of installation, preparation and installation or application procedures, and coordination with related Work and work of others.

1.06 OTHER MEETINGS

- A. In accordance with Contract Documents and as may be required by Owner and Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 32 00
PROGRESS SCHEDULES**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Preliminary Progress Schedule: Submit within time specified in paragraph 2.05 of the General Conditions.
- B. Detailed Progress Schedule: Submit initial Detailed Progress Schedule within 30 days after Effective Date of the Agreement.
- C. Submit with Each Progress Schedule Submission:
 - 1. Contractor's certification that progress schedule submission is the actual schedule being utilized for execution of the Work.
 - 2. Progress Schedule: Four legible copies.
 - 3. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
- D. Prior to final payment, submit a final Updated Progress Schedule.

1.02 PRELIMINARY PROGRESS SCHEDULE

- A. In addition to basic requirements outlined in General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 120 days, and a summary of balance of Project through Final Completion.
- B. Show activities including, but not limited to the following:
 - 1. Notice to Proceed.
 - 2. Permits.
 - 3. Submittals, with review time.
 - 4. Early procurement activities for long lead equipment and materials.
 - 5. Initial site work.
 - 6. Earthwork.
 - 7. Specified Work sequences and construction constraints.
 - 8. Contract Milestone and Completion Dates.
 - 9. Owner-furnished products delivery dates or ranges of dates.
 - 10. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
 - 11. System startup summary.
 - 12. Project close-out summary.
 - 13. Demobilization summary.

- C. Update Preliminary Progress Schedule monthly; as part of progress payment process. Failure to do so may cause Owner to withhold all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Engineer.
- D. Format: In accordance with Article Progress Schedule - Bar Chart.
- E. Detailed progress schedule.
- F. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.
- G. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.
- H. When accepted by Engineer, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.
- I. Update monthly to reflect actual progress and occurrences to date, including weather delays.

1.03 PROGRESS SCHEDULE - BAR CHART

- A. General: Comprehensive bar chart schedule, generally as outlined in Associated General Contractors of America (AGC) Publication No. 1107.1, "Construction Planning and Scheduling, latest edition. If a conflict occurs between the AGC publication and this specification, this specification shall govern.
- B. Format:
 - 1. Unless otherwise approved, white paper, 11-inch by 17-inch sheet size.
 - 2. Title Block: Show name of project and Owner, date submitted, revision or update number, and name of scheduler.
 - 3. Identify horizontally, across the top of the schedule, the time frame by year, month, and day.
 - 4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
 - 5. Legend: Describe standard and special symbols used.
- C. Contents: Identify, in chronological order, those activities reasonably required to complete the Work, including as applicable, but not limited to:
 - 1. Obtaining permits, submittals for early product procurement and long lead time items.

2. Mobilization and other preliminary activities.
3. Initial site work.
4. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s) Subcontract Work.
5. Major equipment design, fabrication, factory testing, and delivery dates.
6. Sitework.
7. Concrete Work.
8. Structural steel Work.
9. Architectural features Work.
10. Conveying systems Work.
11. Equipment Work.
12. Mechanical Work.
13. Electrical Work.
14. Instrumentation and control Work.
15. Interfaces with Owner-furnished equipment.
16. Other important Work for each major facility.
17. Equipment and system startup and test activities.
18. Project closeout and cleanup.
19. Demobilization.

1.04 PROGRESS OF THE WORK

- A. Updated Progress Schedule shall reflect:
 1. Progress of Work to within 5 working days prior to submission.
 2. Approved changes in Work scope and activities modified since submission.
 3. Delays in Submittals or resubmittals, deliveries, or Work.
 4. Adjusted or modified sequences of Work.
 5. Other identifiable changes.
 6. Revised projections of progress and completion.
 7. Report of changed logic.
- B. Produce detailed subschedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns, etc.
- C. If Contractor fails to complete activity by its latest scheduled completion date and this failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within 7 days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current progress schedule. Actions by Contractor to complete Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

- D. Owner may order Contractor to increase plant, equipment, labor force or working hours if Contractor fails to:
 - 1. Complete a Milestone activity by its completion date.
 - 2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.

1.05 NARRATIVE PROGRESS REPORT

- A. Format:
 - 1. Organize same as Progress Schedule.
 - 2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.
- B. Contents:
 - 1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks, etc.).
 - 2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
 - 3. Contractor's plan for management of site (e.g., lay down and staging areas, construction traffic, etc.), utilization of construction equipment, buildup of trade labor, and identification of potential Contract changes.
 - 4. Identification of new activities and sequences as a result of executed Contract changes.
 - 5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
 - 6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
 - 7. Changes to activity logic.
 - 8. Changes to the critical path.
 - 9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
 - 10. Steps taken to recover the schedule from Contractor-caused delays.

1.06 SCHEDULE ACCEPTANCE

- A. Engineer's acceptance will demonstrate agreement that the proposed schedule conforms with requirements of Contract including, but not limited to, the following:
 - 1. Contract Times, including Final Completion and all intermediate Milestones are within the specified times.
 - 2. Specified Work sequences and constraints are shown as specified.

3. Complete Scope of Work is included.
4. Specified Owner furnished Equipment or Material arrival dates, or range of dates, are included.
5. Access restrictions are accurately reflected.
6. Start-up and testing times are as specified.
7. Training time is as specified.
8. Level of detail is as specified herein.
9. Submittal submission and review times are as specified.
10. Duration of activities are reasonable.
11. Sequencing is reasonable and does not include preferential logic contrary to the contingency/float sharing clauses of this Specification.
12. Meets all administrative requirements of Contract Documents.
13. Updated schedules reflect actual dates and duration of Work performed.

B. Preliminary Progress Schedule Review Disposition:

1. Accepted.
2. Rejected as Noted:
 - a. Make requested corrections; resubmit within 10 days.
 - b. Until acceptable to Engineer as the Baseline Progress Schedule, continue the review and revision process, during which time Contractor shall update the schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Detailed Progress Schedule:

1. Accepted.
2. Rejected as Noted:
 - a. Make requested corrections; resubmit within 10 days.
 - b. Until acceptable to Engineer as the Baseline Progress Schedule, continue the review and revision process.

D. Narrative Report: All changes to activity duration and sequences, including the addition or deletion of activities subsequent to Engineer's acceptance of the Baseline Progress Schedule, shall be delineated in the Narrative Report current with the proposed Updated Progress Schedule.

1.07 ADJUSTMENT OF CONTRACT TIMES

- A. Reference General Conditions.
- B. Evaluation and reconciliation of Adjustments of Contract Times shall be based on the Updated Progress Schedule at the time of proposed adjustment or claimed delay.

C. Schedule Contingency:

1. Contingency, when used in the context of the Progress Schedule, is time between Contractor's proposed Completion Time and Contract Completion Time.
2. Contingency included in Progress Schedule is a Project resource available to both Contractor and Owner to meet Contract Milestones and Contract Times. Use of Schedule contingency shall be shared to the proportionate benefit of both parties.
3. Use of schedule contingency suppression techniques such as preferential sequencing and extended activity times are prohibited.
4. Pursuant to Contingency sharing provisions of this Specification, no time extensions will be granted, nor will delay damages be paid until a delay occurs which (i) consumes all available contingency time, and (ii) extends Work beyond the Contract Completion date.

D. Claims Based on Contract Times:

1. Where Engineer has not yet rendered formal decision on Contractor's claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in progress schedule, Contractor shall reflect an interim adjustment in the progress schedule as acceptable to Engineer.
2. It is understood and agreed that such interim acceptance will not be binding on either Contractor or Owner, and will be made only for the purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.
3. Contractor shall revise progress schedule prepared thereafter in accordance with Engineer's formal decision.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00
SUBMITTALS

PART 1 GENERAL

1.01 GENERAL

- A. Inquiries: Direct to Engineer regarding procedure, purpose, or extent of Submittal.
- B. Timeliness: Schedule and make submissions in accordance with requirements of individual Specification sections and in such sequence as to cause no delay in Work or in Work of other contractors.
- C. Identification of Submittals:
 - 1. Complete, sign, and transmit with each Submittal package, one Transmittal of Contractor's Submittal Form attached at end of this Section.
 - 2. Identify each Submittal with the following numbering and tracking system:
 - a. Sequentially number each Submittal.
 - b. Resubmission of a Submittal will have original number with sequential alphabetic suffix.
 - 3. Format: Orderly, indexed with labeled tab dividers.
 - 4. Show date of submission.
 - 5. Show Project title and Owner's contract identification and contract number.
 - 6. Show names of Contractor, Subcontractor or Supplier, and manufacturer as appropriate.
 - 7. Identify, as applicable, Contract Document section and paragraph to which Submittal applies.
 - 8. Identify Submittal type; submit only one type in each Submittal package.
 - 9. Identify and indicate each deviation or variation from Contract Documents.
- D. Resubmissions: Clearly identify each correction or change made.
- E. Incomplete Submittal Submissions:
 - 1. Engineer will return entire Submittal for Contractor's revision/correction and resubmission.
 - 2. Submittals which do not clearly bear Contractor's specific written indication of Contractor review and approval of Submittal or which are transmitted with an unsigned or uncertified submission form or as may otherwise be required will be returned to Contractor unreviewed.

- F. Nonspecified Submissions: Submissions not required under these Contract Documents and not shown on submissions will not be reviewed and will be returned to Contractor.
- G. Engineer's Review: Engineer will act upon Contractor's Submittal and transmit response to Contractor not later than 20 working days after receipt, unless otherwise specified. Resubmittals will be subject to same review time.
- H. Schedule Delays:
 - 1. No adjustment of Contract Times or Price will be allowed due to Engineer's review of Submittals, unless all of the following criteria are met:
 - a. Contractor has notified Engineer in writing that timely review of Submittal in question is critical to progress of Work, and has received Engineer's written acceptance to reflect such on current accepted submissions and progress schedule. Written agreement by the Engineer to reduce Submittal review time will be made only for unusual and Contractor-justified reasons. Acceptance of a progress schedule containing Submittal review times less than specified or less than agreed to in writing by Engineer will not constitute Engineer's acceptance of review times.
 - b. Engineer has failed to review and return first submission of a Submittal within agreed time indicated on current accepted schedule of submissions or, if no time is indicated thereon, within 30 days after receipt.
 - c. Contractor demonstrates that delay in progress of Work is directly attributable to Engineer's failure to return Submittal within time indicated and accepted by Engineer.
 - 2. No adjustment of Contract Times or Price will be allowed due to delays in progress of Work caused by rejection and subsequent resubmission of Submittals, including multiple resubmissions.

1.02 SHOP DRAWINGS AND SAMPLES

- A. Copies:
 - 1. Shop Drawings and Product Data: Submit four copies, plus whatever the Contractor requires to be returned, maximum eight.
 - 2. Samples: Two, unless otherwise specified in individual Specification sections.

3. Electronic Submittals: Contractor may be required to submit all documents electronically. If so the following will be followed:
 - a. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at the time of execution of the Contract Documents. Electronic files which contain more than ten (10) pages in Adobe Acrobat format shall contain internal book-marking from an index page to major sections of the document. PDF files shall be set to open "Bookmarks and Page" view. General information shall be added to each PDF file, including Title, Subject, Author, and Keywords.
 - b. The PDF files shall be set up to print legibly at either 8-1/2-inch by 11-inch, 11-inch by 17-inch or 22-inch by 34-inch.
 - c. New electronic files shall be required for each submittal.
 - d. Each electronic file shall also include a copy of the Submittal Transmittal Form and completed Submittal Checklist.
 - e. Submittals shall be transmitted by uploading the PDF file of the submittal to the project SharePoint site. Submittal review comments will be transmitted back to the Subcontractor electronically via the project SharePoint site as well.
 - f. Subcontractor shall provide authorization to reproduce and/or distribute each file as many times as necessary for the Project.
 - g. Subcontractor shall include all costs for preparation and transmittal of electronic submittals in its bid, including all resubmittals and final record copies.
 - h. Final Record Copies: After all initial and resubmittal information has been approved, consolidate all information and responses to comments into one conformed record copy. Provide one electronic copy of the conformed record copy to CH2M HILL to verify incorporation of previously submitted data. Hard copies, number as required herein, that exactly match the final conformed electronic copy of the submittal will be submitted to CH2M HILL within 30 days of approval of the electronic copy.
- B. General: Submit to Engineer as required by individual Specification sections.
- C. Identify and Indicate:
 1. Pertinent Drawing sheet(s) and detail number(s), products, units and assemblies, and system or equipment identification or tag numbers.
 2. Critical field dimensions and relationships to other critical features of Work.
 3. Samples: Source, location, date taken, and by whom.
 4. Each deviation or variation from Contract Documents.
 5. Proper storage and maintenance requirements.

- D. Design Data: When specified, provide Project-specific information as required and as necessary to clearly show calculations, dimensions, logic and assumptions, and referenced standards and codes upon which design is based.
- E. Foreign Manufacturers: When proposed, include following additional information:
 - 1. Names and addresses of at least two companies closest to Project that maintain technical service representatives.
 - 2. Complete inventory of spare parts and accessories for each piece of equipment.
- F. Preparation:
 - 1. Format: Whenever possible, schedule for and combine Shop Drawings and Samples required for submission in each Specification section or division into a single Submittal package. Also combine product data for like items into a single Submittal package.
 - 2. Present in a clear and thorough manner and of sufficient detail to show kind, size, arrangement, and function of components, materials, and devices and compliance with Contract Documents. Identify details by reference to sheet and detail, and schedule or room numbers shown on Drawings.
 - 3. Reproducible Copy:
 - a. Preferred Minimum Sheet Size: 8-1/2- by 11-inch and 11- by 17-inch pages, suitable for photocopying.
 - b. Larger than 11- by 17-Inch Sheets: 22-inch by 34-inch preferred, mylar or sepias suitable for copying in a blueprint machine.
 - 4. Piping Systems: Drawn to scale.
 - 5. Product Data: Clearly mark each copy to identify pertinent products or models and show performance characteristics and capacities, dimensions and clearances required, wiring or piping diagrams and controls, and external connections, anchorage, and supports required.
 - 6. Equipment and Component Titles: Identical to title shown on Drawings.
 - 7. Manufacturer's Standard Schematic Drawings and Diagrams as Follows:
 - a. Modify to delete information that is not applicable to Work.
 - b. Supplement standard information to provide information specifically applicable to Work.
- G. Shop Drawing Disposition: Engineer will review, mark, and stamp as appropriate and distribute marked-up copies as noted:
 - 1. Approved as Submitted (for Incorporation in Work):
 - a. Two copies furnished Owner.
 - b. One copy furnished Resident Project Representative.
 - c. One copy retained in Engineer's file.

- d. Remaining copies returned to Contractor appropriately annotated.
- e. Contractor may begin to implement activities to incorporate specific product(s) or Work covered by Submittal.
- 2. Approved as Noted (for Incorporation in Work):
 - a. Two copies furnished Owner.
 - b. One copy furnished Resident Project Representative.
 - c. One copy retained in Engineer's file.
 - d. Remaining copies returned to Contractor appropriately annotated.
 - e. Contractor may begin to implement activities to incorporate product(s) or Work covered by Submittal, in accordance with Engineer's notations.
- 3. Disapproved:
 - a. One copy furnished Resident Project Representative.
 - b. One copy retained in Engineer's file.
 - c. Remaining copies returned to Contractor appropriately annotated.
 - d. Contractor shall make corrections or develop replacement and resubmit (in same manner and quantity as specified for original submission).
 - e. Submittal is not approved.
- 4. Incomplete:
 - a. One copy furnished Resident Project Representative.
 - b. One copy retained in Engineer's file.
 - c. Remaining copies returned to Contractor appropriately annotated.
 - d. Contractor shall complete and resubmit or submit missing portions.
 - e. Submittal is not approved.

H. Sample Disposition: Same as Shop Drawing disposition; samples will not be returned.

1.03 ADMINISTRATIVE SUBMITTALS

- A. Copies: Submit four.
- B. Description: Submittals that are not Shop Drawings or Samples, or that do not reflect quality of product or method of construction. May include, but not limited to those Submittals identified below.
- C. Applications for Payment (and Cash Allowance Data and Values): Meet requirements of Section 01 29 00, Payment Procedures.
- D. Progress Reports and Quantity Charts: As may be required in Section 01 32 00, Progress Schedules.

- E. Hurricane Evaluation Plan: The Contractor shall prepare the Engineer with a written plan and schedule describing how and when the Contractor will remove all unnecessary items from the work area and tie down all remaining supplies and barricades in the event that a hurricane warning is issued, identifying gussets in particular. If a warning is issued, the Contractor shall remove all unnecessary items from the work area(s) and will tie down all movable (under 200 pounds) objects. The Owner shall not be liable for any financial hardship or delays caused as a result of demobilization or remobilization due to the above.
- F. Schedules:
1. Progress Schedule(s): Meet the requirements of Section 01 32 00, Progress Schedules.
 2. Schedule of Values: Meet requirements of Section 01 29 00, Payment Procedures.
 3. Schedule of Submittal Submissions:
 - a. Prepare and submit, preliminary list of submissions grouped by Contract Document article/paragraph number or Specification section number, with identification, numbering and tracking system as specified under Paragraph Identification of Submittals and as approved by Engineer.
 - b. Include Only the Following Required Submissions:
 - 1) Shop Drawings and Samples.
 - 2) Training plans.
 - 3) Test procedures.
 - 4) Operation and maintenance manuals.
 - 5) Record documents.
 - 6) Specifically required certificates, warranties, and service agreements.
 - c. Coordinate with progress schedule and prepare submissions to show for each Submittal, at a minimum, the following:
 - 1) Estimated submission date to Engineer.
 - 2) Specifically requested and clearly identified Engineer review time if shorter than that set forth herein, with justification for such request and critical dates Submittals will be needed from Engineer.
 - 3) For first 6-month period from the date the Contract Times commence or following any update or adjustment of the submissions, the estimated submission date shall be week, month, and year; for submissions beyond 6-month time period, show closest month and year.
 - d. Submit to Engineer Monthly:
 - 1) Updated list if changes have occurred. Otherwise, submit a written communication confirming existing list.

- 2) Adjusted submissions reflecting submission activity planned for forthcoming 6-month time period and beyond.
Coordinate with progress schedule updates.

G. Submittals Required by Laws, Regulations, and Governing Agencies:

1. Submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
2. Transmit to Engineer for Owner's records one copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.

H. Disposition: Engineer will review, stamp, and indicate requirements for resubmission or acceptance on Submittal as follows:

1. Accepted:
 - a. Acceptance will indicate that Submittal conforms to intent of Contract Documents as to form and substance.
 - b. Contractor may proceed to perform Submittal related Work.
 - c. One copy furnished Owner.
 - d. One copy furnished Resident Project Representative.
 - e. One copy retained in Engineer's file.
 - f. Remaining copies returned to Contractor appropriately annotated.
2. Rejected as Noted:
 - a. One copy retained in Engineer's file.
 - b. Remaining copies returned to Contractor appropriately annotated.
 - c. Contractor shall revise/correct or develop replacement and resubmit.

1.04 QUALITY CONTROL SUBMITTALS

- A. Certificates: Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in the individual Specification sections.
- B. Statements of Qualification: Evidence of qualification, certification, or registration. As required in these Contract Documents to verify qualifications of professional land surveyors, engineers, materials testing laboratories, specialty Subcontractors, trades, specialists, consultants, installers, and other professionals. Reference Article 1.01.A.51 of Supplementary Conditions for the definition of Specialist.
- C. Field Samples: Provide as required by individual Specifications and as may be required by Engineer during progress of Work.

- D. Written Test Reports of Each Test and Inspection: As a minimum, include the following:
1. Date of test and date issued, Project title and number, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
 2. Date and time of sampling or inspection and record of temperature and weather conditions.
 3. Identification of product and Specification section, location of Sample, test or inspection in the Project, type of inspection or test with referenced standard or code, certified results of test.
 4. Compliance with Contract Documents, and identifying corrective action necessary to bring materials and equipment into compliance.
 5. Provide an interpretation of test results, when requested by Engineer.
- E. Disposition: Engineer will review, stamp, and indicate requirements for resubmission or acceptance on Submittal as follows:
1. Accepted:
 - a. Acceptance will indicate that Submittal conforms to intent of Contract Documents as to form and substance.
 - b. Contractor may proceed to perform Submittal related Work.
 - c. One copy furnished Owner.
 - d. One copy furnished Resident Project Representative.
 - e. One copy retained in Engineer's file.
 - f. Remaining copies returned to Contractor appropriately annotated.
 2. Rejected as Noted:
 - a. One copy retained in Engineer's file.
 - b. Remaining copies returned to Contractor appropriately annotated.
 - c. Contractor shall revise/correct or develop replacement and resubmit.

1.05 CONTRACT CLOSEOUT SUBMITTALS

- A. General: In accordance with Section 01 77 00, Contract Closeout.
- B. Disposition: Engineer will review, stamp, and indicate requirements for resubmission or acceptance on Submittal as follows:
1. Accepted:
 - a. Acceptance will indicate that Submittal conforms to intent of Contract Documents as to form and substance.
 - b. Contractor may proceed to perform Submittal related Work.
 - c. One copy furnished Owner.
 - d. One copy furnished Resident Project Representative.
 - e. One copy retained in Engineer's file.

- f. Remaining copies returned to Contractor appropriately annotated.
- 2. Rejected as Noted:
 - a. One copy retained in Engineer's file.
 - b. Remaining copies returned to Contractor appropriately annotated.
 - c. Contractor shall revise/correct or develop replacement and resubmit.

1.06 SUPPLEMENTS

A. The supplement listed below, following "END OF SECTION," is part of this Specification.

- 1. Transmittal of Contractor's Submittal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

CH2M HILL

TRANSMITTAL OF CONTRACTOR'S SUBMITTAL
(ATTACH TO EACH SUBMITTAL)

DATE: _____

TO: _____

Submittal No.: _____
 New Submittal Resubmittal
Previous Submittal No.: _____
Project: _____
Project No.: _____
Specification Section No.: _____

FROM: _____
Contractor

(Cover only one section with each transmittal)
Schedule Date of Submittal: _____

SUBMITTAL TYPE: Shop Drawing Administrative Sample
 Quality Control Contract Closeout "Or-Equal"/Substitute

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____
Contractor (Authorized Signature)

SECTION 01 42 13
ABBREVIATIONS

PART 1 GENERAL

- 1.01 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES
- A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as provided in paragraph 3.02 of the General Conditions, and as may otherwise be required herein and in the individual Specification sections.
 - B. Work specified by reference to the published standard or specification of a government agency, technical association, trade association, professional society or institute, testing agency, or other organization shall meet the requirements or surpass the minimum standards of quality for materials and workmanship established by the designated standard or specification.
 - C. Where so specified, products or workmanship shall also meet or exceed the additional prescriptive or performance requirements included within the Contract Documents to establish a higher or more stringent standard of quality than that required by the referenced standard.
 - D. Where two or more standards are specified to establish quality, the product and workmanship shall meet or exceed the requirements of the most stringent.
 - E. Where both a standard and a brand name are specified for a product in the Contract Documents, the proprietary product named shall meet or exceed the requirements of the specified reference standard.
 - F. Copies of Standards and Specifications of Technical Societies:
 - 1. Copies of applicable referenced standards have not been bound in these Contract Documents.
 - 2. Where copies of standards are needed by the Contractor, obtain a copy or copies directly from the publication source and maintain in an orderly manner at the site as Work site records, available to the Contractor's personnel, Subcontractors, Owner, and Engineer.

1.02 ABBREVIATIONS

A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.

1. AA Aluminum Association
2. AABC Associated Air Balance Council
3. AAMA American Architectural Manufacturers Association
4. AASHTO American Association of State Highway and Transportation Officials
5. ACI American Concrete Institute
6. AFBMA Anti-Friction Bearing Manufacturers' Association
7. AGA American Gas Association
8. AGMA American Gear Manufacturers' Association
9. AI Asphalt Institute
10. AISC American Institute of Steel Construction
11. AISI American Iron and Steel Institute
12. AITC American Institute of Timber Construction
13. ALS American Lumber Standards
14. AMA Acoustical Materials Association
15. AMCA Air Movement and Control Association
16. ANSI American National Standards Institute
17. APA American Plywood Association
18. API American Petroleum Institute
19. APWA American Public Works Association
20. AREA American Railway Engineering Association
21. ARI Air Conditioning and Refrigeration Institute
22. ASA American Standards Association
23. ASAE American Society of Agricultural Engineers
24. ASCE American Society of Civil Engineers
25. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
26. ASNT American Society for Nondestructive Testing
27. ASME American Society of Mechanical Engineers
28. ASTM American Society for Testing and Materials
29. AWI Architectural Wood Work Institute
30. AWWA American Wood Preservers' Association
31. AWPB American Wood Preservers Bureau
32. AWPI American Wood Preservers' Institute
33. AWS American Welding Society
34. AWWA American Water Works Association

35.	BHMA	Builders Hardware Manufacturers' Association
36.	CBMA	Certified Ballast Manufacturers' Association
37.	CDA	Copper Development Association
38.	CGA	Compressed Gas Association
39.	CIPRI	Cast Iron Pipe Research Institute
40.	CISPI	Cast Iron Soil Pipe Institute
41.	CMAA	Crane Manufacturers' Association of America
42.	CRSI	Concrete Reinforcing Steel Institute
43.	CS	Commercial Standard
44.	CSA	Canadian Standards Association
45.	CSI	Construction Specifications Institute
46.	CTSS	Caltrans Standard Specification
47.	EJCDC	Engineers Joint Contract Documents' Committee
48.	ETL	Engineering Test Laboratories
49.	FCC	Federal Communications Commission
50.	FAA	Federal Aviation Administration
51.	FEMA	Federal Emergency Management Agency
52.	FGMA	Flat Glass Marketing Association
53.	FM	Factory Mutual
54.	Fed. Spec.	Federal Specifications
55.	FS	Federal Specification
56.	GA	Gypsum Association
57.	HI	Hydraulic Institute
58.	HMI	Hoist Manufacturers' Institute
59.	ICBO	International Conference of Building Officials
60.	ICEA	Insulated Cable Engineers' Association
61.	IEEE	Institute of Electrical and Electronics Engineers, Inc.
62.	IES	Illuminating Engineering Society
63.	IFI	Industrial Fasteners Institute
64.	ISA	Instrument Society of America
65.	ISO	Insurance Service Office
66.	JIC	Joint Industry Conferences of Hydraulic Manufacturers
67.	MIA	Marble Institute of America
68.	Mil. Sp.	Military Specification or MIL
69.	MS	Military Specifications
70.	MMA	Monorail Manufacturers' Association
71.	NAAMM	National Association of Architectural Metal Manufacturers
72.	NACE	National Association of Corrosion Engineers
73.	NBHA	National Builders' Hardware Association
74.	NEBB	National Environmental Balancing Bureau
75.	NEC	National Electrical Code
76.	NECA	National Electrical Contractor's Association
77.	NEMA	National Electrical Manufacturers' Association

78.	NESC	National Electric Safety Code
79.	NFPA	National Fire Protection Association
80.	NHLA	National Hardwood Lumber Association
81.	NHPMA	Northern Hardwood and Pine Manufacturer's Association
82.	NLMA	National Lumber Manufacturers' Association
83.	NRCA	National Roofing Contractors Association
84.	NSF	National Sanitation Foundation Testing Laboratory
85.	NSPE	National Society of Professional Engineers
86.	NTMA	National Terrazzo and Mosaic Association
87.	NWWDA	National Wood Window and Door Association
88.	OECI	Overhead Electrical Crane Institute
89.	OSHA	Occupational Safety and Health Act (both Federal and State)
90.	PCI	Prestressed Concrete Institute
91.	PEI	Porcelain Enamel Institute
92.	PPI	Plastic Pipe Institute
93.	PS	Product Standards Section-U.S. Department of Commerce
94.	RMA	Rubber Manufacturers' Association
95.	SAE	Society of Automotive Engineers
96.	SCPRF	Structural Clay Products Research Foundation
97.	SDI	Steel Deck Institute
98.	SDI	Steel Door Institute
99.	SIGMA	Sealed Insulating Glass Manufacturing Association
100.	SJI	Steel Joist Institute
101.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
102.	SPI	Society of the Plastics Industry
103.	SSPC	Steel Structures Painting Council
104.	SWI	Steel Window Institute
105.	TEMA	Tubular Exchanger Manufacturers' Association
106.	TCA	Tile Council of America
107.	UBC	Uniform Building Code
108.	UFC	Uniform Fire Code
109.	UL	Underwriters Laboratories Inc.
110.	UMC	Uniform Mechanical Code
111.	US	U.S. Bureau of Standards
112.	USBR	U.S. Bureau of Reclamation
113.	WCLIB	West Coast Lumber Inspection Bureau
114.	WWPA	Western Wood Products Association

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION (NOT USED)****END OF SECTION**

SECTION 01 43 33
MANUFACTURERS' FIELD SERVICES

PART 1 GENERAL

1.01 DEFINITIONS

- A. Person-Day: One person for 8 hours within regular Contractor working hours.

1.02 SUBMITTALS

- A. Informational Submittals:

1. Training Schedule: Submit, in accordance with requirements of this specification, not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
2. Lesson Plan: Submit, in accordance with requirements of this specification, proposed lesson plan not less than 21 days prior to scheduled training and revise as necessary for acceptance.

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

- A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by the equipment manufacturer to issue the certifications required of the manufacturer. Additional qualifications may be specified elsewhere.
- B. Representative subject to acceptance by Owner. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

- A. Furnish manufacturers' services when required by an individual specification section, to meet the requirements of this section.
- B. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, or when a minimum time is not specified, the time required to perform the specified services shall be considered incidental.
- C. Schedule manufacturer' services to avoid conflict with other onsite testing or other manufacturers' onsite services.

- D. Determine, before scheduling services, that all conditions necessary to allow successful testing have been met.
- E. Only those days of service approved by Engineer will be credited to fulfill the specified minimum services.
- F. When specified in individual specification sections, manufacturer's onsite services shall include:
 - 1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
 - 2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
 - 3. Providing, on a daily basis, copies of all manufacturers' representatives' field notes and data to Owner.
 - 4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to Engineer.
 - 5. Resolution of assembly or installation problems attributable to, or associated with, respective manufacturer's products and systems.
 - 6. Assistance during functional and performance testing, and facility startup and evaluation.
 - 7. Training of Owner's personnel in the operation and maintenance of respective product as required.
 - 8. Additional requirements may be specified elsewhere.

3.02 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

- A. When so specified, a Manufacturer's Certificate of Compliance, a copy of which is attached to this section, shall be completed in full, signed by the entity supplying the product, material, or service, and submitted prior to shipment of product or material or the execution of the services.
- B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.
- C. Such form shall certify that the proposed product, material, or service complies with that specified. Attach supporting reference data, affidavits, and certifications as appropriate.
- D. May reflect recent or previous test results on material or product, if acceptable to Engineer.

3.03 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

- A. When so specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by the equipment manufacturer's representative.
- B. Such form shall certify that the signing party is a duly authorized representative of the manufacturer, is empowered by the manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to assure that the equipment is complete and operational.

3.04 TRAINING

A. General:

- 1. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable Specifications.
- 2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Section 01 78 23, Operation and Maintenance Data.
- 3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
- 4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

B. Training Schedule:

- 1. List specified equipment and systems that require training services and show:
 - a. Respective manufacturer.
 - b. Estimated dates for installation completion.
 - c. Estimated training dates.
- 2. Allow for multiple sessions when several shifts are involved.
- 3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.
- 4. Coordinate with Section 01 32 00, Construction Progress Documentation, and Section 01 91 14, Equipment Testing and Facility Startup.

- C. Lesson Plan: When manufacturer or vendor training of Owner personnel is specified, prepare a lesson plan for each required course containing the following minimum information:
 - 1. Title and objectives.
 - 2. Recommended attendees (e.g., managers, engineers, operators, maintenance).
 - 3. Course description, outline of course content, and estimated class duration.
 - 4. Format (e.g., lecture, self-study, demonstration, hands-on).
 - 5. Instruction materials and equipment requirements.
 - 6. Resumes of instructors providing the training.

- D. Pre-startup Training:
 - 1. Coordinate training sessions with Owner's operating personnel and manufacturers' representatives, and with submission of operation and maintenance manuals in accordance with Section 01 78 23, Operation and Maintenance Data.
 - 2. Complete at least 14 days prior to beginning of facility startup.

- E. Post-startup Training: If required in Specifications, furnish and coordinate training of Owner's operating personnel by respective manufacturer's representatives.

3.05 SUPPLEMENTS

- A. The supplements listed below, following "End of Section", are part of this Specification.
 - 1. Form: Manufacturer's Certificate of Compliance.
 - 2. Form: Manufacturer's Certificate of Proper Installation.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER: PRODUCT, MATERIAL, OR SERVICE
SUBMITTED:
PROJECT NAME:
PROJECT NO:

Comments: _____

I hereby certify that the above-referenced product, material, or service called for by the contract for the named project will be furnished in accordance with all applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the contract requirements, and are in the quantity shown.

Date of Execution: _____, 20__

Manufacturer: _____

Manufacturer's Authorized Representative (*print*): _____

(Authorized Signature)

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- Installed in accordance with Manufacturer's recommendations.
- Inspected, checked, and adjusted.
- Serviced with proper initial lubricants.
- Electrical and mechanical connections meet quality and safety standards.
- All applicable safety equipment has been properly installed.
- Functional tests.
- System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Note: Attach any performance test documentation from manufacturer.

Comments: _____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20__

Manufacturer: _____

By Manufacturer's Authorized Representative: _____

(Authorized Signature)

SECTION 01 50 00
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this Section:
1. American Association of Nurserymen: American Standards for Nursery Stock.
 2. U.S. Weather Bureau, "Rainfall-Frequency Atlas of the U.S. for Durations From 30 Minutes to 24 Hours and Return Periods From 1 to 100 Years."
 3. U.S. Department of Agriculture, "Urban Hydrology for Small Watersheds."
 4. Federal Emergency Management Agency.
 5. NFPA, National Fire Prevention Standard for Safeguarding Building Construction Operations.

1.02 SUBMITTALS

- A. Administrative Submittals: Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
- B. Shop Drawings:
1. Temporary Utility Submittals:
 - a. Electric power supply and distribution plans.
 - b. Drainage plans.
 2. Temporary Construction Submittals:
 - a. Parking area plans.
 - b. Contractor's field office, storage yard, and storage building plans, including gravel surfaced area.
 - c. Fencing and protective barrier locations and details.
 - d. Staging area location plan.
 - e. Traffic Control and Routing Plans: As specified herein, and proposed revisions thereto.
 - f. Plan for maintenance of existing plant operations.
 3. Temporary Control Submittals: Noise control plan.
 4. Temporary Operations Submittals:
 - a. Pump Control Panel Relocation.
 - b. Bypass Pumping Operations.

1.03 MOBILIZATION

- A. Mobilization shall Include, but Not be Limited to, these Principal Items:
 - 1. Obtaining required permits.
 - 2. Installing temporary construction power, wiring, and lighting facilities.
 - 3. Providing onsite communication facilities, including telephones.
 - 4. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
 - 5. Arranging for and erection of Contractor's work and storage yard.
 - 6. Posting OSHA required notices and establishing safety programs and procedures.
 - 7. Having Contractor's superintendent at site full time.
- B. Areas designated for Contractor's temporary facilities shall be coordinated with Engineer and City.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 TEMPORARY UTILITIES

- A. Fire Protection: Furnish and maintain on site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable parts of the National Fire Prevention Standard for Safeguarding Building Construction Operations (NFPA No. 241).
- B. Cooling and Ventilating:
 - 1. Provide as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials, equipment, and finishes from damage due to temperature or humidity.
 - 2. Provide adequate forced air ventilation of enclosed areas to cure installed materials, to dispense humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
 - 3. Pay all costs of installation, maintenance, operation, removal, and fuel consumed.

3.02 TEMPORARY ELECTRIC POWER

- A. The Contractor shall make arrangements to obtain and pay for electrical power used until final acceptance by the Owner.

3.03 SAFETY REQUIREMENTS FOR TEMPORARY ELECTRIC POWER

- A. Temporary electric power installation shall meet the construction safety requirements of OSHA, state and other governing agencies.

3.04 TEMPORARY WATER

- A. The Contractor shall make his own arrangements to obtain suitable water and shall pay all costs.

3.05 SANITARY FACILITIES

- A. The Contractor shall provide and maintain sanitary facilities for his employees and his subcontractors that will comply with the regulations of the local and state departments of health and as directed by the Engineer.

3.06 PROTECTION OF WORK AND PROPERTY

A. General:

1. Perform Work within right-of-way and easements in a systematic manner that minimizes inconvenience to property owners and the public.
2. Maintain in continuous service all existing oil and gas pipelines, underground power, telephone or communication cable, water mains, irrigation lines, sewers, poles and overhead power, and all other utilities encountered along the line of work, unless other arrangements satisfactory to owners of said utilities have been made.
3. Where completion of Work requires temporary or permanent removal and/or relocation of an existing utility, coordinate all activities with owner of said utility and perform all work to their satisfaction.
4. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.
5. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
6. In areas where Contractor's operations are adjacent to or near a utility such as gas, telephone, television, electric power, water, sewer, or irrigation system and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection thereof have been made by Contractor.
7. Notify property owners and utility offices that may be affected by construction operation at least 2 days in advance.
 - a. Before exposing a utility, obtain utility owner's permission. Should service of utility be interrupted due to the Contractor's operation, notify proper authority immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.

8. Do not impair operation of existing sewer systems. Prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other sewer structures.
 9. Maintain original site drainage wherever possible.
- B. Site Security: Reference the General Conditions.
- C. Barricades and Lights:
1. Provide as necessary to prevent unauthorized entry to construction areas and affected roads, streets, and alleyways, inside and outside of fenced area, and as required to ensure public safety and the safety of Contractor's employees, other employer's employees, and others who may be affected by the Work.
 2. Provide to protect existing facilities and adjacent properties from potential damage.
 3. Locate to enable access by facility operators and property owners.
 4. Protect streets, roads, highways, and other public thoroughfares that are closed to traffic by effective barricades with acceptable warning signs.
 5. Locate barricades at the nearest intersecting public thoroughfare on each side of the blocked section.
- D. Trees and Plantings:
1. Protect from damage and preserve trees, shrubs, and other plants outside limits of the Work and within limits of the Work which are designated on the Drawings to remain undisturbed.
 - a. Where practical, tunnel beneath trees when on or near the line of trench.
 - b. Employ hand excavation as necessary to prevent tree injury.
 - c. Do not stockpile materials or permit traffic within drip lines of trees.
 - d. Provide and maintain temporary barricades around trees.
 - e. Water vegetation as necessary to maintain health.
 - f. Cover temporarily exposed roots with wet burlap, and keep the burlap moist until soil is replaced around the roots.
 - g. No trees, except those specifically shown on Drawings to be removed, shall be removed without written approval of Engineer.
 - h. Dispose of removed trees in a legal manner off the Site.
 2. Balling and burlapping of trees indicated for replacement shall conform to the recommended specifications set forth in the American Standards for Nursery Stock, published by American Association of Nurserymen. All balls shall be firm and intact and made-balls will not be accepted. Handle ball and burlap trees by the ball and not by the top.

3. In event of damage to bark, trunks, limbs, or roots of plants that are not designated for removal, treat damage by corrective pruning, bark tracing, application of a heavy coating of tree paint, and other accepted horticultural and tree surgery practices.
 4. Replace each plant that dies as a result of construction activities.
 5. Tree and scrub removal and/or trimming must be performed by a City-approved ISA Certified Arborist.
- E. Existing Structures: Where Contractor contemplates removal of small structures such as mailboxes, signposts, and culverts that interfere with Contractor's operations, obtain approval of property owner and Engineer. Replace those removed in a condition equal to or better than original.
- F. Waterways: Keep ditches, culverts, and natural drainages continuously free of construction materials and debris.

3.07 TEMPORARY CONTROLS

A. Air Pollution Control:

1. Minimize air pollution from construction operations.
2. Burning of waste materials, rubbish, or other debris will not be permitted on or adjacent to Site.
3. Conduct operations of dumping rock and of carrying rock away in trucks to cause a minimum of dust. Give unpaved streets, roads, detours, or haul roads used in the construction area a dust-preventive treatment or periodically water to prevent dust. Strictly adhere to applicable environmental regulations for dust prevention.
4. Provide and maintain temporary dust-tight partitions, bulkheads, or other protective devices during construction to permit normal operation of existing facilities. Construct partitions of plywood, insulating board, plastic sheets, or similar material. Construct partitions in such a manner that dust and dirt from demolition and cutting will not enter other parts of existing building or facilities. Remove temporary partitions as soon as the need no longer exists.

B. Noise Control:

1. Provide acoustical barriers so noise emanating from tools or equipment will not exceed legal noise levels.
2. Noise Control Ordinance: City of Key West.
3. Noise Control Plans: Proposed plan to mitigate construction noise impacts and to comply with noise control ordinances including method of construction, equipment to be used, and acoustical treatments.

C. Water Pollution Control:

1. Divert sanitary sewage and non-storm waste flow interfering with construction and requiring diversion to sanitary sewers. Do not cause or permit action to occur which would cause an overflow to an existing waterway.
2. Prior to commencing excavation and construction, obtain Owner's agreement with detailed plans showing procedures intended to handle and dispose of sewage, groundwater, and stormwater flow, including dewatering pump discharges.
3. Comply with procedures outlined in U.S. Environmental Protection Agency manuals entitled, "Guidelines for Erosion and Sedimentation Control Planning" and "Implementation, Processes, Procedures, and Methods to Control Pollution Resulting from All Construction Activity," and "Erosion and Sediment Control-Surface Mining in Eastern United States."
4. Do not dispose of volatile wastes such as mineral spirits, oil, chemicals, or paint thinner in storm or sanitary drains. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.

D. Erosion, Sediment, and Flood Control: Provide, maintain, and operate temporary facilities to control erosion and sediment releases, and to protect Work and existing facilities from flooding during construction period.

3.08 ROADS

- A. Maintain access to all roads. Do not block any roadways during construction. If road blockage is anticipated, Contractor shall receive approval from City prior to starting construction.
- B. Maintain drainage ways. Install and maintain culverts to allow water to flow. Provide corrosion-resistant culvert pipe of adequate strength to resist construction loads.
- C. Provide gravel, crushed rock, or other stabilization material to permit access by all motor vehicles at all times.
- D. Maintain road grade and crown to eliminate potholes, rutting, and other irregularities that restrict access.

3.09 PARKING AREAS

- A. Contractor's vehicle parking shall be limited to Pump Station Rights of Way, and designated areas shown on Drawings. If additional parking is required, Contractor shall submit parking plan, and coordinate with Owner and Engineer. Parking needs will be evaluated on a site by site basis, and at the discretion of the Owner and Engineer, the Parking Division may issue a temporary parking permit (paper yellow hang tag) at \$100.00 per month. This permit is valid for any identified parking needs outside of the work site necessary for the Project.
- B. Control Vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations. No parking along roadways shall be allowed.

3.10 CLEANING DURING CONSTRUCTION

- A. In accordance with General Conditions, as may be specified in Specification sections, and as required herein.
- B. Wet down exterior surfaces prior to sweeping to prevent blowing of dust and debris. At least weekly, sweep all floors (basins, tunnels, platforms, walkways, roof surfaces), and pick up all debris and dispose.
- C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least at weekly intervals, dispose of such waste materials, debris, and rubbish offsite.
- D. At least weekly, brush sweep the entry drive and roadways, and all other streets and walkways affected by Work and where adjacent to Work.

END OF SECTION

SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Products:

1. New items for incorporation in the Work, whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock, and may also include existing materials or components required for reuse.
2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
3. Items identified by manufacturer's product name, including make or model designation, indicated in manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.02 ENVIRONMENTAL REQUIREMENTS

- A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 10 feet above sea level.
- B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 20 degrees F to 105 degrees F.

1.03 PREPARATION FOR SHIPMENT

- A. When practical, factory assemble products. Mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.
- B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

- C. Extra Materials, Special Tools, Test Equipment, and Expendables:
 - 1. Furnish as required by individual Specifications.
 - 2. Schedule:
 - a. Ensure that shipment and delivery occurs concurrent with shipment of associated equipment.
 - b. Transfer to Owner shall occur immediately subsequent to Contractor's acceptance of equipment from Supplier.
 - 3. Packaging and Shipment:
 - a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.
 - b. Prominently displayed on each package, the following:
 - 1) Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
 - 2) Applicable equipment description.
 - 3) Quantity of parts in package.
 - 4) Equipment manufacturer.
 - 4. Deliver materials to Site.
 - 5. Notify Construction Manager upon arrival for transfer of materials.
 - 6. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Owner.
- D. Request a minimum 7-day advance notice of shipment from manufacturer.
- E. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual Specification sections.

1.04 DELIVERY AND INSPECTION

- A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.
- B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.
- C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

- D. Remove damaged products from Site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.05 HANDLING, STORAGE, AND PROTECTION

- A. Handle and store products in accordance with manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01 50 00, Temporary Facilities and Controls. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.
- B. Manufacturer's instructions for material requiring special handling, storage, or protection shall be provided prior to delivery of material.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.
- D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 degrees F. Protect electrical, instrumentation, and control products, and insulate against moisture, water, and dust damage. Connect and operate continuously space heaters furnished in electrical equipment.
- E. Store fabricated products above ground on blocking or skids, and prevent soiling or staining. Store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
- F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.
- G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.
- H. Hazardous Materials: Prevent contamination of personnel, storage area, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide manufacturer's standard materials suitable for service conditions, unless otherwise specified in the individual Specifications.
- B. Where product specifications include a named manufacturer, with or without model number, and also include performance requirements, named manufacturer's products must meet the performance specifications.
- C. Like items of products furnished and installed in the Work shall be end products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.
- D. Equipment, Components, Systems, and Subsystems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, state, and local health and safety regulations.
- E. Regulatory Requirement: Coating materials shall meet federal, state, and local requirements limiting the emission of volatile organic compounds and for worker exposure.
- F. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated 1/2-inch mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.
- G. Authority Having Jurisdiction (AHJ):
 - 1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
 - 2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

H. Equipment Finish:

1. Provide manufacturer's standard finish and color, except where specific color is indicated.
2. If manufacturer has no standard color, provide equipment with gray finish as approved by Owner.

I. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, handwheels, chain operators, special tools, and other spare parts as required for maintenance.

J. Lubricant: Provide initial lubricant recommended by equipment manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.

2.02 FABRICATION AND MANUFACTURE

A. General:

1. Manufacture parts to U.S.A. standard sizes and gauges.
2. Two or more items of the same type shall be identical, by the same manufacturer, and interchangeable.
3. Design structural members for anticipated shock and vibratory loads.
4. Use 1/4-inch minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
5. Modify standard products as necessary to meet performance Specifications.

B. Lubrication System:

1. Require no more than weekly attention during continuous operation.
2. Convenient and accessible; oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
3. Provide constant-level oilers or oil level indicators for oil lubrication systems.
4. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.03 SOURCE QUALITY CONTROL

- A. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).
- B. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

PART 3 EXECUTION

3.01 INSPECTION

- A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.02 INSTALLATION

- A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.
- B. No shimming between machined surfaces is allowed.
- C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.
- D. Repaint painted surfaces that are damaged prior to equipment acceptance.
- E. Do not cut or notch any structural member or building surface without specific approval of Engineer.
- F. Handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's instructions, and as may be specified. Retain a copy of manufacturers' instruction at Site, available for review at all times.

3.03 FIELD FINISHING

- A. In accordance with Section 09 90 00, Painting and Coating, and individual Specification sections.

3.04 ADJUSTMENT AND CLEANING

- A. Perform required adjustments, tests, operation checks, and other startup activities.

3.05 LUBRICANTS

- A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

END OF SECTION

**SECTION 01 77 00
CONTRACT CLOSEOUT**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Quality Control Submittals: Written procedures for maintaining and markup of record documents.
- B. Contract Closeout Submittals: Submit prior to application for final payment.
 - 1. Record Documents: As required in the General Conditions.
 - 2. Approved Shop Drawings and Samples: As required in the General Conditions.
 - 3. Special Bonds, Special Warranties, and Service Agreements.
 - 4. Consent of Surety to Final Payment: As required in the General Conditions.
 - 5. Releases or Waivers of Liens and Claims: As required in the General Conditions.
 - 6. Releases from Agreements.
 - 7. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, Payment Procedures.
 - 8. Spare Parts and Special Tools: As required by individual Specification sections.
 - 9. Elevation Certificates by a registered surveyor of all facilities.

1.02 RECORD DOCUMENTS

- A. Quality Assurance:
 - 1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
 - 2. Accuracy of Records:
 - a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
 - b. Purpose of Project record documents is to document factual information regarding aspects of Work, both concealed and visible, to enable future modification of Work to proceed without lengthy and expensive site measurement, investigation, and examination.
 - 3. Make entries within 24 hours after receipt of information that a change in Work has occurred.

4. Prior to submitting each request for progress payment, request Engineer's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend the whole or any part of the Contractor's Application for Payment, either partial or final.
5. Contractor to have a licensed surveyor provide signed and sealed drawing that include the following as an attachment to the Project Record Drawings.
 - a. All pipe inverts elevations, bottom of structures elevation, pipe grade, LF of new pipe installed;
 - b. All rim elevations. All grate elevations.
 - c. Locations of Catch basins, Well structures, and Manholes.
 - d. All finished floor elevations, landing elevations and building locations.
 - e. Limits of construction.
 - f. Replace existing property pins removed for construction.
 - g. Submit record drawings (four) signed and sealed. Provide to the city three DISCS with electronic copies in AUTOCAD and PDF.
 - h. Certificate of Elevation for Flood Insurance.
 - i. All supplied data collections, As-Built Drawings, files to be compatible with ERSI ArcGIS 10.2.2 Software. The Owner's current computing environment consists of *Microsoft SQL Server – Windows 7/Server 2008 – ERSI GIS Platform*. Interfaces and Integrations:
 - 1) The City of Key West uses a number of software applications critical to its core operation and mission. The proposed mobile asset data collection solution will need to interface with these existing platforms: Arc Collector; ArcGIS Online and ArcMap 10.2.
 - 2) Contact Nicholas Osterhoudt, City GIS Manager, at 305-809-3721 with software related questions.

1.03 RELEASES FROM AGREEMENTS

- A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor's operations have not been kept within the Owner's construction right-of-way.
- B. In the event Contractor is unable to secure written releases, inform the Owner of the reasons:
 1. Owner or its representatives will examine the site, and Owner will direct Contractor to complete Work that may be necessary to satisfy terms of the easement.

2. Should Contractor refuse to perform this Work, Owner reserves the right to have it done by separate contract and deduct the cost of same from the Contract Price, or require the Contractor to furnish a satisfactory Bond in a sum to cover legal claims for damages.
3. When Owner is satisfied that Work has been completed in agreement with the Contract Documents and terms of easements, the right is reserved to waive the requirement for written release if: (i) Contractor's failure to obtain such statement is due to the grantor's refusal to sign, and this refusal is not based upon any legitimate claims that Contractor has failed to fulfill the terms of the easement, or (ii) Contractor is unable to contact or has had undue hardship in contacting the grantor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. General:

1. Promptly following commencement of Contract Times, secure from Engineer at no cost to Contractor, one complete set of Contract Documents. Drawings will be full size.
2. Delete Engineer title block and seal from all documents.
3. Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.
4. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:

1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
2. Make documents and Samples available at all times for observation by Engineer.

C. Making Entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
 - a. Color Coding:
 - 1) Green when showing information deleted from Drawings.
 - 2) Red when showing information added to Drawings.
 - 3) Blue and circled in blue to show notes.
2. Date entries.

3. Call attention to entry by “cloud” drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction, including, but not limited to:
 - a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
 - b. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
 - c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
 - d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
 - e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, Written Amendment, and Engineer's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
 - a. Clearly identify the item by accurate note such as “cast iron drain,” “galv. water,” and the like.
 - b. Show, by symbol or note, vertical location of item (“under slab,” “in ceiling plenum,” “exposed,” and the like).
 - c. Make identification so descriptive that it may be related reliably to Specifications.

3.02 FINAL CLEANING

- A. At completion of Work at each Site or of a part thereof and immediately prior to Contractor's request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor's notice of completion, clean entire site or parts thereof, as applicable.
 1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner and Engineer.
 2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
 3. Repair, patch, and touchup marred surfaces to specified finish and match adjacent surfaces.
 4. Broom clean exterior paved driveways and parking areas.

5. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
 6. Rake clean all other surfaces.
 7. Leave water courses, gutters, and ditches open and clean.
- B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Data, as required by individual Specification sections.

1.02 DEFINITIONS

- A. Preliminary Data: Initial and subsequent submissions for Engineer's review.
- B. Final Data: Engineer-accepted data, submitted as specified herein.
- C. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.03 SEQUENCING AND SCHEDULING

- A. Equipment and System Data:
 - 1. Preliminary Data:
 - a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
 - b. Submit prior to shipment date.
 - 2. Final Data: Submit Instructional Manual Formatted data not less than 30 days prior to equipment or system field functional testing.
- B. Materials and Finishes Data:
 - 1. Preliminary Data: Submit at least 15 days prior to request for final inspection.
 - 2. Final Data: Submit within 10 days after final inspection.

1.04 DATA FORMAT

- A. Prepare preliminary and final data in the form of an instructional manual.
- B. Instructional Manual Format:
 - 1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
 - 2. Size: 8-1/2 inches by 11 inches, minimum.
 - 3. Cover: Identify manual with typed or printed title "OPERATION AND MAINTENANCE DATA" and list:
 - a. Project title.
 - b. Designate applicable system, equipment, material, or finish.
 - c. Identity of separate structure as applicable.
 - d. Identify volume number if more than one volume.
 - e. Identity of general subject matter covered in manual.
 - 4. Spine:
 - a. Project title.
 - b. Identify volume number if more than one volume.
 - 5. Title Page:
 - a. Contractor name, address, and telephone number.
 - b. Subcontractor, Supplier, installer, or maintenance contractor's name, address, and telephone number, as appropriate.
 - 1) Identify area of responsibility of each.
 - 2) Provide name and telephone number of local source of supply for parts and replacement.
 - 6. Table of Contents:
 - a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
 - b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
 - 7. Paper: 20-pound minimum, white for typed pages.
 - 8. Text: Manufacturer's printed data, or neatly typewritten.
 - 9. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
 - 10. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.
- C. Data Compilation Format:
 - 1. Compile all Engineer-accepted preliminary O&M data into a hard-copy, hard-bound set.
 - 2. Each set shall consist of the following:
 - a. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.

- b. Cover: Identify each volume with typed or printed title “OPERATION AND MAINTENANCE DATA, VOLUME NO. ___ OF ___”, and list:
 - 1) Project title.
 - 2) Contractor’s name, address, and telephone number.
 - 3) If entire volume covers equipment or system provided by one Supplier include the following:
 - a) Identity of general subject matter covered in manual.
 - b) Identity of equipment number and Specification section.
- c. Provide each volume with title page and typed table of contents with consecutive page numbers. Place contents of entire set, identified by volume number, in each binder.
- d. Table of contents neatly typewritten, arranged in a systematic order:
 - 1) Include list of each product, indexed to content of each volume.
 - 2) Designate system or equipment for which it is intended.
 - 3) Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
- e. Section Dividers:
 - 1) Heavy, 80 pound cover weight, tabbed with numbered plastic index tabs.
 - 2) Fly-Leaf:
 - a) For each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment.
 - b) List with Each Product:
 - (1) Name, address, and telephone number of Subcontractor, Supplier, installer, and maintenance contractor, as appropriate.
 - (2) Identify area of responsibility of each.
 - (3) Provide local source of supply for parts and replacement.
 - c) Identity of separate structure as applicable.
- f. Assemble and bind material, as much as possible, in same order as specified in the Contract Documents.

1.05 SUBMITTALS

A. Informational:

1. Data Outline: Submit two copies of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.

2. Preliminary Data:
 - a. Submit two copies for Engineer's review.
 - b. If data meets conditions of the Contract:
 - 1) One copy will be returned to Contractor.
 - 2) One copy will be forwarded to Resident Project Representative.
 - c. If data does not meet conditions of the Contract:
 - 1) All copies will be returned to Contractor with Engineer's comments (on separate document) for revision.
 - 2) Engineer's comments will be retained in Engineer's file.
 - 3) Resubmit two copies revised in accordance with Engineer's comments.
3. Final Data: Submit two copies in format specified herein.

1.06 DATA FOR EQUIPMENT AND SYSTEMS

A. Content for Each Unit (or Common Units) and System:

1. Product Data:
 - a. Include only those sheets that are pertinent to specific product.
 - b. Clearly annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 - c. Function, normal operating characteristics, and limiting conditions.
 - d. Performance curves, engineering data, nameplate data, and tests.
 - e. Complete nomenclature and commercial number of replaceable parts.
 - f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
 - g. Spare parts ordering instructions.
 - h. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, terminals).
2. As-installed, color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
 - a. Format:
 - 1) Provide reinforced, punched, binder tab; bind in with text.
 - 2) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.

- 3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
- 4) Identify Specification section and product on Drawings and envelopes.
- b. Relations of component parts of equipment and systems.
- c. Control and flow diagrams.
- d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
 - a. Format:
 - 1) Organize in consistent format under separate heading for each different procedure.
 - 2) Provide logical sequence of instructions for each procedure.
 - 3) Provide information sheet for Owner's personnel, including:
 - a) Proper procedures in event of failure.
 - b) Instances that might affect validity of guarantee or Bond.
 - b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
 - c. Operating Procedures:
 - 1) Startup, break-in, routine, and normal operating instructions.
 - 2) Test procedures and results of factory tests where required.
 - 3) Regulation, control, stopping, and emergency instructions.
 - 4) Description of operation sequence by control manufacturer.
 - 5) Shutdown instructions for both short and extended duration.
 - 6) Summer and winter operating instructions, as applicable.
 - 7) Safety precautions.
 - 8) Special operating instructions.
 - d. Maintenance and Overhaul Procedures:
 - 1) Routine maintenance.
 - 2) Guide to troubleshooting.
 - 3) Disassembly, removal, repair, reinstallation, and re-assembly.
6. Guarantee, Bond, and Service Agreement: In accordance with Section 01 77 00, Closeout Procedures.

B. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, nameplate data, and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 - d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit Directories of Panelboards.

3. Electrical service.
4. Control requirements and interfaces.
5. Communication requirements and interfaces.
6. List of electrical relay settings, and control and alarm contact settings.
7. Electrical interconnection wiring diagram, including as applicable, single-line, three-line, schematic and internal wiring, and external interconnection wiring.
8. As-installed control diagrams by control manufacturer.
9. Operating Procedures:
 - a. Routine and normal operating instructions.
 - b. Startup and shutdown sequences, normal and emergency.
 - c. Safety precautions.
 - d. Special operating instructions.
10. Maintenance Procedures:
 - a. Routine maintenance.
 - b. Guide to troubleshooting.
 - c. Adjustment and checking.
 - d. List of relay settings, control and alarm contact settings.
11. Manufacturer's printed operating and maintenance instructions.
12. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

C. Maintenance Summary:

1. Compile individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or sub-units.
2. Format:
 - a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
 - b. Each Maintenance Summary may take as many pages as required.
 - c. Use only 8-1/2-inch by 11-inch size paper.
 - d. Complete using typewriter or electronic printing.
3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
 - a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
 - b. "Unit" is the unit of measure for ordering the part.
 - c. "Quantity" is the number of units recommended.
 - d. "Unit Cost" is the current purchase price.

1.07 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:
 - a. Catalog number, size, and composition.
 - b. Color and texture designations.
 - c. Information required for reordering special-manufactured products.
2. Instructions for Care and Maintenance:
 - a. Manufacturer's recommendation for types of cleaning agents and methods.
 - b. Cautions against cleaning agents and methods that are detrimental to product.
 - c. Recommended schedule for cleaning and maintenance.

B. Content for Moisture Protection and Weather Exposed Products:

1. Manufacturer's data, giving full information on products:
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Details of installation.
2. Instructions for inspection, maintenance, and repair.

1.08 SUPPLEMENTS

A. The supplement listed below, following "End of Section," is part of this Specification.

1. Form: Maintenance Summary Form.

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION (NOT USED)****END OF SECTION**

MAINTENANCE SUMMARY FORM

PROJECT: _____ CONTRACT NO.: _____

1. EQUIPMENT ITEM _____

2. MANUFACTURER _____

3. EQUIPMENT/TAG NUMBER(S) _____

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____

5. NAMEPLATE DATA (hp, voltage, speed, etc.) _____

6. MANUFACTURER'S LOCAL REPRESENTATIVE _____

a. Name _____ Telephone No. _____

b. Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	Frequency	Lubricant (If Applicable)
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

SECTION 01 91 14
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 GENERAL

1.01 DEFINITIONS

- A. Facility: Entire Project, or an agreed-upon portion, including all of its unit processes.
- B. Functional Test: Test or tests in presence of Engineer and Owner to demonstrate that installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.
- C. Performance Test: Test or tests performed after any required functional test in presence of Engineer and Owner to demonstrate and confirm individual equipment meets performance requirements specified in individual sections.
- D. Unit Process: As used in this section, a unit process is a portion of the facility that performs a specific process function, such as pump station and generator.
- E. Facility Performance Demonstration:
 - 1. A demonstration, conducted by Contractor, with assistance of Owner, to demonstrate and document the performance of the entire operating facility, both manually and automatically (if required), based on criteria developed in conjunction with Owner and as accepted by Engineer.
 - 2. Such demonstration is for the purposes of (i) verifying to Owner entire facility performs as a whole, and (ii) documenting performance characteristics of completed facility for Owner's records. Neither the demonstration nor the evaluation is intended in any way to make performance of a unit process or entire facility the responsibility of Contractor, unless such performance is otherwise specified.

1.02 SUBMITTALS

- A. Informational Submittals:
 - 1. Facility Startup and Performance Demonstration Plan.
 - 2. Functional and performance test results.
 - 3. Completed Unit Process Startup Form for each unit process.
 - 4. Completed Facility Performance Demonstration/Certification Form.

1.03 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

- A. Develop a written plan, in conjunction with Owner's operations personnel; to include the following:
 - 1. Step-by-step instructions for startup of each unit process and the complete facility.
 - 2. Unit Process Startup Form (sample attached), to minimally include the following:
 - a. Description of the unit process, including equipment numbers/nomenclature of each item of equipment and all included devices.
 - b. Detailed procedure for startup of the unit process, including valves to be opened/closed, order of equipment startup, etc.
 - c. Startup requirements for each unit process, including water, power, chemicals, etc.
 - d. Space for evaluation comments.
 - 3. Facility Performance Demonstration/Certification Form (sample attached), to minimally include the following:
 - a. Description of unit processes included in the facility startup.
 - b. Sequence of unit process startup to achieve facility startup.
 - c. Description of computerized operations, if any, included in the facility.
 - d. Contractor certification facility is capable of performing its intended function(s), including fully automatic operation.
 - e. Signature spaces for Contractor and Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Facility Startup Meetings: Schedule, in accordance with requirements of Section 01 31 19, Project Meetings, to discuss test schedule, test methods, materials, chemicals and liquids required, facilities operations interface, and Owner involvement.
- B. Contractor's Testing and Startup Representative:
 - 1. Designate and furnish one or more personnel to coordinate and expedite testing and facility startup.
 - 2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.

- C. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.
- D. Provide Subcontractor and equipment manufacturers' staff adequate to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.
- E. Owner will:
 - 1. Provide water, power, chemicals, and other items as required for startup, unless otherwise indicated.
 - 2. Operate process units and facility with support of Contractor.
 - 3. Provide labor and materials as required for laboratory analyses.

3.02 EQUIPMENT TESTING

- A. Preparation:
 - 1. Complete installation before testing.
 - 2. Furnish qualified manufacturers' representatives, when required by individual Specification sections.
 - 3. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Proper Installation Form, in accordance with Section 01 43 33, Manufacturers' Field Services, when required by individual Specification sections.
 - 4. Equipment Test Report Form: Provide written test report for each item of equipment to be tested, to include the minimum information:
 - a. Owner/Project Name.
 - b. Equipment or item tested.
 - c. Date and time of test.
 - d. Type of test performed (Functional or Performance).
 - e. Test method.
 - f. Test conditions.
 - g. Test results.
 - h. Signature spaces for Contractor and Engineer as witness.
 - 5. Cleaning and Checking: Prior to beginning functional testing:
 - a. Calibrate testing equipment in accordance with manufacturer's instructions.
 - b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
 - c. Lubricate equipment in accordance with manufacturer's instructions.
 - d. Turn rotating equipment by hand when possible to confirm that equipment is not bound.
 - e. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.

- f. Check power supply to electric-powered equipment for correct voltage.
 - g. Adjust clearances and torque.
 - h. Test piping for leaks.
6. Ready-to-test determination will be by Engineer based at least on the following:
- a. Acceptable Operation and Maintenance Data.
 - b. Notification by Contractor of equipment readiness for testing.
 - c. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
 - d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
 - e. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
 - f. Satisfactory fulfillment of other specified manufacturer's responsibilities.
 - g. Equipment and electrical tagging complete.
 - h. Delivery of all spare parts and special tools.

B. Functional Testing:

- 1. Conduct as specified in individual Specification sections.
- 2. Notify Owner and Engineer in writing at least 10 days prior to scheduled date of testing.
- 3. Prepare Equipment Test Report summarizing test method and results.
- 4. When, in Engineer's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual Specification sections. Such acceptance will be evidenced by Engineer/Owner's signature as witness on Equipment Test Report.

C. Performance Testing:

- 1. Conduct as specified in individual Specification sections.
- 2. Notify Engineer and Owner in writing at least 10 days prior to scheduled date of test.
- 3. Performance testing shall not commence until equipment has been accepted by Engineer as having satisfied functional test requirements specified.
- 4. Type of fluid, gas, or solid for testing shall be as specified.
- 5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
- 6. Prepare Equipment Test Report summarizing test method and results.

7. When, in Engineer's opinion, equipment meets performance requirements specified, such equipment will be accepted as conforming to Contract requirements. Such acceptance will be evidenced by Engineer's signature on Equipment Test Report.

3.03 STARTUP OF UNIT PROCESSES

- A. Prior to unit process startup, equipment within unit process shall be accepted by Engineer as having met functional and performance testing requirements specified.
- B. Startup sequencing of unit processes shall be as chosen by Contractor to meet schedule requirements.
- C. Make adjustments, repairs, and corrections necessary to complete unit process startup.
- D. Startup shall be considered complete when, in opinion of Engineer, unit process has operated in manner intended for 5 continuous days without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.
- E. Significant Interruption: May include any of the following events:
 1. Failure of Contractor to provide and maintain qualified onsite startup personnel as scheduled.
 2. Failure to meet specified functional operation for more than 2 consecutive hours.
 3. Failure of any critical equipment or unit process that is not satisfactorily corrected within 5 hours after failure.
 4. Failure of any noncritical equipment or unit process that is not satisfactorily corrected within 8 hours after failure.
 5. As determined by Engineer.
- F. A significant interruption will require startup then in progress to be stopped. After corrections are made, startup test period to start from beginning again.

3.04 FACILITY PERFORMANCE DEMONSTRATION

- A. When, in the opinion of Engineer, startup of all unit processes has been achieved, sequence each unit process to the point that facility is operational.
- B. Demonstrate proper operation of required interfaces within and between individual unit processes.
- C. After facility is operating, complete performance testing of equipment and systems not previously tested.

- D. Document, as defined in Facility Startup and Performance Demonstration Plan, the performance of the facility.
- E. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic operation.

3.05 SUPPLEMENTS

- A. Supplements listed below, following “End of Section,” are a part of this Specification:
 - 1. Unit Process Startup Form.
 - 2. Facility Performance Demonstration/Certification Form.

END OF SECTION

UNIT PROCESS STARTUP FORM

OWNER: _____ **PROJECT:** _____

Unit Process Description: (Include description and equipment number of all equipment and devices):

Startup Procedure (Describe procedure for sequential startup and evaluation, including valves to be opened/closed, order of equipment startup, etc.):

Startup Requirements (Water, power, chemicals, etc.): _____

Evaluation Comments: _____

FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

OWNER: _____ **PROJECT:** _____

Unit Processes Description (List unit processes involved in facility startup):

Unit Processes Startup Sequence (Describe sequence for startup, including computerized operations, if any):

Contractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: _____ **Date:** _____, 20__

Engineer: _____ **Date:** _____, 20__
(Authorized Signature)

SECTION 03 30 10
REINFORCED CONCRETE

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Concrete Institute (ACI):
 - a. 301, Specifications for Structural Concrete for Buildings.
 - b. 305R, Hot Weather Concreting.
 - c. 318/318R, Building Code Requirements for Structural Concrete and Commentary.
 - d. 347, Formwork for Concrete.
 2. ASTM International (ASTM):
 - a. A497, Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 - b. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - c. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - d. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - e. C94, Standard Specification for Ready-Mixed Concrete.
 - f. C150, Standard Specification for Portland Cement.
 - g. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - h. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - i. C494, Standard Specification for Chemical Admixtures for Concrete.
 - j. C618, Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - k. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 3. Concrete Reinforcing Steel Institute (CRSI):
 - a. Manual of Standard Practice.
 - b. Recommended Practice for Placing Reinforcing Bars.

1.02 SUBMITTALS

A. Action Submittals:

1. Reinforcing steel in accordance with CRSI Manual of Standard Practice.
2. Curing compound data.
3. Complete data on the concrete mix, including aggregate gradations and admixtures, in accordance with ASTM C94, signed by a qualified mix designer.
4. Concrete Chloride Content Data: Test results for each trial mix showing chloride content within specified limits.

B. Informational Submittals:

1. Manufacturer's application instructions for curing compound.
2. Ready-mix delivery tickets for each truck in accordance with ASTM C94.

1.03 QUALITY ASSURANCE

- A. Formwork: Unless otherwise specified, follow the recommendations of ACI 347.
- B. Concrete and Reinforcement: Unless otherwise specified, meet the requirements of ACI 301 and ACI 318/318R.
- C. Hot Weather Concreting: Conform to ACI 305R.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Do not place Concrete when the ambient temperature is below 40 degrees F or approaching 40 degrees F and air temperature less than 40 degrees F for the first 7 days, without special protection to keep Concrete above 40 degrees F.
- B. Do not use curing compound where solvents in the curing compounds are prohibited by state or federal air quality laws. Use only water curing methods.

PART 2 PRODUCTS

2.01 CONCRETE

- A. Ready-mixed meeting ASTM C94, Option A.
- B. Portland Cement: ASTM C150, Type II, with maximum alkyl content of 0.60 percent.

C. Admixtures:

1. Air-Entraining: ASTM C260.
2. Water-Reducing: ASTM C494, Type A or Type D.
3. Superplasticizers: ASTM C494, Type F or Type G.
4. Fly Ash: ASTM C618, Class C or Class F.

D. Mix Design:

1. Minimum Allowable 28-day Compressive Field Strength: 5,000 psi when cured and tested in accordance with ASTM C31 and ASTM C39.
2. Cement Content: 540 pounds per cubic yard, minimum.
3. Coarse Aggregate Size: 1 inch and smaller.
4. Slump Range: 3 inches to 5 inches.
5. Air Entrainment: Between 3 and 6 percent by volume. Use 4 percent minimum for concrete placed under requirements of cold weather concreting.
6. Water Reducers: Use in concrete without plasticizers.
7. Superplasticizers: May be used at Contractor's option.
8. Maximum Water-Cement Ratio: 0.40 for concrete with superplasticizing or 0.48 for concrete without superplasticizer.

E. Mixing: Minimum 70 and maximum 270 revolutions of mixing drum. Nonagitator equipment is not allowed.

F. Source Quality Control:

1. Concrete Mixes: Test for chloride content.
 - a. Restrictions: Chloride content for all concrete shall not exceed 0.40 pound of chloride per cubic yard of concrete. The chloride content shall be determined as the average of three tests on samples taken from the concrete. The range of results of the three tests shall not exceed 0.15 pound of chloride per cubic yard of concrete for a valid determination of chloride content. When test results are outside the 0.15 pound of chloride per cubic yard allowable range, an additional three tests shall be run until the test results are within the required range. Samples may be obtained from representative concrete cylinders tested for compressive strength. However, if the cylinders have been exposed to a salt or aggressive environment, the outer 1-inch surface shall be discarded.
 - b. Determination of Chloride Content: Chloride contents shall be determined in accordance with the test methods set out in the State of Florida Department of Transportation's latest edition.

2.02 REINFORCING STEEL

A. Deformed Bars:

1. Typical: ASTM A615, Grade 60.
2. Welded: ASTM A706, Grade 60.

B. Welded Wire Fabric: ASTM A497.

2.03 ANCILLARY MATERIALS

A. Expansion Joint Filler: ASTM D994, 1/2-inch thick, or as shown.

B. Nonshrink Grout:

1. Color: To match concrete.
2. Manufacturers and Products:
 - a. Master Builder Co., Cleveland, OH; Master Flow 928.
 - b. Euclid Chemical Co., Cleveland, OH; Hi-flow Grout.

C. Curing Compound:

1. Water-based, high solids content nonyellowing curing compound meeting requirements of ASTM C309 and ASTM C1315.
 - a. Moisture Loss: 0.40 kg/square meter/72 hours maximum.
 - b. Capable of meeting moisture retention at manufacturer's specified application rate.
2. Manufacturers and Products:
 - a. Chemrex, Inc., Shakopee, MN; Masterkure.
 - b. Euclid Chemical Co., Cleveland, OH; Super Diamond Clear VOX.
 - c. WR Meadows, Inc., Hampshire, IL; VOCOMP-30.
 - d. Vexcon Chemical, Inc.; Philadelphia, PA; Starseal 1315.
 - e. Dayton Superior; Safe Cure and Seal 30%.

2.04 PATCHING MATERIAL

A. Cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum. Provide bonding agent as recommended by manufacturer.

B. Manufacturers and Products:

1. BASF Building Systems, Shakopee, MN; MBT P&R Emaco S88 CI.
2. Sika Corp., Lyndhurst, NJ; SikaTop 123 Plus.

PART 3 EXECUTION**3.01 FORMWORK****A. Form Materials:**

1. Use hard plastic finished plywood for exposed areas, and new shiplap or plywood for unexposed areas.
2. Earth cuts may be used for forming footings.

B. Form Ties:

1. Fixed conical or spherical type inserts that remain in contact with forming material and allow for dry packing of form tie holes.
2. Ties shall withstand pressures and limit deflection of forms to acceptable limits.
3. Wire ties are not acceptable.
4. Provide waterstop collars.

C. Construction:

1. In accordance with ACI 347.
2. Make joints tight to prevent escape of mortar and to avoid formation of fins.
3. Brace as required to prevent distortion during concrete placement.
4. On exposed surfaces locate form ties in uniform pattern or as shown.
5. Construct so ties remain embedded in the wall with no metal within 1 inch of concrete surface when forms, inserts, and tie ends are removed.

D. Form Removal:

1. Remove after concrete has attained 28-day strength, or approval is obtained in writing from Engineer.
2. Remove forms with care to prevent scarring and damaging the surface.

3.02 PLACING REINFORCING STEEL**A. Unless otherwise specified, place reinforcing steel in accordance with CRSI Recommended Practice for Placing Reinforcing Bars.****B. Splices and Laps:**

1. Top Bars: Horizontal bars placed such that 12 inches of fresh concrete is cast below in single placement.
2. Horizontal wall bars are considered top bars.
3. Lap top bars 42 diameters or minimum 24 inches.

4. Lap all other bars 30 diameters or minimum 18 inches.
5. Tie splices with 18-gauge annealed wire as specified in CRSI Standard.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Prior to placing concrete, remove water from excavation and debris and foreign material from forms. Check reinforcing steel for proper placement and correct discrepancies.
- C. Before depositing new concrete on old concrete, clean surface using sandblast or bushhammer or other mechanical means to obtain a 1/4-inch rough profile, and pour a cement-sand grout to minimum depth of 1/2 inch over surface. Proportion 1 part cement to 2.5 parts sand by weight.
- D. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 2 feet deep. Place within 1-1/2 hours after adding cement to mix.
- E. Eight feet maximum vertical drop to final placement, when not guided with chutes or other devices to prevent segregation due to impact with reinforcing.

3.04 COMPACTION

- A. Vibrate concrete as follows:
 1. Apply approved vibrator at points spaced not farther apart than vibrator's effective radius.
 2. Apply close enough to forms to vibrate surface effectively but not damage form surfaces.
 3. Vibrate until concrete becomes uniformly plastic.
 4. Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

3.05 CONSTRUCTION JOINTS

- A. Locate as shown or as approved.
- B. Maximum Spacing Between Construction Joints: 40 feet.

3.06 FINISHING

- A. Tops of Walls:
 - 1. Screed surfaces to true level planes.
 - 2. After initial water has been absorbed, float with wood float and trowel with steel trowel to smooth finish free from trowel marks.
 - 3. Do not absorb wet spots with neat cement.
- B. Unexposed Slab Surfaces: Screed to true surface, bull float with wood float, and wood trowel to seal surface.
- C. Tolerances: Floors shall not vary from level or true plane more than 1/4 inch in 10 feet when measured with a straightedge.
- D. Exterior Slabs and Sidewalks:
 - 1. Bull float with wood float, wood trowel, and lightly trowel with steel trowel.
 - 2. Finish with broom to obtain nonskid surface.
 - 3. Finish exposed edges with steel edging tool.
 - 4. Mark walks transversely at 5-foot intervals, or in pattern shown on Drawings, with jointing tool.

3.07 FINISHING AND PATCHING FORMED SURFACES

- A. Fill form tie holes with nonshrink grout.
- B. Knock off projections exceeding 1/2 inch in height.
- C. Leave surface with texture imparted by the forms.
- D. Cut out honeycombed and defective areas.
- E. Cut edges perpendicular to surface at least 1 inch deep. Do not feather edges. Soak area with water for 24 hours.
- F. Patch with polymer-modified repair material. Follow manufacturer's application instructions.
- G. Finish surfaces to match adjacent concrete.
- H. Keep patches damp for minimum 7 days or spray with curing compound to minimize shrinking.

3.08 PROTECTION AND CURING

- A. Protect fresh concrete from direct rays of sunlight, drying winds, and wash by rain.
- B. Keep concrete slabs continuously wet for a 7-day period. Intermittent wetting is not acceptable.
- C. Use curing compound only where approved by Engineer. Cure formed surfaces with curing compound applied in accordance with manufacturer's directions as soon as forms are removed and finishing is completed.

3.09 FIELD TESTS

- A. Evaluation of Concrete Field Strength: In accordance with ACI 318/318R.
- B. The Contractor shall retain and pay all costs for an independent testing laboratory, approved by the Owner, to perform all concrete testing and reporting.
- C. Chloride Testing:
 - 1. The frequency of chloride content determinations made in accordance with these Specifications and approved procedures shall be as follows:
 - a. When the chloride content is 0.20 pound of chloride per cubic yard or less, subsequent tests shall be made on a frequency of not less than one for every 4 weeks of production as long as the test values remain at or below 0.20 pound of chloride per cubic yard. However, when 12 consecutive chloride content determinations are below 0.20 pound per cubic yard, the frequency of testing may be decreased at the discretion of the Engineer.
 - b. When the chloride content is in the range from 0.20 to 0.30 pound of chloride per cubic yard, subsequent tests shall be made on a frequency of not less than one for every 2 weeks of production as long as test values remain at or below 0.30 pound of chloride per cubic yard.
 - c. When chloride content is greater than 0.30 pound per cubic yard, subsequent chloride content tests shall be made at half the frequency that concrete test cylinders are made for strength determination and at least weekly.
 - 2. For any case listed in paragraph C.1.a-c above, when the source of any component mixture for the concrete is changed or when the design mix is altered, a chloride content determination test shall be made immediately.

3. Test results obtained at the frequency provided in paragraph C.1.a-c, above, shall represent the amount of chloride per cubic yard in all concrete placed subsequent to the immediate preceding test for determination of chloride content.
4. If test results of the required test indicates the chloride levels per cubic yard exceed the specified maximum, concrete production shall be suspended until corrective measures are implemented.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
 2. American Galvanizers Association (AGA):
 - a. Inspection of Hot-Dip Galvanized Steel Products.
 - b. Quality Assurance Manual.
 3. American Iron and Steel Institute (AISI): Stainless Steel Types.
 4. American Ladder Institute (ALI): A14.3, Ladders - Fixed - Safety Requirements.
 5. American National Standards Institute (ANSI).
 6. American Society of Safety Engineers (ASSE): A10.11, Safety Requirements for Personnel and Debris Nets.
 7. American Welding Society (AWS):
 - a. D1.1/D1.1M, Structural Welding Code - Steel.
 - b. D1.2/D1.2M, Structural Welding Code - Aluminum.
 - c. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
 8. ASTM International (ASTM):
 - a. A36/A36M, Standard Specification for Carbon Structural Steel.
 - b. A48/A48M, Specification for Gray Iron Castings.
 - c. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - d. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - e. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - f. A143/A143M, Standard for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - g. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - h. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

- i. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
- j. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- k. A276, Standard Specification for Stainless Steel Bars and Shapes.
- l. A283/A283M, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- m. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- n. A325, Standard Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
- o. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
- p. A384/A384M, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
- q. A385/A385M, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
- r. A489, Standard Specification for Carbon Steel Lifting Eyes.
- s. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- t. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- u. A563, Standard Specification for Carbon and Alloy Steel Nuts.
- v. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- w. A780/A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- x. A786/A786M, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
- y. A793, Standard Specification for Rolled Floor Plate, Stainless Steel.
- z. A967, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.
- aa. A992/A992M, Standard Specification for Structural Steel Shapes.
- bb. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

- cc. B308/B308M, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
 - dd. B429/B429M, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - ee. B632/B632M, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
 - ff. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - gg. D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
 - hh. F436, Standard Specification for Hardened Steel Washers.
 - ii. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
 - jj. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - kk. F594, Standard Specification for Stainless Steel Nuts.
 - ll. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
 - mm. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
9. International Code Council Evaluation Service (ICC-ES):
 - a. AC01, Acceptance Criteria for Expansion Anchors in Masonry Elements.
 - b. AC106, Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
 - c. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
 - d. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
 - e. AC70, Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements.
 10. NSF International (NSF): 61, Drinking Water System Components—Health Effects.
 11. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910.27, Fixed Ladders.
 - b. 29 CFR 1926.105, Safety Nets.
 - c. 29 CFR 1926.502, Fall Protection Systems Criteria and Practices.
 12. Specialty Steel Industry of North America (SSINA):
 - a. Specifications for Stainless Steel.
 - b. Design Guidelines for the Selection and Use of Stainless Steel.
 - c. Stainless Steel Fabrication.
 - d. Stainless Steel Fasteners.

1.02 DEFINITIONS

- A. Anchor Bolt: Cast-in-place anchor; concrete or masonry.
- B. Concrete Anchor: Post-installed concrete anchors listed in this specification.
- C. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals.
- D. Exterior Area: Location not protected from weather by building or other enclosed structure.
- E. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or washdown, nor where wall or roof slab is common to a water-holding or earth-retaining structure.
- F. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or washdown, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.
- G. Submerged: Location at or below top of wall of open water-holding structure, such as basin or channel, or wall, ceiling or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings:
 - a. Metal fabrications, including welding and fastener information.
 - b. Specific instructions for concrete anchor installation, including drilled hole size, preparation, placement, procedures, and instructions for safe handling of anchoring systems.
- B. Informational Submittals:
 - 1. Concrete Post-Installed Anchors:
 - a. Manufacturer's product description and printed installation instructions.
 - b. Current ICC-ES Report for each type of post-installed anchor to be used.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Insofar as practical, factory assemble specified items. Assemblies, because of necessity, have to be shipped unassembled shall be packaged and tagged in

manner that will protect materials from damage and will facilitate identification and field assembly.

- B. Package stainless steel items in a manner to provide protection from carbon impregnation.
- C. Protect painted coatings and hot-dip galvanized finishes from damage as a result of metal banding and rough handling. Use padded slings and straps.
- D. Store fabricated items in dry area, not in direct contact with ground.
- E. Store adhesives anchors at service temperature ranges recommended by manufacturer.

1.05 SPECIAL GUARANTEE

- A. Manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at option of Owner, removal and replacement of sidewalk doors found defective during a period of 5 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in General Conditions.

PART 2 PRODUCTS

2.01 GENERAL

- A. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Steel Wide Flange Shapes	A992/992M
Other Steel Shapes and Plates	A36/A36M
Steel Pipe	A501 or A53/A53M, Type E or S, Grade B
Hollow Structural Sections (HSS)	A500/A500M, Grade B
Stainless Steel:	
Bars and Angles	A276, AISI Type 316 (316L for welded connections)
Shapes	A276, AISI Type 304 (304L for welded connections)
Steel Plate, Sheet, and Strip	A240/A240M, AISI Type 316 (316L for welded connections)

Item	ASTM Reference
Bolts, Threaded Rods, Anchor Bolts, and Anchor Studs	F593, AISI Type 316, Condition CW
Nuts	F594, AISI Type 316, Condition CW
Steel Bolts and Nuts:	
Carbon Steel	A307 bolts, with A563 nuts
High-Strength	A325, Type 1 bolts, with A563 nuts
Anchor Bolts and Rods	F1554, Grade 36 with weldability supplement S1.
Threaded Rods	A36/A36M
Flat Washers (Unhardened)	F844
Flat and Beveled Washers (Hardened)	F436
Aluminum Plates and Structural Shapes	B209 and B308/B308M, Alloy 6061-T6
Aluminum Bolts and Nuts	F468, Alloy 2024-T4
Cast Iron	A48/A48M, Class 35

- B. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, zinc-plated steel, and aluminum material types as indicated in Fastener Schedule at end of this section.

2.02 ANCHOR BOLTS

A. Cast-In-Place Anchor Bolts:

1. Headed type, unless otherwise shown on Drawings.
2. Material type and protective coating as shown in Fastener Schedule at end of this section.

2.03 POST-INSTALLED CONCRETE ANCHORS

A. General:

1. AISI Type 316 stainless steel, as shown in Fastener Schedule at end of this section.
2. Current ICC-ES Report indicating acceptance per IBC 2006 and IBC 2009 for anchors at structural applications in cracked concrete.
3. Anchors shall be suitable for long-term loads, as well as for wind and seismic loads.

4. Acceptable for use in potable water structures by EPA and local health agencies or NSF 61.
5. Torque-Controlled Expansion Anchors (Wedge Anchors):
 - a. Wedge anchors used in sustained tension applications (such as overhead or cantilevered applications) shall have current ICC-ES Report that demonstrates compliance with ICC-ES AC193 for cracked concrete.
 - b. Manufacturers and Products:
 - 1) ITW Ramset/Red Head, Addison, IL; Trubolt+ Wedge Anchor (ESR-2427).
 - 2) Hilti, Inc., Tulsa, OK; Kwik-Bolt-TZ (KB-TZ) Anchors (ESR-1917).
 - 3) Powers Fasteners, Brewster, NY; Power-Stud +SD2 or +SD1 Anchors (ESR-2502 and ESR-2818).
 - 4) Simpson Strong-Tie Co., Inc., Pleasanton, CA; Strong-Bolt Anchors (ESR-1771).
 - 5) Wej-It Corp., Tulsa, OK; ANKRtite CCAT Wedge Anchor (ESR-2777).
6. Displacement-Controlled Expansion Anchors (Drop-in Anchors):
 - a. Self-drilling anchors, snap-off or flush type, zinc-plated.
 - b. Nondrilling Anchors: Flush type for use with zinc-plated or stainless steel bolt, or stud type with projecting threaded stud.
 - c. Manufacturers and Products:
 - 1) ITW Ramset/Red Head, Addison, IL; Multi-Set II Drop-In and Self Drill Anchor.
 - 2) Hilti, Inc., Tulsa, OK; Hilti HDI Drop-In Anchor.
 - 3) Powers Fasteners, Brewster, NY; Steel Drop-In Anchor.
 - 4) Simpson Strong-Tie Co., Inc., Pleasanton, CA; Drop-In Anchor.
7. Self-Tapping Concrete Screw Anchors:
 - a. When used in sustained tension applications (such as overhead or cantilevered applications) shall have current ICC-ES Report that demonstrates compliance with ICC-ES AC193 for cracked concrete.
 - b. Manufacturers and Products:
 - 1) Powers Fasteners, Brewster, NY; Wedge-Bolt+ (ESR-2526).
 - 2) Powers Fasteners, Brewster, NY; Vertigo+ Rod Hanger Screw Anchor (ESR-2989).
 - 3) Powers Fasteners, Brewster, NY; Snake+ Flush Mount Screw Anchor (ESR-2272).
 - 4) Hilti, Inc., Tulsa, OK; HUS-EZ Screw Anchor (ESR-3027).
 - 5) Simpson Strong-Tie Co., Inc., Pleasanton, CA; Titen HD Screw Anchor (ESR-2713).

8. Light-Duty Torque Controlled Expansion Anchors (Sleeve Anchors):
 - a. Manufacturers and Products:
 - 1) ITW Ramset/Red Head, Addison, IL; Dynabolt Hex Nut Sleeve Anchor.
 - 2) Powers Fasteners, Brewster, NY; Lok-Bolt AS.
 - 3) Simpson Strong-Tie Co., Inc., Pleasanton, CA; Sleeve-All Hex Head Anchor.
 - 4) Wej-It Corp., Tulsa, OK; Wej-It Sleeve Anchor.
 9. Heavy-Duty Torque Controlled Expansion Anchors (Sleeve Anchors):
 - a. Manufacturers and Products:
 - 1) Powers Fasteners, Brewster, NY; Power-Bolt+ Anchor.
 - 2) Hilti, Inc., Tulsa, OK; HSL-3 Heavy Duty Sleeve Anchor.
- B. Adhesive Anchors (Epoxy Anchors):
1. If approved by Engineer, adhesive anchors used in sustained tension applications (such as overhead or cantilevered applications) shall have current ICC-ES Report that demonstrates compliance with ICC-ES AC308 for cracked concrete.
 2. Threaded Rod:
 - a. ASTM F593 stainless steel threaded rod, diameter as shown on Drawings.
 - b. Length as required, to provide minimum depth of embedment.
 - c. Clean and free of grease, oil, or other deleterious material.
 - d. For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.
 3. Adhesive:
 - a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
 - b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
 - c. Mixed Adhesive: Nonsag light paste consistency with ability to remain in 1-inch diameter overhead drilled hole without runout.
 - d. Meet requirements of ASTM C881/C881M.
 4. Packaging and Storage:
 - a. Disposable, self-contained cartridge system capable of dispensing both components in proper mixing ratio and fitting into manually or pneumatically operated caulking gun.
 - b. Store adhesive cartridges and adhesive components on pallets or shelving in covered storage area.
 - c. Container Markings: Include manufacturer's name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

- d. Dispose of when:
 - 1) Shelf life has expired.
 - 2) Stored other than in accordance with manufacturer's instructions.
 - 5. Manufacturers and Products:
 - a. Hilti, Inc., Tulsa, OK; HIT Doweling Anchor System, HIT RE 500 SD (ESR-2322).
 - b. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-XP Epoxy Adhesive Anchors(ESR-2508).
 - c. Powers Fasteners, Brewster NY, PE1000+ Adhesive anchoring system (ESR-2583).
- C. Adhesive Threaded Inserts:
- 1. Stainless steel, internally threaded inserts.
 - 2. Manufacturer and Product: Hilti, Inc., Tulsa, OK; HIS-RN Insert with HIT-RE 500-SD adhesive.

2.04 ACCESSORIES

A. Antiseizing Lubricant for Stainless Steel Threaded Connections:

- 1. Suitable for potable water supply.
- 2. Resists washout.
- 3. Manufacturers and Products:
 - a. Bostik, Middleton, MA; Neverseez.
 - b. Saf-T-Eze Div., STL Corp., Lombard, IL; Anti-Seize.

B. Neoprene Gasket:

- 1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on Drawings.
- 2. Thickness: Minimum 1/4 inch.
- 3. Furnish without skin coat.
- 4. Manufacturer and Product: Monmouth Rubber and Plastics Corporation, Long Branch, NJ; Durafoam DK1111LD.

2.05 FABRICATION

A. General:

- 1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
- 2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
- 3. Conceal fastenings where practical; where exposed, flush countersink.

4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials:

1. Use steel shapes, unless otherwise noted.
2. Steel to be hot-dip galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 and 0.25 percent.
3. Fabricate aluminum in accordance with AA Specifications for Aluminum Structures—Allowable Stress Design.

C. Welding:

1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
3. Steel: Meet fabrication requirements of AWS D1.1/D1.1M, Section 5.
4. Aluminum: Meet requirements of AWS D1.2/D1.2M.
5. Stainless Steel: Meet requirements of AWS D1.6/D1.6M.
6. Complete welding before applying finish.

D. Painting:

1. Shop prime with rust-inhibitive primer as specified in Section 09 90 04, Painting (Condensed), unless otherwise indicated.
2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 04, Painting (Condensed), unless indicated otherwise.
3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

E. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143/A143M, ASTM A384/A384M, and ASTM A385/A385M. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385/A385M.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.

4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
 5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
 6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
 7. Galvanized steel sheets in accordance with ASTM A653/A653M.
 8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.
- F. Electrolytic Protection: Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 04, Painting (Condensed), unless indicated otherwise.
- G. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.
- H. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

2.06 SOURCE QUALITY CONTROL

- A. Visually inspect all fabrication welds and correct deficiencies.
1. Steel: AWS D1.1/D1.1M, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
 2. Aluminum: AWS D1.2/D1.2M.
 3. Stainless Steel: AWS D1.6/D1.6M.

PART 3 EXECUTION

3.01 INSTALLATION OF METAL FABRICATIONS

- A. General:
1. Install metal fabrications plumb and level, accurately fitted, free from distortion or defects.
 2. Install rigid, substantial, and neat in appearance.
 3. Install manufactured products in accordance with manufacturer's recommendations.
 4. Obtain Engineer approval prior to field cutting steel members or making adjustments not scheduled.

B. Aluminum:

1. Do not remove mill markings from concealed surfaces.
2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
3. Fabrication, mechanical connections, and welded construction shall be in accordance with the AA Aluminum Design Manual.

3.02 CAST-IN-PLACE ANCHOR BOLTS

- A. Locate and hold anchor bolts in place with templates at time concrete is placed.
- B. Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.
- C. Minimum Bolt Size: 1/2-inch diameter by 12 inches long, unless otherwise shown.

3.03 CONCRETE POST-INSTALLED ANCHORS

- A. Begin installation only after concrete to receive anchors has attained design strength.
- B. Install in accordance with manufacturer's instructions.
- C. Provide minimum embedment, edge distance, and spacing as follows, unless indicated otherwise by anchor manufacturer's instructions or shown otherwise on Drawings:

Anchor Type	Minimum Embedment (Bolt Diameters)	Minimum Edge Distance (Bolt Diameters)	Minimum Spacing (Bolt Diameters)
Expansion	9	6	12
Adhesive	9	9	13.5

- D. Use only drill type and bit type and diameter recommended by anchor manufacturer. Clean hole of debris and dust with brush and compressed air per manufacturer's printed installation instructions.

- E. When embedded steel or rebar is encountered in drill path, slant drill to clear obstruction. If drill must be slanted more than 10 degrees to clear obstruction, notify Engineer for direction on how to proceed.
- F. Adhesive Anchors:
 - 1. Do not install adhesive anchors when temperature of concrete is below 40 degrees F or above 100 degrees F, unless cold temperature adhesives, compliant with ACI 308 are used. Refer to the respective ICC-ES report and manufacturer's printed installation instructions.
 - 2. Remove water from hole with oil-free compressed air. Damp or water filled holes may be allowed only if approved in manufacturer's printed installation instructions and ICC-ES report.
 - 3. For hollow-unit masonry, install screen tube in accordance with manufacturer's printed installation instructions.
 - 4. Do not disturb anchor during recommended curing time.
 - 5. Do not exceed maximum torque as specified in manufacturer's printed installation instructions.

3.04 ACCESS COVERS

- A. Install access covers, including sidewalk doors, floor hatches, and hinged manhole covers in accordance with manufacturer's instructions.
- B. Accurately position prior to placing concrete, such that covers are flush with floor surface.
- C. Protect from damage resulting from concrete placement. Thoroughly clean exposed surfaces of concrete spillage to obtain a clean, uniform appearance.
- D. Route drain pipe to exterior face of concrete or as shown on Drawings.

3.05 ELECTROLYTIC PROTECTION

- A. Aluminum and Galvanized Steel:
 - 1. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, or dissimilar metals, as specified in Section 09 90 04, Painting (Condensed), unless indicated otherwise.
 - 2. Do not apply protective coating to galvanized steel anchor bolts unless indicated otherwise.
 - 3. Allow coating to dry before installation of the material.

4. Protect coated surfaces during installation.
5. Should coating become marred, prepare and touch up in accordance with paint manufacturer's written instructions.

B. Stainless Steel:

1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
3. Remove contamination using cleaning and passivation methods in accordance with requirements of ASTM A380 and ASTM A967.
4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
5. After treatment, visually inspect surfaces for compliance.

3.06 PAINTING

A. Painted Galvanized Surfaces: Prepare as specified in Section 09 90 04, Painting (Condensed).

B. Repair of Damaged Hot-Dip Galvanized Coating:

1. Conform to ASTM A780/A780M.
2. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780/A780M.
3. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780/A780M.
4. Use magnetic gauge to determine thickness is equal to or greater than base galvanized coating.

3.07 FIELD QUALITY CONTROL

A. Contractor-Furnished Quality Control:

1. Inspection and testing required in Section 01 45 16.13, Contractor Quality Control.
2. Certificate of Compliance per Section 01 43 33, Manufacturer's Field Services, for test results, or calculations, or drawings that ensure material and equipment design and design criteria meet requirements of Section 01 61 00, Common Product Requirements.

3.08 FASTENER SCHEDULE

A. Unless indicated otherwise on Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Anchor Bolts Cast Into Concrete for Structural Steel, Metal Fabrications and Castings		
Interior Dry Areas	Stainless steel headed anchor bolts, unless indicated otherwise	
Exterior and Interior Wet Areas	Stainless steel headed anchor bolts	
Submerged and Corrosive Areas	Stainless steel headed anchor bolts	
2. Anchor Bolts Cast Into Concrete for Equipment Bases		
Interior Dry Areas	Stainless steel headed anchor bolts, unless otherwise specified with equipment	
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel headed anchor	
3. Drilled Anchors for Metal Components to Cast-in-Place Concrete (e.g., Ladders, Handrail Posts, Electrical Panels, and Equipment)		
Interior Dry Areas	Stainless steel wedge or expansion anchors	
Submerged, Exterior, Interior Wet, and Corrosive Areas	Adhesive stainless steel anchors	
4. Connections for Structural Steel Framing		
Exterior and Interior Wet and Dry Areas	High-strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for steel framing members.

Service Use and Location	Product	Remarks
5. Connections of Aluminum Components		
Submerged, Exterior and Interior Wet and Dry Areas	Stainless steel bolted connections, unless otherwise specified with equipment	
6. All Others		
Exterior and Interior Wet and Dry Areas	Stainless steel fasteners	

- B. Antiseizing Lubricant: Use on stainless steel threads.
- C. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 120 degrees F.

END OF SECTION

SECTION 05 52 00
METAL RAILINGS

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. Aluminum Association, Incorporated (AA): DAF45, Designation System for Aluminum Finishes.
 2. American Iron and Steel Institute (AISI).
 3. ASTM International (ASTM):
 - a. E985, Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
 4. International Code Council (ICC): International Building Code (IBC).
 5. Occupational Safety and Health Act (OSHA): 29 CFR 1910, Code of Federal Regulations.

1.02 DEFINITIONS

- A. Handrails: Synonymous with terms; i.e., guardrail system, railing system, ramp-rail system, and stair-rail system. Handrails are comprised of a framework of vertical, horizontal, or inclined members, grillwork or panels, accessories, or combination thereof.
- B. ICC Evaluation Services Report for concrete anchor manufacturers.
- C. Special Inspection: As governed by the ICC IBC.
- D. Toeboards: Vertical barrier at floor level usually erected on handrails along exposed edges of floor or wall openings, platforms, ramps, or stairs to prevent miscellaneous items from falling through.

1.03 SUBMITTALS

- A. Action Submittals:
1. Shop Drawings:
 - a. Indicate handrail profiles, sizes, connections, anchorage, size and type of fasteners, and accessories. Project-specific scale plans and elevations of handrails.
 - b. Manufacturer's literature and catalog data of handrail and components.

- c. Design Data: Calculations or test data using design performance loads and include the following:
 - 1) Bending stress in, and deflection of, posts in accordance with ASTM E985.
 - 2) Stress in post base connection.
 - 3) Calculation of anchorage forces and comparison of these forces to ICC IBC recommendations regarding safe allowable design loads of anchorages.
 - 4) For concrete anchor spacings less than 12 anchor diameters and edge distances less than six anchor diameters, make reduction in allowable pullout and shear values. Provide independent laboratory inspection service for ICC Evaluation Services Report values with Special Inspection.
 - 2. Samples:
 - a. Railing sections, 6 inches long showing different connections and proposed finish.
 - b. Each fitting including wall brackets, castings, toeboard fittings, and rail expansion joints.
- B. Informational Submittals:
- 1. Manufacturer's assembly and installation instructions.
 - 2. Special Inspection:
 - a. Manufacturer's instructions for Special Inspection of concrete anchors.
 - b. Special Inspection report in accordance with Article Tests and Inspections.
 - 3. Test Reports: Test data may supplement load calculations providing data covers the complete handrail system, including anchorage:
 - a. Test data for handrail and components showing load and deflection due to load, in enough detail to prove handrail is strong enough and satisfies national, state, local standards, regulations, code requirements, and OSHA 29 CFR 1910, using design loads specified. Include test data for the following:
 - 1) Railing and post connections.
 - 2) Railing wall connections.
 - 3) Post and base connections.
 - 4) Railing expansion joint connections.
 - 5) Railing gate assembly, including latch and gate stop. Both gate latch and stop to support required loads applied, independent of each other.
 - 6) Railing gate hinges.
 - b. Deflection Criteria: In accordance with ASTM E985 and design loads specified.

- c. Aluminum Rail Piping: Test data showing yield strength of pipe as-delivered equals or exceeds values specified in this section.
- d. Concrete Anchors: Calculations and test data for review prior to use, on anchors other than those specified.
- 4. Manufacturer's written recommendations describing procedures for maintaining handrails including cleaning materials, application methods, and precautions to be taken in the use of cleaning materials.
- 5. Manufacturer's Certificate of Proper Installation in accordance with Section 01 43 33, Manufacturers' Field Services.

1.04 QUALITY ASSURANCE

- A. Qualifications: Calculations required for design data stamped by a registered civil or structural engineer licensed in the state where the Project will be constructed.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handrails adequately packaged and wrapped to prevent scratching and denting during shipment, storage, and installation. Maintain protective wrapping until railing is completely installed.
- B. Aluminum Handrails:
 - 1. Shop assemble into practical modules of lengths not exceeding 24 feet for shipment.
 - 2. Deliver toeboards loose for field assembly.
 - 3. Deliver clear anodized handrail pipe and posts with protective plastic wrap.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Thermal Movements: Allow for thermal movement resulting from the following maximum range in ambient temperature in design, fabrication, and installation of handrails to prevent buckling, opening up of joints, over stressing of components, connections and other detrimental effects. Base design calculation on actual surface temperatures of materials due to both solar heat gain and night time sky heat loss. Temperature change is difference between high or low temperature and installation temperature.
 - 1. Temperature Change Range: 70 degrees F, ambient; 100 degrees F, material surfaces.

PART 2 PRODUCTS

2.01 DESIGN PERFORMANCE

- A. Structural Performance of Handrails: Design, test, fabricate, and install handrails to withstand the following structural loads without exceeding allowable design working stress or allowable deflection. Apply each load to produce maximum stress and deflection in each of the respective components comprising handrails.
 - 1. Top Rail of Handrails: Capable of withstanding the following load cases applied:
 - a. Concentrated load of 200 pounds applied at any point and in any direction in accordance with FBC.
 - b. Uniform load of 50 pounds per lineal foot applied in any direction in accordance with FBC.
 - c. Concentrated load need not be assumed to act concurrently with uniform loads in accordance with FBC.
 - 2. Concrete Anchors for Handrail Wall Brackets: Anchors with a strength required by calculations with concrete strength assumed at 4,000 psi and in conformance with FBC.
 - 3. Concrete Anchors: In accordance with FBC for size, length, embedment, spacing, and edge distance to match required loads shown in calculations.

2.02 ALUMINUM HANDRAILS

- A. General:
 - 1. Furnish pre-engineered and prefabricated two-rail handrails.
 - 2. Pop rivets and glued railing construction not permitted.
- B. Manufacturers:
 - 1. Thompson Fabricating Co., Birmingham, AL.
 - 2. Moultrie Manufacturing, Moultrie, GA; Wesrail II.
- C. Rails, Posts, and Formed Elbows: Extruded Alloy 6105-T5 or 6061-T6, minimum tensile strength of 38,000 psi and minimum yield strength of 35,000 psi.
 - 1. Miscellaneous Aluminum Parts: 6063-T6 or 6061-T6 extruded aluminum of adequate strength for all loads.

2. Post and Railing: Nominal 1-1/2-inch diameter.
 - a. Rails: 1.900-inch outside diameter by 0.145-inch wall thickness, Schedule 40.
 - b. Posts: 1.900-inch outside diameter by 0.200-inch wall thickness, Schedule 80.
 - c. Solid dowel interconnectors of 6105-T5 or 6061-T6 aluminum.

D. Fittings:

1. Handrail and Post Fittings: Extruded, machined bar stock, permanent mold castings, or die castings of sufficient strength to meet load requirements. Fittings shall match color of pipe in handrails. Sand cast parts not permitted.
2. Concrete Top Mount Post Base:
 - a. Four holes in base for concrete anchors. For narrow walls or curbs, furnish two holes in base for concrete anchors with required edge distance.
 - b. Manufacturers and Products:
 - 1) Thompson Fabricating Co.; Part No. TBF-3.4 and Part No. TBF-3.2 for narrow walls and curbs.
 - 2) Moultrie Manufacturing Co.; Part No. WII4HB and WII2HB for narrow walls and curbs.
3. Concrete Side Mounted Handrail Bracket: Extruded aluminum, Alloy 6063-T6 with two holes for bolts or concrete anchors.
 - a. Manufacturers and Products:
 - 1) Thompson Fabricating Co.; Part No. TSM-1.50 (one piece).
4. Concrete Anchors for Securing Bases and Brackets to Concrete: Type 316 stainless steel 1/2-inch (minimum diameter) concrete anchors, unless otherwise shown on Drawings.
5. Handrail Connections for Metal Stairway Stringers:
 - a. Extruded aluminum bracket, Alloy 6063-T6.
 - b. Bracket bolts 1/2-inch diameter Type 316 stainless steel bolts.
 - c. Offset Adjustable Stair Fitting:
 - 1) Thompson Fabricating Co.; Part No. ASF of cast Al-mag.
 - 2) Moultrie Manufacturing Co.; Standard and custom elbow angles, Part No. W51XXX (numbers vary based on angle).
 - d. Base Connection:
 - 1) Manufacturers and Products:
 - a) Thompson Fabricating Co.; Part Nos. SMB-2 or SMB-3, ASF, APF.
 - b) Moultrie Manufacturing Co.; Part No. WIISMBEXT.
6. Handrail Connections for Metal Beams:
 - a. Extruded aluminum bracket, Alloy 6063-T6.
 - b. Bracket bolts 1/2-inch diameter Type 316 stainless steel bolts.

- c. Manufacturers and Products:
 - 1) Thompson Fabricating Co.; Part Nos. SMB-2 or SMB-3. Use Part No. TSM-1.5 if bracket is attached to flat side of channel.
 - 2) Moultrie Manufacturing Co.; Part No. WIISMBEXT. Use Part No. WIISMB if bracket is attached to flat side of channel.
- 7. Handrail Wall Brackets: Adjustable wall fitting, with provision for three 3/8-inch Type 316 stainless steel bolts or concrete anchors.
 - a. Manufacturers and Products:
 - 1) Thompson Fabricating Co.; Part No. AWF cast Al-mag aluminum bracket.
 - 2) Moultrie Manufacturing Co.; Part No. W41100.
- 8. Miscellaneous Rail to Post Fittings:
 - a. Aluminum Tee Fittings:
 - 1) Manufacturers and Products:
 - a) Thompson Fabricating Co.; Part Nos. TF-1 and TX-1.
 - b) Moultrie Manufacturing Co.; Part Nos. WIIT40, WIIT40/05, WIIT80, and WIIT80/05.
 - b. Aluminum Ell Fittings:
 - 1) Manufacturers and Products:
 - a) Thompson Fabricating Co.; Part Nos. TE-1, TE-2, and TE-3.
 - b) Moultrie Manufacturing Co.; Part No. 51900.
 - c. Aluminum Splice Lock:
 - 1) Manufacturers and Products:
 - a) Thompson Fabricating Co.; Part No. SL-1.
 - b) Moultrie Manufacturing Co.; Part No. WIIS40.
 - d. Aluminum Expansion Joint Splice:
 - 1) Manufacturers and Products:
 - a) Thompson Fabricating Co.; Part No. ES-1.
 - b) Moultrie Manufacturing Co.; Part No. WII40, omit set screws on one side.
 - e. Formed Aluminum Wall Flange:
 - 1) Manufacturers and Products:
 - a) Thompson Fabricating Co.; Part No. CF-2.
 - b) Moultrie Manufacturing Co.; Part No. 41250.
- 9. Handrail Gate: 6063-T6, 6105-T5, or 6061-T6 extruded aluminum.
 - a. Hardware Manufacturers and Products:
 - 1) Julius Blum & Co., Inc., Carlstadt, NJ; No. 782/3 gate hinges with springs, and No. 784 gate latch and stop.
 - 2) CraneVeyor Corp., South El Monte, CA; No. C4370b gate hinges with spring, No. C4369 gate latch, and No. C4368 gate stop.

- 3) Thompson Fabricating Co., Birmingham, AL.
 - 4) Moultrie Manufacturing Co., Moultrie, GA; Part No. W60006.
10. Toeboards and Accessories:
 - a. Material: Molded or extruded 6063 or 6061 aluminum.
 - b. Manufacturers:
 - 1) Thompson Fabricating Co.
 - 2) Moultrie Manufacturing Co.; Part No. WIKP20.
 11. Castings for Handrails:
 - a. Cast Al-mag with sufficient strength to meet load and test requirements.
 - b. Anodizable grade finish with excellent resistance to corrosion when subject to exposure of sodium chloride solution intermittent spray and immersion.
- E. Concrete Embedded Metal Anchorages: In accordance with Section 05 50 00, Metal Fabrications.
- F. Finishes:
1. Handrail Pipe and Post: In accordance with AA DAF45, designation AA-M32-C22-A41.
 2. Cast Fittings and Toeboards: In accordance with AA DAF45, designation AA-M10-C22-A41.

2.03 ANCHOR BOLTS, FASTENERS, AND CONCRETE ANCHORS

- A. Locknuts, Washers, and Screws:
1. Elastic Locknuts, Steel Flat Washers, RHMS Round Head Machine Screws: Type A 316 stainless steel.
 2. Flat Washers: Molded nylon.
 3. Manufacturer: McMaster-Carr Supply Co., Los Angeles, CA.
- B. Bolts and Nuts for Bolting Handrail to Metal Beams: ASTM A193/A193M and ASTM A194/A194M, Type A 316 stainless steel with minimum yield strength for bolts of 95,000 psi, unless otherwise shown.
- C. Concrete Anchors:
1. Stainless steel Type 316.
 2. Use ICC IBC approved values for size, length, embedment, spacing, and edge distance to match required loads shown in calculations.

D. Epoxy Anchors:

1. Heavy-duty, for exterior use only in accordance with Section 05 50 00, Metal Fabrications, as an alternative to mechanical concrete anchors.
2. Design and provide number required.
3. Do not use where fire or elevated temperatures above 110 degrees F exist.

2.04 FABRICATION OF ALUMINUM HANDRAILS

A. Shop Assembly:

1. Post Spacing: Maximum 5-foot horizontal spacing.
2. Railing Posts Bolted to Metal or Concrete:
 - a. In lieu of field cutting, provide approved fitting with sufficient post overlap, containing provisions for vertical adjustment.
 - b. Field fit-up is required.
3. Free of burrs, nicks, and sharp edges when fabrication is complete.
4. Welding is not permitted.

B. Shop/Factory Finishing:

1. Use same alloy for uniform appearance throughout fabrication for railings.
2. Handrail and Post Fittings: Match fittings with color of pipe in handrail.
3. Sand cast parts not permitted.

C. Tolerances:

1. Shop assemble rails, posts, and formed elbows with a close tolerance for tight fit.
2. Fit dowels tightly inside posts.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide railing posts longer than needed and field cut to exact dimensions required in order to satisfy vertical variations on the actual structure. Install railing with a base that provides plus or minus 1/4-inch vertical adjustment inside base fitting. If adjustment is required in the field and exceeds plus or minus 1/4-inch, reduce post length not to exceed beyond bottom of lowest set-screw or bolt in base fitting.
- B. Field fabrication of aluminum railing systems not permitted.
- C. Modification to structure not permitted where handrail is attached.

3.02 HANDRAIL INSTALLATION

- A. Assembly and Installation: Perform in accordance with manufacturer's written recommendations for installation.
- B. Protection from Entrapped Water:
 - 1. Make provisions in exterior and interior installations subject to high humidity to drain water from railing system.
 - 2. Posts mounted in concrete, bends, and elbows occurring at low points drill weep holes of 1/4-inch diameter at lowest possible elevations, one hole per post or rail. Drill hole in the plane of the rail.
- C. Expansion Joints:
 - 1. Maximum intervals of 54 feet on center and at structural joints.
 - 2. Slip joint with internal sleeve extending 2 inches beyond each side of joint. Provide 1/2-inch slip joint gap to allow for expansion.
 - 3. Fasten to one side using 3/8-inch diameter set-screw. Place set-screw at bottom of pipe.
 - 4. Locate joints within 12 inches of posts. Locate expansion joints in rails that span expansion joints in structural walls and floors supporting the posts.
- D. Setting Posts:
 - 1. Embedded:
 - a. Clean dust and foreign matter from sleeves or blockouts.
 - b. Moisten interior of hole and surrounding surface with clean water. Fill hole with nonshrink grout prior to installing post.
 - c. Brace railing until grout sets.
 - d. Posts installed outside and exposed to freezing temperatures, drill weep hole through post approximately 1/2 inch above level of grout inside post and in plane of rail to prevent entrapment and freezing of water inside post.
 - 2. Surface Mounted:
 - a. Bolt post baseplate connectors firmly in place.
 - b. Shims, wedges, grout, and similar devices for handrail post alignment not permitted.
- E. Posts and Rails:
 - 1. Set posts plumb and aligned to within 1/8 inch in 12 feet.
 - 2. Set rails horizontal or parallel to slope of steps to within 1/8 inch in 12 feet.

3. Install posts and rails in same plane. Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.
4. Support 1-1/2-inch rails directly above stairway stringers with offset fittings.

F. Handrail Wall Brackets:

1. Support wall rails on brackets spaced maximum 6 feet on centers for steel and 5 feet for aluminum as measured on the horizontal projection.
2. Install wall anchor backplates on solid blocking in stud walls.

G. Toeboard:

1. Provide at handrails, except where 4-inch or higher concrete curbs are installed or at gates.
2. Accurately measure in field for correct length; after handrail post installation cut and secure to posts.
3. Dimension between bottom of toeboard and walking surface not to exceed 1/4 inch.
4. Aluminum Toeboards: Provide expansion and contraction connections between each post.
5. Steel Toeboards: Between each post cut toeboard and provide slotted holes for expansion and contraction.

H. Railing Gate: Install in accordance with manufacturer's installation instructions.

3.03 FIELD FINISHING

- A. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces as specified in Section 09 90 04, Painting (Condensed).
1. Treatment of Field Welds for Galvanized Steel Railings: Touch up welds by application of two coats high-zinc dust content paint to dry film thickness of 2 mils.

3.04 TESTS AND INSPECTIONS

- A. Perform Special Inspection for anchors where ICC Evaluation Services Reports require them for anchor strength value used.
- B. Provide an independent test laboratory to perform Special Inspection.

3.05 CLEANING

- A. Wash railing system thoroughly using clean water and soap. Rinse with clean water.
- B. Do not use acid solution, steel wool, or other harsh abrasive.
- C. If stain remains after washing, restore in accordance with manufacturer's recommendations or replace stained handrails.

END OF SECTION

**SECTION 05 53 00
METAL GRATINGS**

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
- a. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 - b. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
 - c. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - d. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
2. National Association of Architectural Metal Manufacturers (NAAMM):
- a. MBG 531, Metal Bar Grating Manual.

1.02 SUBMITTALS

- A. Action Submittals:
1. Shop Drawings:
 - a. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other Work.
 - b. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.
 - c. Catalog information and catalog cuts.
 - d. Manufacturer's specifications, to include coatings.
- B. Informational Submittals:
1. Special handling and storage requirements.
 2. Installation instructions.
 3. Factory test reports.
 4. Manufacturer's Certification of Compliance for specified products.
 5. Written Test Report that swaged crossbars, if used on grating, meet the requirements of the specified test and additional requirements of these Specifications.

1.03 PREPARATION FOR SHIPMENT

- A. Insofar as is practical, factory assemble items provided.
- B. Package and clearly tag parts and assemblies that are of necessity shipped unassembled and protect the materials from damage, and facilitate identification and final assembly in the field.

PART 2 PRODUCTS

2.01 FOOT TRAFFIC GRATING

- A. Design:
 - 1. Uniform Service Load: 100 psf minimum, unless otherwise shown.
 - 2. Maximum Deflection: 1/4 inch, unless otherwise shown.
 - 3. Space bearing bars at 1-3/16 inch center-to-center.
 - 4. Banding: 3/16 inch minimum.
- B. Material:
 - 1. Aluminum Bar Type Grating:
 - a. Press-locked rectangular design, as manufactured by IKG/Borden, Clark, NJ; IKG/Borden Type B or Type F.
 - b. Swage locked aluminum grating, rectangular bar type, as manufactured by:
 - 1) IKG/Borden, Clark, NJ; IKG/Borden Type BS or Type FS.
 - 2) Seidelhuber Metal Products Inc., San Carlos CA; Type A-2.
 - 3) Ohio Gratings, Inc., Canton, OH; Aluminum Flush Top, Type 19SGF2.
 - 4) Klemp Corp., Chicago, IL; Type KRP.
 - c. Swage locked aluminum I-bar grating, as manufactured by:
 - 1) IKG/Borden, Clark, NJ; Type IF.
 - 2) Seidelhuber Metal Products, Inc., San Carlos, CA; Type 19SI2.
 - 3) Ohio Gratings, Inc., Canton, OH; Type 19 SGI 2.
 - 4) Klemp Corp., Chicago, IL; Type KIP.
 - 2. Stair Treads:
 - a. Material and Type: Same as grating material and grating type as furnished for connecting walkway or work surface.
 - b. Nosings: Integral ribbing and serrated edge on one long axis of tread or nonslip, abrasive on each tread along one long edge.
 - c. Carrier Plate or Angle: Furnish at each end for connection to stair stringers.
 - d. Manufacturers: Same as for grating.

2.02 ACCESSORIES

A. Anchor Bolts and Nuts:

1. Stainless Steel: ASTM A193 and ASTM A194, Type 316.

B. Flat Washers (Unhardened): ASTM F844.

C. Removable Fastener Clips and Bolts:

1. Removable from above grating walkway surface.
2. Hat Bracket: Type 304 stainless steel.
3. Bolt: Type 316 stainless steel.
4. Manufacturer and Product: Struct-Fast, Wellesley Hills, MA; Gratefast.

D. Partially Removable Anchor:

1. Bolt: Threaded stud, Type 316 stainless steel.
 - a. Manufacturer: Nelson Stud Welding Co., Lorain, OH.
2. Hat Bracket: Type 304 stainless steel.
 - a. Manufacturer: STRUCT-FAST, Wellesley Hills, MA.

2.03 FABRICATION

A. General:

1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Weld Connections: Not permitted on grating except at banding bars.

B. Design:

1. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
2. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
3. Minimum Bearing: NAAMM MBG 531.
4. Metal Crossbar Spacing: 4 inches maximum, unless otherwise shown or specified.

5. Crossbars: Flush with top of main bar and extend downward a minimum of 50 percent of the main bar depth.
 - a. Swaged Crossbars:
 - 1) Within 1/4 inch of top of grating with 1/2 inch minimum vertical dimension after swaging, and minimum before swaging dimension of 5/16 inch square.
 - 2) Crossbar Dimension After Swaging: Minimum 1/8 inch wider than the opening at minimum of two corners at each side of each square opening in main bar.
 - 3) Crossbars may be a special extruded shape so that after swaging the top will be flat, 3/16 inch wide and will be flush with the top surface of the bearing bars for a minimum of 5/8 inch at center between bearing bars.
 - 4) Flush crossbar meeting all of the above except that after swaging shall overlap one corner by a minimum of 1/8 inch. A Sample of one bearing bar and one crossbar shall be tested by holding the bearing bar and pulling on the crossbar. The crossbar to bearing bar shall sustain a minimum of 300 pounds without pullout of the bearing bar.
 - 5) Tightly fit main bars and crossbars allowing no differential movement.
 6. Do not use weld type crossbars.
 7. Banding: Same material as grating; NAAMM MBG 531 and NAAMM MBG 532.
 8. Furnish stainless steel Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete, as manufactured by Nelson Studs Welding Co., Lorain, OH.

C. Supports:

1. Seat Angles and Beams:
 - a. Same material as rectangular bar grating.
 - b. Extruded aluminum frame with slot for recessed grating clips, as manufactured by Thompson Fabricating Co., for aluminum I-Bar type grating.
2. Coordinate dimensions and fabrication with grating to be supported.
3. Coordinate dimensions with increased depth due to serrations.
4. Welded Frames with Anchors: Continuously welded.

D. Slip-Resistant Surface:

1. Rectangular Aluminum Bar Grating: As manufactured by:
 - a. IKG/Borden, Clark, NJ; EZ Weldslip-Resistant Coating.
 - b. Seidelhuber Metal Products, Inc., Hayward, CA; Safety Grit Non-Slip System.

- c. Ohio Gratings, Inc., Canton, OH with “Slip-Not” Safety Surface manufactured by W.S. Molnar Co., Detroit, MI.
- E. Aluminum:
1. ASTM B221 extruded shapes.
 2. Fabricate as shown and in accordance with manufacturer’s recommendations.
 3. Grind smooth sheared edges exposed in the finished work.
 4. Swage crossbars, if used, with equipment strong enough to deform crossbars.
 5. Eliminate any loose crossbar intersections on swaged grating.
- F. Foot Traffic Grating: Any single grating section, individual plank, or plank assembly shall be not less than 1 foot 6 inches or greater than 3 feet 0 inch in width or weigh more than 150 pounds.

PART 3 EXECUTION

3.01 PREPARATION

- A. Electrolytic Protection:
1. Aluminum in contact with dissimilar metals, other than stainless steel, and embedded or in contact with masonry, grout, and concrete, protect surfaces as specified in Section 09 90 04, Painting (Condensed).
 2. Allow paint to dry before installation of the material.

3.02 INSTALLATION

- A. Install supports such that grating sections have a solid bearing on both ends, and that rock and wobble grating movement does not occur.
- B. Install plumb or level as applicable.
- C. Install welded frames with anchors to straight plane without offsets.
- D. Anchor grating securely to supports using minimum of four fastener clips and bolts per grating section.
- E. Use stainless steel anchors and accessories with aluminum gratings.
- F. Completed installation shall be rigid and neat in appearance.

- G. Commercially Manufactured Products:
 - 1. Install in accordance with manufacturer's recommendations.
 - 2. Secure grating to support members with fasteners.
 - 3. Welding is not permitted.
 - 4. Fasteners: Field locate and install.
 - 5. Permit each grating section to be easily removed and replaced.
- H. Protect painted surfaces during installation.
- I. Should coating become marred, prepare and touch up surface in accordance with paint manufacturer's instructions.

END OF SECTION

**SECTION 09 90 04
PAINTING (CONDENSED)**

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. NACE International (NACE): RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
 2. NSF International (NSF): 61, Drinking Water System Components-Health Effects.
 3. The Society for Protective Coatings (SSPC):
 - a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
 - b. PA 3, Guide to Safety in Paint Applications.
 - c. SP 1, Solvent Cleaning.
 - d. SP 2, Hand Tool Cleaning.
 - e. SP 3, Power Tool Cleaning.
 - f. SP 5, Joint Surface Preparation Standard White Metal Blast Cleaning.
 - g. SP 6, Joint Surface Preparation Standard Commercial Blast Cleaning.
 - h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
 - i. SP 10, Joint Surface Preparation Standard Near-White Blast Cleaning.
 - j. SP 11, Power Tool Cleaning to Bare Metal.
 - k. SP 12, Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating.
 - l. SP 13, Surface Preparation of Concrete.
 - m. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

1.02 DEFINITIONS

- A. Terms used in this section:
1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
 2. FRP: Fiberglass Reinforced Plastic.
 3. HCl: Hydrochloric Acid.
 4. MDFT: Minimum Dry Film Thickness, mils.
 5. MDFTPC: Minimum Dry Film Thickness per Coat, mils.

6. Mil: Thousandth of an inch.
7. PDS: Product Data Sheet.
8. PSDS: Paint System Data Sheet.
9. PVC: Polyvinyl Chloride.
10. SFPG: Square Feet per Gallon.
11. SFPGPC: Square Feet per Gallon per Coat.
12. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
 - a. Product Data Sheets:
 - 1) For each product, furnish a Product Data Sheet (PDS), the manufacturer's technical data sheets, and paint colors available (where applicable). The PDS form is appended to the end of this section.
 - 2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.
 - 3) Furnish copies of paint system submittals to coating applicator.
 - 4) Indiscriminate submittal of manufacturer's literature is not acceptable.
 - b. Detailed chemical and gradation analysis for each proposed abrasive material.
2. Samples:
 - a. Proposed Abrasive Materials: 5-pound minimum Sample for each proposed.
 - b. Reference Panel:
 - 1) Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel prepared to specified requirements for each grade of sandblast specified herein.
 - a) Provide panel representative of steel used, and prevent from deterioration of surface quality.
 - b) Upon approval by Engineer, preserve panel as reference source for inspection.
 - 2) Paint:
 - a) Before painting work is started, prepare minimum 8-inch by 10-inch Sample with type of paint and application specified, on similar substrate to which paint is to be applied.
 - b) Furnish additional Samples as required until colors, finishes, and textures are approved.
 - c) Approved Samples to be quality standard for final finishes.

B. Informational Submittals:

1. Applicator's Experience: List of references substantiating this requirement as specified.
2. Manufacturer's written verification that submitted products are suitable for the intended use.
3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified herein.
4. If manufacturer of finish coating differs from that of shop primer, provide both manufacturers' written confirmation that materials are compatible.
5. Coating Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.

1.04 QUALITY ASSURANCE

A. Applicator's Experience: Minimum 5 years' practical experience in application of specified products.

B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
 - a. Paint manufacturer's instructions.
 - b. SSPC PA 3, Guide to Safety in Paint Applications.
 - c. Federal, state, and local agencies having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Site in unopened containers that plainly show designated name, date of manufacture, color, and manufacturer.
- B. Store paints in a protected area that is heated or cooled to maintain temperature range recommended by paint manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures outside of manufacturer's recommended maximum or minimum allowable, or in dust, smoke-laden atmosphere, damp or humid weather.
2. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air. Strictly adhere to coating manufacturer's recommendations.

1.07 EXTRA MATERIALS

- A. Provide small quantity kits for touchup painting and for painting other small areas.
- B. Fusion Bonded Coating: Provide appropriate liquid repair kits for field use.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Paint manufacturer shall be nationally recognized manufacturer of paints and protective coatings and regularly engaged in production of such materials that have essentially identical service conditions as this Project.
- B. Minimum of 5 years' verifiable experience in manufacture of specified products.

2.02 ABRASIVE MATERIALS

- A. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.03 PAINT MATERIALS

- A. General:
 - 1. Material Quality: Manufacturer's highest quality products and suitable for the intended service.
 - 2. Materials, Including Primer and Finish Coats: Produced by same paint manufacturer.
 - 3. Thinners, Cleaners, Driers, and Other Additives: As recommended by paint manufacturer of particular coating.
- B. Products:

Product	Definition
Bituminous Paint	Single-component, coal-tar pitch based
Epoxy Filler/Surfacer	100 percent solids epoxy trowel grade filler and surfacer, nonshrinking, suitable for application to concrete and masonry. Approved for potable water contact and conforming to NSF 61, where required
Epoxy Primer	Converted epoxy primer containing rust-inhibitive pigments

Product	Definition
High Build Epoxy	Polyamidoamine epoxy, minimum 69% volume solids, capability of 4 MDFT to 8 MDFT per coat
Inorganic Zinc Primer	Solvent or water based, having 85% metallic zinc content in the dry film; follow manufacturer's recommendation for topcoating
NSF Epoxy	Polyamidoamine epoxy, approved for potable water contact and conforming to NSF 61
Epoxy, High Solids	Polyamidoamine epoxy, 80% volume solids, minimum, suitable for immersion service
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish
Rust-Inhibitive Primer	Single-package steel primers with anticorrosive pigment loading
Stain, Concrete	Acrylic, water repellent, penetrating stain

2.04 COLORS

- A. Provide as selected by Owner.
- B. Formulate with colorants free of lead, lead compounds, or other materials, which might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.
- C. Proprietary identification of colors is for identification only. Any authorized manufacturer may supply matches.

2.05 SHOP FINISHES

- A. Shop Blast Cleaning: Reference paragraph Shop Coating Requirements, this section.
- B. Surface Preparation: Provide Engineer minimum 7 days' advance notice to start of shop surface preparation work and coating application work.
- C. Shop Coating Requirements:
 1. When required by equipment Specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.
 2. Where manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In

such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Pipe:

1. Ductile Iron Pipe:

- a. Use SSPC standards as a guide for desired prepared surface. Follow recommendations of pipe and coating manufacturers for means and methods to achieve SSPC-equivalent surface.
- b. Prior to blast cleaning, grind smooth surface imperfections including, but not limited to, delaminating metal or oxide layers.
- c. Surface preparation and application of primer and finish coats shall be performed by pipe manufacturer.

PART 3 EXECUTION

3.01 GENERAL

A. Surface Preparation Inspection:

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. In event of conflict, more stringent shall apply.
2. Notify Engineer minimum 7 days' prior to start of surface preparation work or coating application work.
3. Perform work only in presence of Engineer, unless Engineer grants prior approval to perform work in Engineer's absence.

B. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating until completion of curing cycle.

C. Perform painting in accordance with recommendations of the following:

1. Paint manufacturer's instructions.
2. Federal, state, and local agencies having jurisdiction.

3.02 PROTECTION OF MATERIALS NOT TO BE PAINTED

A. Protect all surfaces adjacent to, or downwind of Work area from overspray. Contractor shall be responsible for any damages resulting from overspray.

- B. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere.
- C. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- D. Protect working parts of mechanical and electrical equipment from damage.
- E. Mask openings in motors to prevent paint and other materials from entering the motors.

3.03 FIELD SANDBLASTING

- A. Perform sandblasting for items and equipment where specified, and as required to restore damaged surfaces previously shop or field blasted and primed. Materials, equipment, procedures shall meet requirements of SSPC.

3.04 PREPARATION OF SURFACES

A. Metal Surface Preparation:

1. General:
 - a. Submit samples prior to surface preparation blasting.
 - b. Conform to current SSPC specifications as follows:
 - 1) Solvent Cleaning: SP 1.
 - 2) Hand Tool Cleaning: SP 2.
 - 3) Power Tool Cleaning: SP 3.
 - 4) White Metal Blast Cleaning: SP 5.
 - 5) Commercial Blast Cleaning: SP 6.
 - 6) Brush-Off Blast Cleaning: SP 7.
 - 7) Near-White Blast Cleaning: SP 10.
 - 8) Power Tool Cleaning to Bare Metal: SP 11.
 - 9) High Pressure Waterjetting: SP 12.
 - c. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet- or vacu-blast methods may be required. Follow coatings manufacturers' recommendations for wet-blast additives and first coat application.
 - d. Hand-tool clean areas that cannot be cleaned by power-tool cleaning.
2. Blast Cleaning Requirements:
 - a. Comply with applicable federal, state, and local, air pollution and environmental control regulations for blast cleaning and disposition of spent aggregate and debris.
 - b. Alternatives to standard abrasive blast cleaning methods subject to Engineer review.

B. Concrete Surface Preparation:

1. Do not begin until 30 days after concrete has been placed.
2. Meet requirements of SSPC SP 13.
3. Remove grease, oil, dirt, salts or other chemicals, loose materials or other foreign matter by solvent, detergent, or other suitable cleaning methods.
4. Brush-off blast clean concrete surfaces to remove loose concrete and to provide a tooth for binding. If brush-off blasting is impractical, surface may be acid etched with muriatic acid solution. Approval is subject to producing desired profile equivalent to No. 80 grit flint sandpaper. Acid etching of vertical or overhead surfaces will not be accepted.
5. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting.

C. Plastic and FRP Surface Preparation:

1. Hand sand with medium grit sandpaper to provide tooth for coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

3.05 PAINT MIXING

A. Multiple-Component Coatings:

1. Prepare using contents of container for each component as packaged by paint manufacturer.
2. No partial batches will be permitted.
3. Do not use multiple-component coatings that have been mixed beyond their pot life.
4. Mix only components specified and furnished by paint manufacturer.
5. Do not intermix additional components for reasons of color or otherwise, even within same generic type of coating.

B. Keep paint materials sealed when not in use.

C. Where more than one coat of material is applied within given system, alternate color to provide visual reference that required number of coats has been applied.

3.06 PAINT APPLICATION

A. General:

1. Inspection: Schedule with Engineer in advance for cleaned surfaces and all coats prior to succeeding coat.
2. Apply coating in accordance with paint manufacturer's recommendations. Allow sufficient time between coats to ensure thorough drying of previously applied paint.
3. Fusion Bonded Coating Application: Electrostatic, fluidized bed, or flocking.
4. Paint units to be bolted together and to structures, prior to assembly or installation.
5. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.

B. Shop Primed or Factory Finished Surfaces:

1. Inspection: Schedule inspection for compliance with Specifications of shop primed or factory finished items with Engineer in advance of delivery to Site.
2. Hand or power sand areas of chipped, peeled, or abraded coating, feathering the edges. Follow with a spot primer using specified primer.
3. For two-package or converted coatings, consult coatings manufacturer for specific procedures as relates to manufacturer's products.
4. Prior to application of finish coats, clean shop-primed surfaces free of dirt, oil, and grease and apply mist coat of specified primer, 1-mil dry film thickness.
5. After welding, prepare and prime holdback areas as required for specified paint system. Apply primer in accordance with manufacturer's instructions.

C. Manufacturer Applied Paint Systems:

1. Repair abraded areas on factory finished items in accordance with equipment manufacturer's directions.
2. Carefully blend repaired areas into original finish.

D. Porous Surfaces, Such As Concrete and Masonry:

1. Filler/Surfacer: Use coating manufacturer's recommended product to fill air holes, bug holes, and other surface voids or defects.

2. Prime Coat:
 - a. May be thinned to provide maximum penetration and adhesion.
 - b. Type and Amount of Thinning: Determined by paint manufacturer and dependent upon surface density and type of coating.
3. Surfaces Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of coating.

E. Film Thickness and Coverage:

1. Number of Coats:
 - a. Minimum required, irrespective of coating thickness.
 - b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Application Thickness:
 - a. Do not exceed coating manufacturer's recommendations.
 - b. Use wet film thickness gauge to measure proper coating thickness during application.
3. Film Thickness Measurement and Electrical Inspection of Coated Surface:
 - a. Perform with properly calibrated instruments.
 - b. Recoat and repair as necessary for compliance with Specifications.
 - c. Coats will be subject to inspection by Engineer and coating manufacturer's representative.
4. Visually inspect concrete, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thickness are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase hiding.

3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. System No. 2 Submerged Metal—Domestic Sewage:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 5, White Metal Blast Cleaning	Prime in accordance with manufacturer's recommendations	
	Coal-Tar Epoxy	2 coats, 16 MDFT

1. Use on the following items or areas:
 - a. Metal surfaces new below a plane 1 foot above maximum liquid surface, metal surfaces above maximum liquid surface which are part of immersed equipment, concrete embedded surfaces of metallic items, such as wall pipes, pipes, pipe sleeves, access manholes, gate guides and thimbles, and structural steel, except reinforcing steel and the following specific surfaces:
 - 1) Interior surface of steel piping noted in Piping Schedule.

B. System No. 4 Exposed Metal—Highly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Epoxy Primer— Ferrous Metal	1 coat, 2.5 MDFT
	High Build Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Exposed metal surfaces, new located inside or outside of structures and exposed to weather and as other items as identified in the Specifications to be coated with this system.
2. Anchor bolts and other items as identified in the Specifications.
3. Hollow metal door and frames.
4. Contractor to verify that factory primer is compatible with the paint system above.

C. System No. 27 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 1, Solvent Cleaning	Prime in accordance with manufacturer's recommendations	
	Bituminous Paint	1 coat, 10 MDFT

1. Use on aluminum surfaces embedded or in contact with concrete.

D. System No. 29 Fusion Bonded Coating:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Fusion Bonded Coating 100% Solids Epoxy	1 or 2 coats, 7 MDFT

1. For steel pipe and fittings, meet all requirements of AWWA C213.
2. Use on the following items:
 - a. Interior and exterior of valves as specified.

E. System No. 29A Fusion Bonded, Steel Dowel Coating:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Fusion Bonded Coating 100% Solids Epoxy	1 or 2 coats, 7 MDFT
TFE Lube, Shop Applied; Grease Lube Alternative, Field Applied just Prior to Installation	TFE Lube or Grease Lube	1 coat, as required

1. Use on steel expansion joint dowels.

3.08 FIELD QUALITY CONTROL

A. Testing Equipment:

1. Provide magnetic type dry film thickness gauge, to test coating thickness specified in mils, as manufactured by Nordson Corp., Anaheim, CA; Mikrotest.
2. Provide electrical holiday detector, low voltage, wet sponge type, to test completed coating systems, 20 mils or less MDFT, for holidays and discontinuities as manufactured by Tinker and Razor, San Gabriel, CA, Model M-1.

3. Provide high voltage holiday detector for coatings in excess of 20 mils MDFT. Unit as recommended by coating manufacturer.
- B. Testing:
1. Thickness and Continuity Testing:
 - a. Measure coating thickness specified in mils with magnetic type dry film thickness gauge in accordance with SSPC PA 2.
 - b. Check each coat for correct millage. Do not make measurement within 8 hours, minimum, after application of coating.
 - c. Test finish coat, 20 mils thick or less, except zinc primer, galvanizing, and elastomeric coatings, for holidays and discontinuities with electrical holiday detector, low voltage, wet sponge type in accordance with NACE RP0188.
 - d. Holiday detect coatings in excess of 20 mils MDFT with high voltage units recommended by coating manufacturer, and in accordance with NACE RP0188.
 - e. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final test may also be conducted by Engineer.
- C. Unsatisfactory Application:
1. Clean and top coat surfaces found to have improper finish color or insufficient film thickness.
 2. Evidence of runs, bridges, shiners, laps, or other imperfections shall be cause for rejection.
 3. Repair defects in coating system per written recommendations of coating manufacturer.
 4. Leave staging up until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer.
- D. Damaged Coatings, Pinholes, and Holidays:
1. Feather edges and repair in accordance with recommendations of paint manufacturer.
 2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather edges. Follow with primer and finish coat in accordance with Specifications. Depending on extent of repair and appearance, finish sanding and topcoat may be required.
 3. Repair fusion bonded coatings as recommended by original applicator.
 4. Apply finish coats, including touchup and damage-repair coats, in a manner, which will present uniform texture and color-matched appearance.

3.09 MANUFACTURER'S SERVICES

- A. In accordance with Section 01 43 33, Manufacturers' Field Services, coating manufacturer's representative shall be present at Site as follows:
 - 1. On first day of application of any coating.
 - 2. Minimum of two additional Site inspection visits as required to resolve field problems attributable to, or associated with, manufacturers' product.
 - 3. As required to verify full cure of coating prior to coated surfaces being placed into immersion service.

3.10 CLEANUP

- A. Place cloths and waste that might constitute fire hazard in closed metal containers or destroy at end of each day.
- B. Upon completion of work, remove staging, scaffolding, and containers from Site or destroy in legal manner.
- C. Completely remove paint spots, oil, or stains from adjacent surfaces and floors and leave entire job clean.

3.11 SUPPLEMENTS

- A. The supplements listed below, following "End of Section," are a part of this Specification:
 - 1. Paint System Data Sheet (PSDS).
 - 2. Product Data Sheet (PDS).

END OF SECTION

PAINT SYSTEM DATA SHEET

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

Paint System Number (from Spec.):		
Paint System Title (from Spec.):		
Coating Supplier:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	Product Name/Number (Proprietary)	Min. Coats, Coverage

PAINT PRODUCT DATA SHEET

Complete and attach manufacturer's Technical Data Sheet to this PDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning: _____

Ambient Temperature Limitations: min.: _____ max.: _____

Surface Temperature Limitations: min.: _____ max.: _____

Surface Profile Requirements: min.: _____ max.: _____

Attach additional sheets detailing manufacturer's recommended storage requirements and holiday testing procedures.

SECTION 13 34 23
PRECAST CONCRETE BUILDING

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Concrete Institute (ACI): 301, Specifications for Structural Concrete for Buildings.
 2. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
 3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
 - a. 90A, Energy Conservation in New Building Design (Fundamentals Handbook).
 4. ASTM International (ASTM):
 - a. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - b. A615/A615M, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - c. C150, Standard Specification for Portland Cement.
 - d. C94/C94M, Standard Specification for ready-mixed Concrete.
 - e. C920, Standard Specification for Elastomeric Joint Sealants.
 - f. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - g. E774, Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.
 5. National Fire Protection Association (NFPA):
 - a. 10, Portable Fire Extinguishers.
 - b. 70, National Electrical Code.
 - c. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
 - d. 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - e. 101, Life Safety Code.
 6. Steel Door Institute (SDI): 100, Recommended Specifications, Standard Steel Doors and Frames.

1.02 WORK INCLUDED

A. New Pump Stations (Total 5):

1. Pump Station A:
 - a. Located: On platform approximately 3 feet 0 inch above grade.
 - b. Interior, Minimum Clear: 14 feet by 10 feet.
 - c. Clear Ceiling Minimum Height: 10 feet 6 inches.
2. Pump Station B:
 - a. Located: On platform approximately 6 feet 10 inches above grade.
 - b. Interior, Minimum Clear: 14 feet 10 feet.
 - c. Clear Ceiling Minimum Height: 10 feet 6 inches.
3. Pump Station C:
 - a. Located: On platform approximately 5 feet 6 inches above grade.
 - b. Interior, Minimum Clear: 14 feet 10 feet.
 - c. Clear Ceiling Minimum Height: 10 feet 6 inches.
4. Pump Station D:
 - a. Located: On platform approximately 3 feet 0 inch above grade.
 - b. Interior, Minimum Clear: 18 feet 10 feet.
 - c. Clear Ceiling Minimum Height: 10 feet 6 inches.
5. Pump Station DA:
 - a. Located: On platform approximately 8 feet 3 inches above grade.
 - b. Interior, Minimum Clear: 14 feet 10 feet.
 - c. Clear Ceiling Minimum Height: 10 feet 6 inches.

B. Contractor shall furnish the simple single-span precast concrete building above. Building shall be delivered and assembled by the manufacturer on the Contractor's prepared elevated slab, a cast-in-place concrete foundation as indicated on approved Shop Drawings and/or Contract Drawings and in accordance with manufacturer's recommendations. Building shall be provided by manufacturer with all necessary openings as specified. Contractor shall construct concrete foundation in conformance with the Contract Drawings and the manufacturer's structural requirements. Shop Drawings shall be submitted and reviewed by the Contractor and Engineer/Architect prior to fabrication.

1. Coordinate enclosure design with electrical equipment. Design to enclose electrical adjustable frequency drives, panelboards, and other equipment.
2. Interface between building wall and foundation slab shall be designed so that waterproof joint between floor slab and wall will not rely solely on applied sealant.
3. Design to include finishes, doors, frames and hardware to produce as complete building as described within this Specification and as shown on the construction Drawings.
4. Control indoor air quality and temperature.
5. Provide lighting fixtures and power outlets.

6. Openings shall be provided in building walls and roof and foundation floor slab in anticipation of all required utility, piping and equipment openings identified through the Shop Drawing process.

C. Design Requirements:

1. Applicable Building Code: Meet the requirements of the Florida Building Code (FBC), 2010 edition, and State of Florida High Velocity Hurricane Zones and Wind-borne Debris regions and design criteria on Drawings.
2. Note that buildings in proximity to existing buildings will require a 1-hour fire rated concrete wall separation which when required are shown on each Architectural Drawing in accordance with Florida Building Code.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
 - a. Foundation: separate submission.
 - b. Manufacturer's Standard Details and Structural Calculations: Clearly mark those portions that apply to specific Project and those parts that do not apply.
 - c. Manufacturer's Literature and Technical Data: Drawings and Specifications for proposed building system.
 - d. Painting Systems: Specifications including paint manufacturer's name, product trade-name, and preparation for shop and field coats.
 - e. Doors, frames, hardware, interior finishes, and exterior finishes, cutsheets and Specifications.
 - f. Testing information showing that door assemblies can meet required positive and negative developed wind pressures in accordance with Florida Building Code.
 - g. HVAC Equipment Manufacturer's Literature and Technical Data: Drawings and specifications for proposed HVAC system.
 - h. Electrical Stub-Up Cut-Outs: Show size and location of cut-outs for electrical equipment.
 - i. Drawings stamped by Contractor's engineer and prepared specifically for this Project.
 - j. Materials and Structural Details: Show materials, details of finishes, fastenings, methods of joining, sealants, anchor bolt, shear angle, and base plate details, including all sizes and dimensions, size and location of structural members.
 - 1) Calculations stamped by Contractor's Florida-licensed engineer.

- 2) Complete structural analysis of structural components and connections.
 - a) Heat loss calculations showing conformance with applicable code.
2. Samples: Colors of metal siding and interior standard finishes available.

B. Informational Submittals:

1. Experience records of manufacturer and installer.
2. Approval of installer by manufacturer of structure components.
3. Certification that codes and referenced standards have been met.
4. Description and details of electrical continuity and grounding methods.
5. Test reports.

1.04 QUALITY ASSURANCE

A. Fabricator must be a certified producer/member of The Precast/Prestressed Concrete Institute (PCI), National Precast Concrete Association (NPCA) or equal.

B. Building fabricator must have a minimum of 5 years' experience manufacturing and setting transportable precast concrete buildings.

C. Qualifications:

1. Designer: Engineer registered in Florida.
2. Manufacturer:
 - a. At least 5 years' experience in work of the type required in this section.
 - b. Production capacity to provide work required for this Project without delay.
3. Erector/Installer:
 - a. Not less than 5 years' experience in the erection of prefabricated structures similar to this Project.
 - b. Approved by manufacturer of building components.
4. Regulatory Requirements; design building system to meet requirements of:
 - a. 2010 Florida Building Code.
 - b. 2010 Florida Mechanical Code.
 - c. NFPA 70, National Electric Code.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver building components in undamaged condition to Site only when ready for installation.

- B. Protect products from damage and deterioration.
- C. Handle products in accordance with manufacturers' instructions.

1.06 SPECIAL GUARANTEE

- A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of Work specified in this Specification section found defective during a minimum period of 5 years and as stated below after the date of Substantial Completion.
- B. Conditions: Roofing shall remain watertight for 20 years.

PART 2 PRODUCTS

2.01 DESIGN REQUIREMENTS

- A. Building General:
 1. Each Building: Height and clear interior floor dimensions as shown on Drawings.
 2. Roof Slope: Minimum 3 inches vertical to 12 inches horizontal. The roof shall extend a minimum of 3 inches beyond the wall panel on each side.
 3. R-value of Roof: 30.
 4. Wall to floor joints must be waterproofed to prevent water migration into the building along top of wall panels and at the floor.
 5. Envelope construction shall be an exterior pre-cast exterior concrete wall treated architecturally with a selected form liner (ship lap), to appear as wood lap siding. Exterior surfaces to be stained with Bondcrete waterproofer and sealer in colors selected by the Engineer or Owner.
 6. The roof will have form-liner treatment to look like standing seam metal roof. Roof assembly R-value shall be R=30.
 7. Exterior walls and roof are to be stained with Bondcrete waterproofer and sealer in colors selected by the Engineer or Owner. Primer for walls and roof shall be as recommended by manufacturer of waterproofer.

8. The interior surface will be insulated with 3/16-inch Econo-E insulation (R-13), 1-1/2-inch Styrofoam board insulation (7-7.5) and finished with 1/2-inch OSB laminated with pre-finished white textured fiberglass-reinforced plastic full height continuous panels. This is the manufacturer AEP's standard combination of insulating products used to achieve the required R-value of the walls and roof and may be accomplished by other combinations of insulating products with documentation approved as equal by the Engineer.
9. No roof, floor, or vertical wall joints will be allowed, except at corners. Wall panels shall be set on top of floor panel.
10. Provide watertight structure that has straight, plumb walls with square corners.
11. Panel Connections (if delivered separate): All panels shall be securely fastened together with 1/4-inch thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A36 HR, prime coated after fabrication. All fasteners to be 1/2-inch diameter bolts complying with ASTM A307 for low-carbon steel bolts.
12. Cast-in anchors used for panel to panel connections shall be Dayton-Superior No. F-63, or equal manufacturer's recommended method of building panel anchorage. Any exposed panel connections shall be primed and painted.
13. The precast concrete building shall be provided without the floor/foundation slab, stairs, railings. Floor slab cutouts will be any wiring/conduits, will be coordinated by the Contractor responsible for construction of the raised foundation/floor slab.
14. Upon installation of the building on the prepared foundation/floor slab, all voids left around the perimeter of the building shall be grouted solid to prevent insects, water, dirt, and other debris from entering the building.
15. Design Loads: See Drawing 001-G-004 Design Criteria.

2.02 MATERIALS

- A. Concrete: Furnish as specified in Section 03 30 10, Reinforced Concrete.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 deformed bars.
- C. Welded Wire Fabric: ASTM A497/A497M.
- D. Concrete Formwork: HDO plywood. Manufacturer/fabricator standard formliners and backer boards as required to achieve profiles as shown on the floor plans.
- E. Concrete Mix: ASTM C94/C94M, Option A.
 1. Cement: ASTM C150, Type I or Type II, with maximum alkyl content of 0.6 percent.

2. Coarse Aggregate Size: 3/4 inch.
 3. Design for Minimum Compressive Strength at 28 Days: 5,000 psi.
- F. Sealant: Single part polyurethane or silicone meeting ASTM C920, Type S, Grade NS, Class 25.
- G. Building Criteria:
1. Interior:
 - a. Walls and Ceiling: Pre-finished FRP panels with joint trim covers as used by the manufacturer for this type of application.
 - b. Moldings are PVC (polyvinyl chloride) moldings No. 85 white.
 - c. Rivets: No. 85 white. Or approved equal.
 - d. Furring Studs to be Dietrich Z studs 25 gauge at 24 inches on center or equal (Assembly above or equal.).
 - e. Floor Base: 4-inch Cove base as manufactured by Roppe Rubber or approved equal.
 - f. Flame Spread: ASTM E84 rating of 25 or less.
- H. Doors and Frames and Door Hardware:
1. Door width 3 feet 0 inch by height 8 feet 0 inch by 1-3/4 inch shown on Drawings. Exterior Door: 14-gauge Galvanized primed welded frame and 16-gauge galvanized primed insulated flush door. Door and frame assembly will be labeled for use as part of a required fire rated assembly.
 2. All doors and frames to have back welded frame seams and factory baked on zinc-rich primer ready for paint system specified. Primer must be compatible with scheduled finish paint system Paint System No. 4 specified in Section 09 90 04, Painting (Condensed).
 3. In accordance with Florida Building Code, exterior hardware, frame and door will have third-party testing showing that as a total door assembly, each exterior door will meet required developed wind pressures. Therefore hardware specified below is to be adjusted as to model and manufacturer required by testing entity such as a Miami Dade Notice of Acceptance or Florida product approval report:
 - a. Exterior Door Hardware:
 - 1) 5BB1 4.5 by 4.5 hinges non-rising pins, (3), finish 652, manufactured by Ives.
 - 2) Rim Panic Device: Von Duprin with outside keyed lever handle. Door always open in the exit direction; finish 626. Keyed into Owner's existing system.
 - 3) Primus Core Only: 20-740.
 - 4) Surface Closer: Parallel arm 4110 CUSH SRI series manufactured by LCN; finish 689.
 - 5) Threshold: 172A manufactured by Pemko.

- 6) Door Bottom: Model 209 AV as manufactured by Pemko.
- 7) Perimeter Seals: Model 290APK manufactured by Pemko.
- 8) Rain Drip: Model 142A as manufactured by Pemko.

I. Exterior Color Finishes:

1. Colors: to be selected by Engineer or Owner.
2. The entire precast concrete roof panel surface must be cleaned and primed with a material that prepares the concrete surface for proper adherence to the coating material.
3. Caulking:
 - a. Joint between building and floor slab shall be caulked on the exterior and interior surface of the joints.
 - b. Caulking shall be Sikaflex-1A elastic sealant or equal.
 - c. Exterior caulk joint to be 3/8-inch by 3/8-inch square so that sides of joint are parallel for correct caulk adhesion. Back of joint to be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of joint and not the back.
 - d. Caulk color and exterior finish color to be selected by Owner.

J. Building System Manufacturers:

1. Manufacturer: This Specification is based on manufacturer standards of:
 - a. AES Precast Corp, Northport, Alabama.
 - b. Concrete Modular Systems, Inc., St. Petersburg, Florida,
Phone: 1-727-945-1864, Fax 1-727-945-9756.
2. Other manufacturers will only be approved by submittal of equal quality and performance by the Engineer.

K. Fire Protection: Furnish and install minimum UL Rated 10B:C, 15 pound capacity carbon dioxide bracket mounted fire extinguisher in accordance with NFPA 10 or as directed by authority having jurisdiction.

L. Plumbing Systems: Not required.

M. Fiberglass Signs:

1. OSHA approved DANGER sign, three-ply laminated fiberglass, minimum 1/8-inch thick, with contrasting color core message layer between two clear weather-resistant surface layers.
2. Manufacturers:
 - a. Best Manufacturing Co.
 - b. Brady Signmark.
3. Text: DANGER ELECTRICAL EQUIPMENT AUTHORIZED PERSONNEL ONLY.
4. Location: Mount one sign to the exterior side of each exterior door.

2.03 HEATING AND AIR-CONDITIONING

A. General:

1. Heating, Ventilating, and Air Conditioning: Furnish heating and air-conditioning system to maintain inside temperature between 50 and 100 degrees F and relative humidity between 50 and 70 percent.
2. Allowable Insulation: Minimum R-value of 11 on walls and 19 ceiling hr/sq ft/degree F/Btu.
3. Refrigerant and condensation piping routed above electrical equipment shall not be permitted.
4. Refer to equipment schedules on Drawings for minimum required unit performance.

B. Split System AC indoor unit, Ductless:

1. General:
 - a. Split system, indoor, DX, ductless, fan coil AC unit, complete with DX coil, fan, fan motor, piping connectors, electrical controls, and microprocessor control system.
 - b. Suitable for use with air conditioner or heat pump outdoor unit.
 - c. Indoor unit shall be of the same manufacturer as the associated outdoor unit.
2. Unit Cabinet:
 - a. High-impact plastic or painted galvanized steel.
 - b. Fully insulated.
 - c. Discharge and inlet grilles, high-impact polystyrene.
3. Evaporator Fan:
 - a. Tangential direct-drive blower type with air intake at upper front face of unit and discharge at bottom front.
 - b. Air Sweep:
 - 1) Provide automatic, motor-driven horizontal air sweep as standard.
 - 2) Air sweep operation shall be user selectable.
 - 3) Vertical direction may be manually adjusted and horizontal air sweep may be manually set.
4. Motor:
 - a. Open drip-proof, permanently lubricated ball bearing with inherent overload protection.
 - b. Minimum three speed.
5. DX Evaporator Coil:
 - a. Copper tube with aluminum fins and galvanized steel tube sheets.
 - b. Fins bonded to tubes by mechanical expansion.
 - c. Refrigerant piping sweat connections.

- d. Condensate Drain Pan:
 - 1) Locate under coil with drain connection for hose attachment to remove condensate.
 - 2) Provide internal trap and auxiliary drip pan under coil header.
6. Controls:
 - a. Refrigerant Metering: Factory installed refrigerant metering device.
 - b. Automatic restart after power failure at same operating conditions as at failure.
 - c. Timer function to provide a minimum 15-hour timer cycle for system AUTO/START/STOP.
 - d. Temperature-sensing controls shall sense return air temperature. Provide indoor air high discharge temperature shutdown.
 - e. Indoor coil freeze protection.
 - f. Filter status indication after 250 hours of indoor fan operation.
 - g. Test mode button to run self-diagnostics and aid in troubleshooting.
 - h. AUTO/STOP features shall have integral setback control.
 - i. Automatic air sweep control provides ON or OFF activation of air sweep louvers.
 - j. Dehumidification mode provides increased latent removal capability by modulating fan speed and set point temperature.
 - k. Fan only operation provides room air circulation when no cooling is required.
 - l. Diagnostics to provide continuous checks of unit operation and warn of possible malfunctions. Error message shall be displayed at unit and at remote controller.
 - m. Fan Speed Control: User-selectable for high, medium, low or microprocessor automatic operation during all operating modes.
 - n. Time delay shall prevent compressor restart in less than 3 minutes.
 - o. Provide outdoor unit high temperature protection to detect excessive outdoor unit discharge temperatures.
 - p. Manual defrost button to initiate defrost cycle from handset.
 - q. Demand defrost shall be provided and shall minimize defrost cycles by internally adjusting defrost timing based on frost accumulation.
7. Air Filters: Filter track with factory-supplied cleanable filters.
8. Accessories: Provide as scheduled in Equipment schedules.
9. Manufacturers:
 - a. Carrier.
 - b. EnviroAir.
 - c. Mitsubishi.
 - d. Trane.

C. Split System AC Outdoor Units:

1. General:
 - a. Factory assembled, single piece, air-cooled AC outdoor unit.
 - b. Contained within the unit enclosure shall be factory wiring, piping, controls, compressor, and holding charge of R-410A refrigerant.
 - c. Outdoor unit shall be same manufacturer as associated indoor unit.
2. Unit Cabinet:
 - a. Constructed of galvanized steel, phosphatized and coated with a baked enamel finish on inside and outside.
 - b. Removable access panels for access to internal components.
 - c. Outdoor Compartment: Isolated, with acoustic lining to ensure quiet operation.
 - d. Knockouts for unit electrical power.
3. Condenser Fans:
 - a. Direct-drive propeller type and shall blow air through outdoor coil.
 - b. Motors:
 - 1) Totally enclosed, with Class B insulation and permanently lubricated bearings.
 - 2) Thermal overload protection.
 - c. Shaft of stainless steel construction.
 - d. Fan blades shall be corrosion-resistant and be statically and dynamically balanced.
 - e. Equip openings with PVC-coated protection grille over fan and coil.
4. Compressor:
 - a. Fully hermetic reciprocating or scroll type.
 - b. Equipped with oil system, operating oil charge, and motor.
 - c. Internal overloads shall protect compressor from overtemperature and overcurrent.
 - d. Motor: NEMA rated, Class F, suitable for operation in a refrigerant atmosphere.
 - e. Scroll compressors shall have high discharge gas temperature protection.
 - f. Reciprocating compressors shall be equipped with crankcase heaters to minimize liquid refrigerant accumulation in compressor during shutdown and to prevent refrigerant dilution of oil.
 - g. Installed on rubber vibration isolators and shall have internal spring isolation.
5. Condenser Coil:
 - a. Constructed of aluminum fins mechanically bonded to internally enhanced seamless copper tubes that are cleaned, dehydrated, and sealed.

- b. Coat entire coil with anti-corrosion protective coating, in accordance with Article Factory Dip-Applied Protective Coating.
- 6. Refrigeration Components:
 - a. Brass external liquid line service valve with service gauge port connections.
 - b. Suction line service valve with service gauge connection port.
 - c. Service gauge port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps.
 - d. Suction Line: Accumulator.
 - e. Pressure relief.
- 7. Controls:
 - a. Factory selected, assembled, and tested.
 - b. Refrigerant Metering:
 - 1) Reversing valve for heat pump units.
 - 2) Heating mode metering device for heat pump units.
 - c. Automatic restart on power failure.
 - d. Three-pole contactors.
 - e. Time delay control sequence shall be provided standard through control board on indoor units.
 - f. High pressure and liquid line low pressure switches.
 - g. Automatic outdoor fan motor protection.
 - h. Start capacitor and relay (single-phase units without scroll compressors).
 - i. Defrost board to provide defrost control.
 - j. Safeties:
 - 1) Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.
 - 2) Safety lockout if an outdoor unit safety is open.
 - 3) High condensing temperature protection.
 - 4) System diagnostics.
 - 5) Compressor motor current and temperature overload protection.
 - 6) High pressure relief.
 - 7) Outdoor fan failure protection.
- 8. Accessories: Provide as scheduled in Equipment schedule.
- 9. Manufacturers:
 - a. Carrier.
 - b. EnviroAir.
 - c. Mitsubishi.
 - d. Trane.

D. Factory Dip-Applied Protective Coating:

- 1. General:
 - a. Factory dip-applied protective coating for application to plate fin and tube coils.

- b. Coil factory assembled and tested before coating application.
 - c. Coating suitable for coils with maximum 30 fins per inch fin density. Bridging of product across coil fins is unacceptable.
 - d. After application and proper curing, product shall endure bending of coil assembly in standard manufacturing process without cracking.
2. Coating Material: Use one of the following materials:
- a. Epoxy Modified Phenolic: Straight phenolic materials are not acceptable.
 - b. Epoxy or epoxy urethane.
 - c. Polyelastomer: Complex chain linked polyelastomer material.
3. Coating Process:
- a. Coil Inspection and Sealing:
 - 1) Inspect coil for open tubes, headers, capillary tubes; repair as necessary.
 - 2) Fill with dry nitrogen, cap and seal, to prevent contamination of internal coil surfaces with cleaning or coating solutions.
 - b. Coil Cleaning:
 - 1) Immerse coil in heated alkaline cleaning solution to remove lubricants, machining oils, and residual factory contamination.
 - 2) Followed with immersion in potable water bath to neutralize and remove cleaning solution.
 - c. Coating Application:
 - 1) Immerse coil assembly in coating bath, including headers, casing, and heat exchange surfaces.
 - 2) Coil shall be completely removed from equipment during coating application.
 - 3) Spray-on coatings are not acceptable.
 - d. Curing: Oven baked at a metal temperature not to exceed 400 degrees F.
 - e. Quality Control: Free from voids, checks, cracks and blisters.
 - f. Performance: Coil finish shall meet or exceed the following criteria:
 - 1) Salt Spray Test: In accordance with ASTM B117, minimum 3,000-hour duration, with no fin corrosion or degradation.
 - 2) Thermal Efficiency: Loss no greater than 1 percent after coating application.
 - 3) Exposure to UV Light: UV inhibited life of minimum 10 years when exposed to sun in the State of Florida.
 - g. Manufacturers and Products:
 - 1) Aero-Marine Engineering Inc.; Technicoat 10-1.
 - 2) AST ElectroFin Inc.; ElectroFin.
 - 3) Bronz glow; F-875.

2.04 ELECTRICAL

- A. See Electrical Drawings and Specifications for interior convenience outlets, power requirements and lighting fixture and switching requirements.
 - 1. Electrical Systems: Not included in this Specification.
 - 2. Special Construction: Electrical lighting, equipment, power distribution and switches are to be supplied and installed under a separate Specification.

2.05 SOURCE QUALITY CONTROL

- A. Inspections: Before shipment, inspect for complete, functional assembly.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Site and access to determine effect on proposed building.
- B. Investigate soils conditions and their effect on proposed building.
- C. Examine Site poured in place concrete floor slab and subgrade in preparations for building installation.

3.02 SUBGRADE PREPARATION

- A. Site shall conform to the requirements of the building manufacturer. The Contractor shall be responsible for preparing the subgrade for the building.
- B. Verify site conditions and make necessary field measurements.
- C. Perform Site modifications to suit installation of each prefabricated building.
- D. Contractor shall be responsible for all excavation, subgrade, preparation, and fill and backfill.

3.03 ERECTION

- A. Erect structural components in accordance with manufacturer's instructions. Securely anchor to concrete foundation.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of permanent, stable structure.
- C. Install materials following manufacturers' instructions and recommendations.

3.04 FIELD QUALITY CONTROL

- A. Functional Tests: Conduct on moving and operating components.
- B. Electrical Continuity: Test continuity of completed metal structure and installed equipment to ground.

3.05 FIELD FINISHING

- A. Doors and Frames: Apply paint system No. 4 as specified in Section 09 90 04, Painting (Condensed). Broom-finished concrete floor or provide other skid-resistant concrete floor surface.
- B. Touchup will occur in the field after installation. Entire structure is to be weather tight.
- C. Do not paint electrical equipment.

3.06 FIELD QUALITY CONTROL

- A. Functional Tests: Conduct on moving and operating components.

3.07 HEATING AND VENTILATING

- A. Install equipment and components following manufacturer's instructions and recommendations.
- B. Meet requirements of NFPA 90A and 90B.
- C. Adjust for proper operation and control.

3.08 ELECTRICAL SYSTEMS

- A. Meet requirements of National Electrical Code, NFPA 70.
- B. Install products in accordance with manufacturers' instructions and recommendations.
- C. Provide grounding for building by connecting to the plant ground grid.

3.09 MANUFACTURER'S SERVICES

- A. Provide manufacturers' representatives at Site for installation assistance, inspection and certification of proper installation, equipment testing, startup assistance, and training of Owner's personnel for specified component, subsystem, equipment, or system.

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- B. Manufacturer shall be responsible for delivery of the buildings, and shall provide representation to off load and set in-place buildings, making sure they are set level and final touchup as required has been completed. See Section 01 43 33, Manufacturers' Field Services.

3.10 CLEANING/ADJUSTING

- A. Adjust door and hardware for smooth operation of door and hardware functions.
- B. Thoroughly clean interior and exterior of building and leave watertight and ready for use.

3.11 PROTECTION

- A. Protect installed products from damage.

END OF SECTION

SECTION 26 05 01
ELECTRICAL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway Transportation Officials (AASHTO).
2. ASTM International (ASTM):
 - a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - b. A240/A240M, Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
 - c. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - d. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - e. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
3. Electronic Industries Association (EIA/TIA): 569, Commercial Building Standard for Telecommunications Pathways and Spaces.
4. Federal Specifications (FS):
 - a. W-C-596, Connector, Electrical, Power, General Specification for.
 - b. W-S-896, Switch, Toggle (Toggle and Lock), Flush Mounted (General Specification).
5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
 - b. PC62.41.1, Draft Guide on the Surge Environment in Low-Voltage (1,000V and less) AC Power Circuits.
 - c. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
 - d. 114, Standard Test Procedures for Single-Phase Induction Motors.
6. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
7. National Electrical Contractor's Association, Inc. (NECA): 1, Standard Practices for Good Workmanship in Electrical Contracting.

8. National Electrical Manufacturers Association (NEMA):
 - a. C80.1, Rigid Steel Conduit-Zinc Coated.
 - b. C80.3, Electrical Metallic Tubing-Zinc Coated.
 - c. C80.6, Intermediate Metal Conduit-Zinc Coated (IMC).
 - d. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - e. CC1, Electrical Power Connectors for Substations.
 - f. ICS 1, Industrial Control and Systems: General Requirements.
 - g. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - h. ICS 2.3, Industrial Control and Systems: Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers.
 - i. MG 1, Motors and Generators.
 - j. PB 1, Panelboards.
 - k. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - l. ST 20, Dry Type Transformers for General Applications.
 - m. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - n. TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
 - o. WC 55, Instrumentation Cables and Thermocouple Wire.
 - p. WC 70, Standard for Non-Shielded Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy.
 - q. WC 71, Standard for Non-Shielded Cables Rated 2001-5000 Volts for use in the Distribution of Electrical Energy.
 - r. WC 74, 5-46 KV Shielded Power Cable for use in the Transmission and Distribution of Electric Energy.
 - s. WD 1, General Color Requirements for Wiring Devices.
9. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
10. Underwriters Laboratories, Inc. (UL):
 - a. 1, Flexible Metal Conduit.
 - b. 6, Electrical Rigid Metal Conduit—Steel.
 - c. 13, Power-Limited Circuit Cables.
 - d. 44, Thermoset Insulated Wires and Cables.
 - e. 62, Flexible Cord and Fixture Wire.
 - f. 67, Panelboards.
 - g. 98, Enclosed and Dead-Front Switches.
 - h. 198C, High Interrupting Capacity Fuses, Current Limiting Types.
 - i. 198E, Class R Fuses.
 - j. 360, Liquid-Tight Flexible Steel Conduit.
 - k. 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors.
 - l. 486C, Splicing Wire Connectors.

- m. 489, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
- n. 508, Industrial Control Equipment.
- o. 510, Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
- p. 514B, Fittings for Cable and Conduit.
- q. 674, Electric Motors And Generators for use in Division 1 Hazardous (Classified) Locations.
- r. 854, Service-Entrance Cables.
- s. 1059, Terminal Blocks.
- t. 1561, Dry-Type General Purpose and Power Transformers.
- u. 2111, Overheating Protection for Motors.

1.02 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction.
- B. MCOV: Maximum Allowable Continuous Operating Voltage.
- C. MOV: Metal Oxide Varistor.
- D. SASD: Silicon Avalanche Suppressor Diode.
- E. SVR: Surge Voltage Rating.
- F. TVSS: Transient Voltage Surge Suppressor.

1.03 SUBMITTALS

- A. Action Submittals:
 - 1. Boxes and device plates.
 - 2. Junction and pullboxes.
 - 3. Terminal blocks.
 - 4. Support and framing channels.
 - 5. Conduit, fittings, and accessories.
 - 6. Conductors, cable, and accessories.
 - 7. Grounding materials.
 - 8. Main circuit breaker.
 - 9. Combination full-voltage, magnetic starter including Control Diagram.
 - 10. Nonfused switches.
 - 11. Switchboard matting.

B. Informational Submittals:

1. Field test reports.
2. Signed permits indicating Work is acceptable to regulatory authorities having jurisdiction.

1.04 APPROVAL BY AUTHORITY HAVING JURISDICTION

- A. Provide the Work in accordance with current edition of NFPA 70, National Electrical Code (NEC). Where required by the Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.
- B. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have the appropriate UL listing mark or label by a Nationally Recognized Testing Laboratory.

1.05 ENVIRONMENTAL CONDITIONS

- A. The following areas are classified hazardous, Class I, Division 1, Groups C and D, due to the potential for accumulation of hazardous concentrations of combustible gases, and for exposure to corrosive environment. Use materials and methods required for such areas.
1. Inside storm water wet well.
 2. Three-foot 0-inch radius around stormwater wet well vent openings.
- B. The following areas are classified hazardous, Class I, Division 2, Groups C and D, due to the potential for accumulation of hazardous concentrations of combustible gases, and for exposure to corrosive environment. Use materials and methods required for such areas.
1. Five-foot 2-inch radius around stormwater wet well vent openings.
 2. The area 18 inches above and extending 36 inches from all hatches or openings to the storm water wet well.
 3. Enclosed, below grade valve and metering vaults with closed piping systems containing storm water.
- C. The following areas are classified nonhazardous and wet. Use materials and methods required for such areas.
1. Outdoor abovegrade areas not covered above.

1.06 QUALIFICATIONS

- A. PVC-Coated, Rigid Steel Conduit Installer: Must be certified by conduit manufacturer as having received minimum 2 hours of training on installation procedures and manufacturer's on-site verification that the proper equipment for bending, threading, and installation of PVC-coated steel conduit is at the site. The manufacturer shall inspect all repairs to the coating and provide the Owner with written assurance that all repairs have been completed in a manner that will maintain the integrity of the factory coating.

PART 2 PRODUCTS

2.01 GENERAL

- A. Products shall comply with all applicable provisions of NFPA 70.
- B. Like Items of Equipment: End products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.
- C. Hazardous Areas: Products shall be acceptable to the regulatory authority having jurisdiction and in accordance with NFPA 70 (NEC) for the class, division, and group of hazardous area indicated.
- D. Equipment Finish: Manufacturer's standard finish color, except where specific color is indicated.

2.02 JUNCTION AND PULL BOXES

- A. Conduit Bodies Used as Junction Boxes: As specified under Article Conduit and Fittings.
- B. Large Cast Metal Box:
 - 1. NEMA 250, Type 6P, suitable for 24-hour submersion under a 6-foot head of water.
 - 2. Box: Cast ferrous metal, electrogalvanized finished, with factory-bossed, drilled and tapped conduit entrances and exterior mounting lugs. No field drilling allowed.
 - 3. Cover: Nonhinged screws.
 - 4. Gasket: Neoprene.
 - 5. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
 - 6. Manufacturers and Products, Surface Mounted Nonhinged Type: O-Z/Gedney; Series YF-SUB6P.

2.03 TERMINAL BLOCKS

- A. UL 486E and UL 1059.
- B. Size components to allow insertion of necessary wire sizes.
- C. Capable of termination of control circuits entering or leaving equipment, panels, or boxes.
- D. Screw clamp compression, dead front barrier type, with current bar providing direct contact with wire between compression screw and yoke.
- E. Yoke, current bar, and clamping screw of high strength and high conductivity metal.
- F. Yoke shall guide all strands of wire into terminal.
- G. Current bar shall ensure vibration-proof connection.
- H. Terminals:
 - 1. Capable of wire connections without special preparation other than stripping.
 - 2. Capable of jumper installation with no loss of terminal or rail space.
 - 3. Individual, rail mounted.
- I. Marking system, allowing use of preprinted or field-marked tags.
- J. Manufacturers:
 - 1. Weidmuller, Inc.
 - 2. Ideal.
 - 3. Electrovert USA Corp.

2.04 SUPPORT AND FRAMING CHANNELS

- A. PVC Coated Framing Channel: Carbon steel framing channel with 40-mil polyvinyl chloride coating.
- B. Stainless Steel Framing Channel: Rolled, ASTM A167, Type 316 stainless steel, 12-gauge minimum.
- C. Extruded Aluminum Framing Channel:
 - 1. Material: Extruded from Type 6063-T6 aluminum alloy.
 - 2. Fittings fabricated from Alloy 5052-H32.

D. Manufacturers:

1. B-Line Systems, Inc.
2. Unistrut Corp.
3. Aickinstrut.

2.05 CONDUIT AND FITTINGS

A. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of NEMA RN 1.
2. Material:
 - a. Meet requirements of NEMA C80.1 and UL 6.
 - b. Exterior Finish : PVC coating, 40 mils nominal thickness, bond to metal shall have tensile strength greater than PVC.
 - c. Interior finish: Urethane coating, 2 mils nominal thickness.
3. Threads: Hot-dipped galvanized and factory coated with urethane.
4. Bendable without damage to either interior or exterior coating.
5. Robroy PERMA-COTE, no substitutions allowed.

B. Flexible Metal, Liquid-Tight Conduit:

1. UL 360 listed for 105 degrees C insulated conductors.
2. Material: Galvanized steel, with an extruded PVC jacket.

C. Fittings:

1. Provide bushings, grounding bushings, conduit hubs, conduit bodies, couplings, unions, conduit sealing fittings, drain seals, drain/breather fittings, expansion fittings, and cable sealing fittings, as applicable.
2. PVC-Coated Rigid Galvanized Steel Conduit:
 - a. Meet requirements of UL 514B.
 - b. Fittings: Rigid galvanized steel type, PVC-coated by conduit manufacturer.
 - c. Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC-coated by conduit manufacturer.
 - d. Finish: 40-mil PVC exterior, 2-mil urethane interior.
 - e. Overlapping pressure sealing sleeves.
 - f. Conduit Hangers, Attachments, and Accessories: PVC-coated.
 - g. Manufacturers:
 - 1) Robroy Industries.
 - 2) Ocal.
 - h. Expansion Fitting Manufacturer and Product: Ocal; Ocal-Blue XJG.

3. Flexible Metal, Liquid-Tight Conduit:
 - a. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
 - b. Insulated throat and sealing O-rings.

2.06 CONDUIT ACCESSORIES

A. Identification Devices:

1. Raceway Tags:
 - a. Material: Permanent, nonferrous metal.
 - b. Shape: Round.
 - c. Raceway Designation: Pressure stamped, embossed, or engraved.
 - d. Tags relying on adhesives or taped-on markers not permitted.

B. Raceway Band:

1. Slip-on Type:
 - a. Provide heat-shrinkable, black, medium-wall polyolefin tubing with factory-applied adhesive/sealant. Select product size based upon raceway outside diameter.
 - b. Manufacturer and Product: 3M; Type IMCSN, medium wall cable sleeve.
2. Wrap-around Type:
 - a. Provide 4-inch width, 20-mil thickness, nonprinted black PVC corrosion protection tape with primer.
 - b. Manufacturer and Product: 3M; Type Scotchrap 51 with Scotchrap Pipe Primer.

2.07 CONDUCTORS AND CABLES

A. Conductors 600 Volts and Below:

1. Conform to applicable requirements of NEMA WC 71, WC 72, and WC 74.
2. Conductor Type:
 - a. 120- and 277-Volt Lighting, No. 10 AWG and Smaller: Solid copper.
 - b. 120-Volt Receptacle Circuits, No. 10 AWG and Smaller: Solid copper.
 - c. All Other Circuits: Stranded copper.
3. Insulation: Type XHHW.

B. Type 1, Multiconductor Control Cable:

1. Conductors:
 - a. No. 14 AWG, seven-strand copper.
 - b. Insulation: 15-mil PVC with 4-mil nylon.

- c. UL 1581 listed as Type THHN/THWN rated VW-1.
 - d. Conductor group bound with spiral wrap of barrier tape.
 - e. Color Code: In accordance with ICEA S-58-679, Method 1, Table 2.
2. Cable: Passes the ICEA T-29-520 210,000 Btu per hour Vertical Tray Flame Test.
3. Cable Sizes:

No. of Conductors	Max. Outside Diameter (Inches)	Jacket Thickness (Mils)
3	0.41	45
5	0.48	45
7	0.52	45
12	0.72	60
19	0.83	60
25	1.00	60
37	1.15	80

4. Manufacturers:
- a. Okonite Co.
 - b. Southwire.
- C. Type 3, No. 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 55 requirements.
- 1. Outer Jacket: 45-mil nominal thickness.
 - 2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
 - 3. Dimension: 0.31-inch nominal OD.
 - 4. Conductors:
 - a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
 - b. 20 AWG, seven-strand tinned copper drain wire.
 - c. Insulation: 15-mil nominal PVC.
 - d. Jacket: 4-mil nominal nylon.
 - e. Color Code: Pair conductors, black and red.
 - 5. Manufacturers:
 - a. Okonite Co.
 - b. Alpha Wire Corp.
 - c. Belden.

D. Accessories:

1. Tape:
 - a. General Purpose, Flame Retardant: 7 mils, vinyl plastic, Scotch Brand 33, rated for 90 degrees C minimum, meeting requirements of UL 510.
 - b. Flame Retardant, Cold and Weather Resistant: 8.5 mils, vinyl plastic, Scotch Brand 88.
 - c. Arc and Fireproofing:
 - 1) 30 mils, elastomer.
 - 2) Manufacturers and Products:
 - a) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tapebinder.
 - b) Plymount; Plyarc 53, with Plyglas 77 glass cloth tapebinder.
2. Identification Devices:
 - a. Sleeve-type, permanent, PVC, yellow or white, with legible machine-printed black markings.
 - b. Manufacturer and Products: Raychem; Type D-SCE or ZH-SCE.
3. Connectors and Terminations:
 - a. Nylon, Self-Insulated Crimp Connectors:
 - 1) Manufacturers and Products:
 - a) Thomas & Betts; Sta-Kon.
 - b) Burndy; Insulug.
 - c) ILSCO.
4. Self-Insulated, Freespring Wire Connector (Wire Nuts):
 - a. Plated steel, square wire springs.
 - b. UL Standard 486C.
 - c. Manufacturers and Products:
 - 1) Thomas & Betts.
 - 2) Ideal; Twister.
5. Cable Lugs:
 - a. In accordance with NEMA CC 1.
 - b. Rated 600 volts of same material as conductor metal.
 - c. Uninsulated Crimp Connectors and Terminators:
 - 1) Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
 - 2) Manufacturers and Products:
 - a) Thomas & Betts; Color-Keyed.
 - b) Burndy; Hydent.
 - c) ILSCO.
 - d. Uninsulated, Bolted, Two-Way Connectors and Terminators:
 - 1) Manufacturers and Products:
 - a) Thomas & Betts; Locktite.
 - b) Burndy; Quiklug.
 - c) ILSCO.

6. Cable Ties:
 - a. Nylon, adjustable, self-locking, and reusable.
 - b. Manufacturer and Product: Thomas & Betts; TY-RAP.
7. Heat Shrinkable Insulation:
 - a. Thermally stabilized, crosslinked polyolefin.
 - b. Manufacturer and Product: Thomas & Betts; SHRINK-KON.

2.08 GROUNDING

- A. Ground Rods: Provide copper-clad steel with minimum diameter of 3/4 -inch, and length of 20 feet.
- B. Ground Conductors: As specified in Article Conductors and Cable.
- C. Connectors:
 1. Exothermic Weld Type:
 - a. Outdoor Weld: Suitable for exposure to elements or direct burial.
 - b. Manufacturers: Erico Products, Inc.; Cadweld and Cadweld Exolon, no substitutions allowed.
 2. Compression Type:
 - a. Compress-deforming type; wrought copper extrusion material.
 - b. Single indentation for conductors 6 AWG and smaller.
 - c. Double indentation with extended barrel for conductors 4 AWG and larger.
 - d. Single barrels prefilled with oxide-inhibiting and antiseizing compound.
 - e. Manufacturers:
 - 1) Burndy Corp.
 - 2) Thomas and Betts Co.
 - 3) ILSCO.
 3. Mechanical Type:
 - a. Split-bolt, saddle, or cone screw type; copper alloy material.
 - b. Manufacturers:
 - 1) Burndy Corp.
 - 2) Thomas and Betts Co.

2.09 PHASE MONITOR RELAY

- A. Features:
 1. Voltage and phase monitor relay shall drop out on low voltage, voltage unbalance, loss of phase, or phase reversal.
 2. Contacts: Single-pole, double-throw, 10 amperes, 120/240V ac. Where additional contacts are shown or required, provide magnetic control relays.

3. Adjustable trip and time delay settings.
4. Transient Protection: 1,000V ac.
5. Mounting: Multipin plug-in socket base.

B. Manufacturer and Product: Automatic Timing and Controls; SLD Series.

2.10 CIRCUIT BREAKER, INDIVIDUAL, 0 TO 600 VOLTS

- A. UL 489 listed for use at location of installation.
- B. Voltage and Trip Ratings: As shown.
- C. Minimum Interrupt Rating: 35,000 amps rms symmetrical at 480 volts.
- D. Thermal-magnetic, quick-make, quick-break, indicating type showing ON/OFF and TRIPPED indicating positions of operating handle.
- E. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
- F. Locking: Provisions for padlocking handle.
- G. Enclosure: As shown.
- H. Interlock: Enclosure and switch shall interlock to prevent opening cover with breaker in the ON position.
- I. Accessories: Shunt trip, auxiliary switches, handle lock-on devices, double lugs as shown or otherwise required. Shunt trip operators shall be continuous duty rated or have coil-clearing contacts.
- J. Service Entrance Use: Breakers in required enclosure and required accessories shall be UL 489 listed.
- K. Manufacturers:
 1. Eaton.
 2. General Electric Co.
 3. Square D Co.

2.11 NONFUSED SWITCH, INDIVIDUAL, LOW VOLTAGE

- A. NEMA KS 1.
- B. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.
- C. Lugs: Suitable for use with 75 degrees C wire at NEC 75 degrees C ampacity.

- D. Where indicated, provide with auxiliary contact, as follows:
 - 1. Operation: Make before power contacts make and break before power contacts break.
 - 2. Contact Rating: 7,200VA make, 720VA break, at 600V, NEMA ICS 5 Designation A600.
- E. Enclosures: NEMA 4X Type 304 stainless steel.
- F. Interlock: Enclosure and switch to prevent opening cover with switch in ON position. Provide bypass feature for use by qualified personnel.

2.12 COMBINATION FULL-VOLTAGE, MAGNETIC STARTER

- A. Rating: Horsepower rated at 600 volts, UL labeled for 35,000 amperes at 480 volts short circuit capacity with overload protection.
- B. Controller: Three-phase, nonreversing, full voltage, NEMA ICS 1, NEMA ICS 2, Class A.
- C. Control: As shown on Drawings.
- D. Disconnect Type: Motor circuit protector.
- E. Enclosure: NEMA 250, type 4X 316 stainless steel.
- F. Padlockable operating handle, capable of up to three locks
- G. Solid State Motor Overload Protection:
 - 1. Inverse-time-limit characteristic.
 - 2. Phase loss, phase unbalanced and Class II ground fault protection.
 - 3. Current operated electronic circuitry with adjustable trip.
 - 4. Class 10/20/30 relay trip, switch selectable.
 - 5. N.O. auxiliary contact for remote monitoring.
 - 6. Manual reset.
 - 7. Provide in each ungrounded phase.
 - 8. Mount within starter unit.
 - 9. Communications: None.
- H. Control Transformer:
 - 1. Two winding, 120-volt secondary, primary voltage to suit.
 - 2. Two current-limiting fuses for primary circuit.
 - 3. One fuse in secondary circuit with blown fuse indicator.
 - 4. Mount within starter unit.

- I. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
- J. Lifting lugs on equipment and devices weighing over 100 pounds.
- K. Anchor Bolts: Type 316 stainless steel, 1/2-inch minimum diameter.
- L. Operating Conditions:
 - 1. Ambient Temperature: Maximum 40 degrees C.
 - 2. Altitude: 3,000 feet above sea level.
 - 3. Equipment to be fully rated.
- M. Materials, equipment, and accessories specified in this section shall be products of:
 - 1. Eaton Electrical/Cutler-Hammer.
 - 2. Schneider Electric/Square D Services.
 - 3. General Electric Co.

2.13 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH

- A. Contact Rating: 7,200VA make, 720VA break, at 600V, NEMA ICS 5 Designation A600.
- B. Selector Switch Operating Lever: Standard.
- C. Indicating Light: Push-to-test.
- D. Pushbutton Color:
 - 1. ON or START: Black.
 - 2. OFF or STOP: Red.
- E. Pushbutton and selector switch lockable in OFF position, unless otherwise indicated.
- F. Legend Plate:
 - 1. Material: Aluminum.
 - 2. Engraving: Enamel filled in high contrasting color.
 - 3. Text Arrangement: 11-character/spaces on one line, 14-character/spaces on each of two lines, as required, indicating specific function.
 - 4. Letter Height: 7/64-inch.

G. Manufacturers and Products:

1. Heavy-Duty, Oil-Tight Type:
 - a. General Electric Co.; Type CR 104P.
 - b. Square D Co.; Type T.
 - c. Eaton/Cutler-Hammer; Type 10250T.
2. Heavy-Duty, Watertight, and Corrosion-Resistant Type:
 - a. Square D Co.; Type SK.
 - b. General Electric Co.; Type CR 104P.
 - c. Eaton/Cutler-Hammer; Type E34.
 - d. Crouse-Hinds; Type NCS.

2.14 TIME DELAY RELAY

- A. Industrial relay with contacts rated 5 amps continuous, 3,600VA make, 360VA break.
- B. NEMA ICS 2 Designation: B150 (150 volts).
- C. Solid-state electronic, field convertible ON/OFF delay.
- D. One normally open and one normally closed contact (minimum).
- E. Repeat accuracy plus or minus 2 percent.
- F. Timer adjustment from 1 second to 60 seconds, unless otherwise indicated on Drawings.
- G. Manufacturers and Products:
 1. Square D Co.; Type F.
 2. Eaton/Cutler-Hammer.
 3. General Electric Co.

2.15 ELAPSED TIME METER

- A. Drive: Synchronous motor.
- B. Range: 0 hour to 99,999.9 hours, nonreset type.
- C. Mounting: Semiflush panel.
- D. Manufacturers and Products:
 1. General Electric Co.; Type 240, 2-1/2-inch Big Look.
 2. Eagle Signal Controls; Bulletin 705.

2.16 INTRINSIC SAFETY BARRIER

- A. Provides a safe energy level for exposed wiring in a Class I, Division 1 or Division 2 hazardous area when circuit is connected to power source in nonhazardous area.
- B. Rating: Power source shall be rated 24 volts dc, nominal, with not more than 250 volts available under fault conditions.
- C. Contact Rating: 5 amps, 250 volts ac.
- D. Mounting: Rail or surface.
- E. Manufacturers and Products:
 - 1. MTL, Inc.; Series 2000 or Series 3000.
 - 2. R. Stahl, Inc.

2.17 SWITCHBOARD MATTING

- A. Provide matting having a breakdown of 20 kV minimum.
- B. Manufacturer: U.S. Mat and Rubber Company.

PART 3 EXECUTION

3.01 GENERAL

- A. Install materials and equipment in accordance with manufacturer's instructions and recommendations.
- B. Install materials and equipment in hazardous areas in a manner acceptable to regulatory authority having jurisdiction for the class, division, and group of hazardous areas shown.
- C. Electrical Drawings show general locations of equipment, devices, and raceways, unless specifically dimensioned. Contractor shall be responsible for actual location of equipment and devices and for proper routing and support of raceways, subject to approval of Engineer.
- D. Check approximate locations of raceways and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify Engineer in writing.
- E. Install work in accordance with NECA Standard of Installation, unless otherwise specified.

- F. Keep openings in boxes and equipment closed during construction.
- G. Lay out work carefully in advance. Do not cut or notch any structural member without specific approval of Engineer. Carefully perform cutting, channeling, chasing, or drilling of platform, walls, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces to original condition.
- H. Realign equipment not properly aligned and correct unlevelness.
- I. Properly anchor electrical equipment found to be inadequately anchored.
- J. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench/screw driver to manufacturer's recommendations, or as otherwise specified in NETA ATS.
- K. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.
- L. Provide proper lubrication of applicable moving parts.
- M. Electrical Enclosures:
 - 1. Remove foreign material and moisture from enclosure interior.
 - 2. Vacuum and wipe clean enclosure interior.
 - 3. Remove corrosion found on metal surfaces.
 - 4. Repair or replace, as determined by Engineer door and panel sections having dented surfaces.
 - 5. Repair or replace, as determined by Engineer poor fitting doors and panel sections.
 - 6. Repair or replace improperly operating latching, locking, or interlocking devices.
 - 7. Replace missing or damaged hardware.

3.02 COMBINING CIRCUITS INTO COMMON RACEWAY

- A. Drawings show each homerun circuit to be provided. Do not combine power or control circuits into common raceways without prior authorization of Engineer.

3.03 DEMOLITION

- A. General Demolition:
 - 1. Where shown, de-energize and disconnect nonelectrical equipment for removal by others.

2. Where shown, de-energize, disconnect, and remove electrical equipment.
3. Remove affected circuits and raceways back to serving panelboard or control panel. Where affected circuits are consolidated with others, remove raceways back to first shared conduit or box. Where underground or embedded raceways are to be abandoned, remove raceway to 1 inch below surface of structure or 12 inches belowgrade and restore existing surface.

3.04 CLEANING AND TOUCHUP PAINTING

- A. Cleaning: Throughout the Work, clean interior and exterior of devices and equipment by removing debris and vacuuming.
- B. Touchup Paint:
 1. Touchup scratches, scrapes and chips on exterior and interior surfaces of devices and equipment with finish matching type, color, and consistency and type of surface of original finish.
 2. If extensive damage is done to equipment paint surfaces, refinish entire equipment in a manner that provides a finish equal to or better than factory finish, that meets requirements of Specification, and is acceptable to Engineer.

3.05 PROTECTION FOLLOWING INSTALLATION

- A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation.
- B. Cap conduit runs during construction with manufactured seals.
- C. Close openings in boxes or equipment during construction.
- D. Energize space heaters furnished with equipment.

3.06 SERVICE ENTRANCE EQUIPMENT AND METERING

- A. Unless otherwise specified or shown, schedule and coordinate work of serving utility as required to provide electric service to the Work.

3.07 JUNCTION AND PULL BOXES

- A. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.
- B. Install pull boxes where necessary in raceway system to facilitate conductor installation.

- C. Use conduit bodies as junction and pull boxes where no splices are required and their use is allowed by applicable codes.
- D. Installed boxes shall be accessible.
- E. Do not install on finished surfaces.
- F. Install plumb and level.
- G. Support boxes independently of conduit by attachment to building structure or structural member.
- H. Mounting Hardware: Stainless steel.
- I. Location/Type:
 - 1. Outdoor: NEMA 250, Type 6P, cast ferrous metal with electrogalvanized finish.
 - 2. Underground Conduit: Direct-buried.

3.08 SUPPORT AND FRAMING CHANNELS

- A. Install where required for mounting and supporting electrical equipment and raceway systems.
- B. Channel Type: Outdoor: PVC coated carbon steel or stainless steel.
- C. Treat carbon steel channel cut ends prior to installation with cold galvanizing process, and PVC coating touchup paint.

3.09 CONDUIT AND FITTINGS

- A. General:
 - 1. Crushed or deformed raceways not permitted.
 - 2. Maintain raceway entirely free of obstructions and moisture.
 - 3. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.
 - 4. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.
 - 5. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.
 - 6. Group raceways installed in same area.
 - 7. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.
 - 8. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.
 - 9. Install watertight fittings in outdoor, underground, or wet locations.

10. Paint threads and cut ends, before assembly of fittings or PVC-coated galvanized conduit with zinc-rich paint or liquid galvanizing compound.
11. Metal conduit to be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.
12. Do not install raceways in concrete equipment pads, foundations, or beams.
13. Horizontal raceways installed under slabs shall lie completely under slab, with no part embedded within slab.
14. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.
15. Install conduits for fiber optic cables, telephone cables, and Category 5 data cables in strict conformance with the requirements of EIA/TIA 569.

B. Conduit Application:

1. Diameter:
 - a. Minimum Trade Size: 3/4 inch.
 - b. Material: PVC-coated rigid galvanized steel.

C. Connections:

1. For dry type transformers, instrumentation, and other equipment where flexible connection is required to minimize vibration:
 - a. Flexible metal, liquid-tight conduit.
 - b. Length: 18 inches minimum, 60 inches maximum, sufficient to allow movement or adjustment of equipment.
2. Outdoor areas, process areas exposed to moisture, and areas required to be oiltight and dust-tight: Flexible metal, liquid-tight conduit.

D. Penetrations:

1. Make at right angles, unless otherwise shown.
2. Notching or penetration of structural members, including footings and beams, not permitted.

E. Support:

1. Support from structural members only, at intervals not exceeding NFPA 70 requirements, and in any case not exceeding 8 feet. Do not support from piping, pipe supports, or other raceways.
2. Multiple Adjacent Raceways: Provide ceiling trapeze. For trapeze-supported conduit, allow 10 percent extra space for future conduit.
3. Application/Type of Conduit Strap:
 - a. Steel Conduit: Zinc-coated steel, pregalvanized steel, or malleable iron.
 - b. PVC-Coated Rigid Steel Conduit: PVC-coated metal.

4. Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:
 - a. Wood: Wood screws.
 - b. Hollow Masonry Units: Toggle bolts.
 - c. Concrete or Brick: Expansion shields, or threaded studs driven in by powder charge, with lock washers and nuts.
 - d. Steelwork: Machine screws.
 - e. Location/Type of Hardware: Stainless steel.

F. Bends:

1. Install concealed raceways with a minimum of bends in the shortest practical distance.
2. Make bends and offsets of longest practical radius.
3. Install with symmetrical bends or cast metal fittings.
4. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.
5. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.
6. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run and raceways are same size.
7. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

G. PVC-Coated Rigid Steel Conduit:

1. Install in accordance with manufacturer's instructions.
2. All tools and equipment used in the cutting, bending, threading, and installation of PVC-coated rigid steel conduit shall be designed to limit damage to the PVC coating.
3. Provide PVC boot to cover all exposed threading.

H. Termination at Enclosures:

1. Cast Metal Enclosure: Provide manufacturer's premolded insulating sleeve inside metallic conduit terminating in threaded hubs.
2. Nonmetallic, Cabinets, and Enclosures: Terminate conduit in threaded conduit hubs, maintaining enclosure integrity.
3. Sheet Metal Boxes, Cabinets, and Enclosures:
 - a. Flexible Metal Conduit: Provide two-screw type, insulated, malleable iron connectors.
 - b. PVC-Coated Rigid Galvanized Steel Conduit: Provide PVC-coated, liquid-tight, metallic connector.

4. Free-Standing Enclosures: Terminate metal conduit entering bottom with grounding bushing; provide a grounding jumper extending to equipment ground bus or grounding pad.

I. Underground Raceways:

1. Grade: Maintain minimum grade of 4 inches in 100 feet, either from one manhole, handhole, or pull box to the next, or from a high point between them, depending on surface contour.
2. Cover: Maintain minimum 2-foot cover above conduit, unless otherwise shown.
3. Make routing changes as necessary to avoid obstructions or conflicts.
4. Couplings: In multiple conduit runs, stagger so couplings in adjacent runs are not in same transverse line.
5. Union type fittings not permitted.
6. Spacers:
 - a. Provide preformed, nonmetallic spacers, designed for such purpose, to secure and separate parallel conduit runs in a trench.
 - b. Install at intervals not greater than that specified in NFPA 70 for support of the type conduit used, but in no case greater than 10 feet.
7. Support conduit so as to prevent bending or displacement during backfilling.
8. Installation with Other Piping Systems:
 - a. Crossings: Maintain minimum 12-inch vertical separation.
 - b. Parallel Runs: Maintain minimum 12-inch separation.
 - c. Installation over valves or couplings not permitted.
9. Metallic Raceway Coating: Along entire length, coat with raceway coating.

J. Empty Raceways:

1. Provide permanent, removable cap over each end.
2. Provide PVC plug with pull tab for underground raceways with end bells.
3. Provide nylon pull cord.
4. Identify, as specified in Article Identification Devices, with waterproof tags attached to pull cord at each end, and at intermediate pull point.

K. Identification Devices:

1. Raceway Tags:
 - a. Identify origin and destination.
 - b. Install at each terminus, near midpoint, and at minimum intervals of every 50 feet of exposed raceway, whether in ceiling space or surface mounted.
 - c. Provide corrosion-resistant wire for attachment.

2. Warning Tape: Install approximately 18 inches above underground or concrete-encased raceways. Align parallel to, and within 12 inches of, centerline of runs.

L. Raceway Band:

1. Install wherever metallic conduit emerges from concrete slabs. Not required with PVC-coated RGS conduit. Center band at slab surface and install according to manufacturer's instructions.
 - a. Slip-on Type: Clean conduit surface at installation location. Cut tubing to 4-inch minimum lengths and slip onto raceway prior to slab placement and termination of conduit. Heat-shrink onto conduit.
 - b. Wrap-around Type: Use where slip-on access to conduit is not possible. Clean conduit surface at installation location. Apply primer. Apply wraps to provide two layers of tape. Neatly finish tape end to prevent unraveling.

3.10 CONDUCTORS AND CABLES

- A. Conductor storage, handling, and installation shall be in accordance with manufacturer's recommendations.
- B. Do not exceed manufacturer's recommendations for maximum pulling tensions and minimum bending radii.
- C. Conduit system shall be complete prior to drawing conductors. Lubricate prior to pulling into conduit. Lubrication type shall be as approved by conductor manufacturer.
- D. Terminate all conductors and cables, unless otherwise shown.
- E. Do not splice conductors, unless specifically indicated or approved by Engineer.
- F. Bundling: Where single conductors and cables in manholes, handholes, vaults, cable trays, and other indicated locations are not wrapped together by some other means, bundle conductors from each conduit throughout their exposed length with cable ties placed at intervals not exceeding 12 inches.
- G. Wiring within Equipment and Local Control Panels: Remove surplus wire, dress, bundle, and secure.

H. Power Conductor Color Coding:

1. No. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering an area 1-1/2 to 2 inches wide.
2. No. 8 AWG and Smaller: Provide colored conductors.
3. Colors:
 - a. Neutral Wire:
 - 1) White; 120/240 and 120/208 volt systems.
 - 2) Gray; 277/480 volt systems.
 - b. Live Wires, 120/240-Volt, Single-Phase System: Black, red.
 - c. Live Wires, 120/208-Volt, Three-Phase System: Black, red, or blue.
 - d. Live Wires, 277/480-Volt, Three-Phase System: Brown, orange, or yellow.
 - e. Ground Wire: Green.

I. Circuit Identification:

1. Circuits Appearing in Circuit Schedules: Identify power, instrumentation, and control conductor circuits, using circuit schedule designations, at each termination and in accessible locations such as manholes, handholes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.
2. Circuits Not Appearing in Circuit Schedules: Assign circuit name based on device or equipment at load end of circuit. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.
3. Method: Identify with sleeves. Taped-on markers or tags relying on adhesives not permitted.

J. Connections and Terminations:

1. Install wire nuts only on solid conductors.
2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control circuit conductors.
3. Tape insulate all uninsulated connections.
4. Install crimp connectors and compression lugs with tools approved by connector manufacturer.

3.11 GROUNDING

- A. Grounding shall be in compliance with NFPA 70 and as shown.
- B. Ground electrical service neutral at service entrance equipment to supplementary grounding electrodes.

- C. Maximum Resistance: 5 ohms to remote earth as measured with a clamp-on ground meter when connected to ground rods.
- D. Ground each separately derived system neutral to nearest effectively grounded building structural steel member or separate grounding electrode.
- E. Bond together system neutrals, service equipment enclosures, exposed noncurrent-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and cables, receptacle ground connections, and metal piping systems.
- F. Shielded Instrumentation Cables:
 - 1. Ground shield to ground bus at power supply for analog signal.
 - 2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
 - 3. Do not ground instrumentation cable shield at more than one point.
- G. Equipment Grounding Conductors: Provide in all conduits containing power conductors and control circuits above 50 volts.
- H. Ground Rods: Install full length with conductor connection at upper end. Install one ground rod in each handhole.
- I. Visual and Mechanical Inspection:
 - 1. Equipment and circuit grounds in pump control panel and RTU assemblies for proper connection and tightness.
 - 2. Ground bus connections in pump control panel and RTU assemblies for proper termination and tightness.
 - 3. Effective transformer core and equipment grounding.
 - 4. Accessible connections to grounding electrodes for proper fit and tightness.
 - 5. Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.

3.12 COMBINATION FULL-VOLTAGE, MAGNETIC STARTER

- A. General:
 - 1. Install equipment in accordance with NEMA ICS 2.3, IEEE C2, NECA 402, Submittals, and manufacturer's written instructions and recommendations.
 - 2. Install equipment plumb and in longitudinal alignment with wall.
 - 3. Coordinate terminal connections with installation of secondary feeders.
 - 4. Grout mounting channels into floor or mounting pads.

5. Retighten current-carrying bolted connections and enclosure support framing and panels to manufacturer's recommendations.
6. Motor Data: Provide typed, self-adhesive label attached inside each motor starter enclosure door displaying the following information:
 - a. Motor served by tag number and equipment name.
 - b. Nameplate horsepower.
 - c. Motor code letter.
 - d. Full load amperes.
 - e. Service factor.
 - f. Installed overload relay heater catalog number.

B. Circuit Breakers:

1. Field adjust trip settings of motor starter magnetic-trip-only circuit breakers.
2. Adjust to approximately 11 times motor rated current.
3. Determine motor rated current from motor nameplate following installation.

C. Overload Relay: Select and install overload relay heaters and switch settings after actual nameplate full-load current rating of motor has been determined.

3.13 INTRINSIC SAFETY BARRIERS

- A. Install in compliance with ISA RP12.06.01.
- B. Arrange conductors such that wiring from hazardous areas cannot short to wiring from nonhazardous area.
- C. Stencil "INTRINSICALLY SAFE CIRCUIT" on all boxes enclosing barriers.

3.14 SWITCHBOARD MATTING

- A. Install 36-inch width at panelboards, control panels, and adjustable frequency drives.
- B. Matting shall run full length of all sides of equipment that have operator controls or afford access to devices.

3.15 FIELD QUALITY CONTROL

- A. Tests shall be performed in accordance with the requirements of Section 01 91 14, Equipment Testing and Facility Startup.
- B. General:
 1. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.

2. Test instrument calibration shall be in accordance with NETA ATS.
 3. Perform inspection and electrical tests after equipment has been installed.
 4. Perform tests with apparatus de-energized whenever feasible.
 5. Inspection and electrical tests on energized equipment are to be:
 - a. Scheduled with Owner prior to de-energization.
 - b. Minimized to avoid extended period of interruption.
- C. Tests and inspection shall establish that:
1. Electrical equipment is operational within industry and manufacturer's tolerances.
 2. Installation operates properly.
 3. Equipment is suitable for energization.
 4. Installation conforms to requirements of Contract Documents and NFPA 70.
- D. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.
- E. Adjust mechanisms and moving parts for free mechanical movement.
- F. Verify nameplate data for conformance to Contract Documents.
- G. Realign equipment not properly aligned and correct unlevelness.
- H. Properly anchor electrical equipment found to be inadequately anchored.
- I. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations, or as otherwise specified.
- J. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.
- K. Provide proper lubrication of applicable moving parts.
- L. Investigate and repair or replace:
1. Electrical items that fail tests.
 2. Active components not operating in accordance with manufacturer's instructions.
 3. Damaged electrical equipment.
- M. Electrical Enclosures:
1. Remove foreign material and moisture from enclosure interior.
 2. Vacuum and wipe clean enclosure interior.

3. Remove corrosion found on metal surfaces.
 4. Repair or replace, as determined by Engineer, door and panel sections having damaged surfaces.
 5. Replace missing or damaged hardware.
- N. Provide certified test report(s) documenting the successful completion of specified testing. Include field test measurement data.
- O. Test the following equipment and materials:
1. Grounding electrodes.
- P. Controls:
1. Test control and signal wiring for proper termination and function.
 2. Test local control panels and other control devices for proper terminations, configuration and settings, and functions.
 3. Demonstrate control, monitoring, and indication functions in presence of Owner and Engineer.

END OF SECTION

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. Institute of Electrical and Electronics Engineers (IEEE): C57.96, Guide for Loading Dry Type Transformers.
 2. National Electrical Contractor's Association (NECA): 409, Recommended Practice for Installing and Maintaining Dry-Type Transformers.
 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ST 20, Dry-Type Transformers for General Applications.
 - c. TP 1, Guide For Determining Energy Efficiency for Distribution Transformers.
 4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
 5. Underwriters Laboratories Inc. (UL):
 - a. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
 - b. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
 - c. 1561, Standard for Dry-Type, General Purpose, and Power Transformers.

1.02 SUBMITTALS

- A. Action Submittals:
1. Descriptive information.
 2. Dimensions and weight.
 3. Transformer nameplate data.
 4. Schematic and connection diagrams.
- B. Informational Submittals:
1. Test Report: Sound test certification for dry type power transformers (0 to 600-volt, primary).

PART 2 PRODUCTS

2.01 GENERAL

- A. UL 1561, NEMA ST 20, unless otherwise indicated.
- B. Dry-type, self-cooled, two-winding, with copper windings.
- C. Units larger than 5 kVA suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
- D. Efficiency: Meet or exceed values in Table 4.2 of NEMA TP 1.
- E. Maximum Sound Level per NEMA ST 20:
 - 1. 40 decibels for 0 kVA to 9 kVA.
 - 2. 45 decibels for 10 kVA to 50 kVA.
- F. Overload capability: Short-term overload in accordance with IEEE C57.96.
- G. Vibration Isolators:
 - 1. Rated for transformer's weight.
 - 2. Isolation Efficiency: 99 percent, at fundamental frequency of sound emitted by transformer.
 - 3. Less Than 30 kVA: Isolate entire unit from structure with external vibration isolators.
 - 4. 30 kVA and Above: Isolate core and coil assembly from transformer enclosure with integral vibration isolator.
- H. Manufacturers:
 - 1. General Electric Co.
 - 2. Square D Co.
 - 3. Eaton/Cutler-Hammer.

2.02 MINI-POWER CENTER (MPC)

- A. General: Transformer, primary and secondary main circuit breakers, and secondary panelboard section enclosed in NEMA 250, Type 4X, 316 stainless steel enclosure.
- B. Transformer:
 - 1. Insulation Class and Temperature Rise: Manufacturer's standard.
 - 2. Core and Coil: Encapsulated.
 - 3. Full capacity, 2-1/2 percent voltage taps, two above and two below normal voltage.

4. Primary Voltage: 480, three-phase.
 5. Secondary Voltage: 208/120 volts, three-phase, four-wire.
- C. Panelboard: Full, UL 489, short-circuit current rated.
1. Type: Thermal-magnetic, quick-make, quick-break, indicating, with noninterchangeable molded case circuit breakers.
 2. Number and Breaker Ampere Ratings: Refer to Panel Schedule.

2.03 GENERAL PURPOSE TRANSFORMER

- A. Insulation Class and Temperature Rise: Manufacturer's standard.
- B. Core and Coil:
1. Encapsulated for single-phase units 1/2 kVA to 25 kVA and for three-phase units 3 kVA to 15 kVA.
 2. Thermosetting varnish impregnated for single-phase units 37.5 kVA and above, and for three-phase units 30 kVA and above.
- C. Enclosure:
1. Single-Phase, 3 kVA to 25 kVA: NEMA 250, Type 3R, nonventilated.
 2. Single-Phase, 37-1/2 kVA and Above: NEMA 250, Type 2, ventilated.
 3. Three-Phase, 3 kVA to 15 kVA: NEMA 250, Type 3R, nonventilated.
 4. Three-Phase, 30 kVA and Above: NEMA 250, Type 2, ventilated.
 5. Outdoor Locations: NEMA 250, Type 3R.
 6. Corrosive Locations: NEMA 250, Type 3R stainless steel.
- D. Voltage Taps:
1. Single-Phase, 3 kVA to 10 kVA: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
 2. Single-Phase, 15 kVA and Above: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
 3. Three-Phase, 3 kVA to 15 kVA: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
 4. Three-Phase, 30 kVA and Above: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
- E. Impedance: 4.5 percent minimum on units 75 kVA and larger.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with NECA and manufacturer's instructions.
- B. Load external vibration isolator such that no direct transformer unit metal is in direct contact with mounting surface.
- C. Provide moisture-proof, flexible conduit for electrical connections.
- D. Connect voltage taps to achieve (approximately) rated output voltage under normal plant load conditions.

END OF SECTION

SECTION 26 24 16 PANELBOARDS

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. Institute of Electrical and Electronics Engineers (IEEE):
 - a. C62.1, Surge Arresters for Alternating Current Power Circuits.
 - b. C62.11, Standards for Metal-Oxide Surge Arrestors for AC Power Circuits.
 2. National Electrical Contractor's Association (NECA): 407, Recommended Practice for Installing and Maintaining Panelboards.
 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. 289, Application Guide for Ground Fault Circuit Interrupters.
 - c. AB 1, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - d. KS 1, Enclosed Switches.
 - e. LA 1, Surge Arrestors.
 - f. PB 1, Panelboards.
 - g. PB 1.1, General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
 5. Underwriters Laboratories Inc. (UL):
 - a. 67, Standard for Panelboards.
 - b. 98, Standard for Enclosed and Dead-Front Switches.
 - c. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
 - d. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
 - e. 508, Standard for Industrial Control Equipment.
 - f. 870, Wireways, Auxiliary Gutters and Associated Fittings.
 - g. 943, Standard for Ground-Fault Circuit-Interrupters.

1.02 SUBMITTALS

- A. Action Submittals:
1. Manufacturer's data sheets for each type of panelboard, protective device, accessory item, and component.
 2. Manufacturer's shop drawings including dimensioned plan, section, and elevation for each panelboard type, enclosure, and general arrangement.

3. Tabulation of features for each panelboard to include the following:
 - a. Protective devices with factory settings.
 - b. Provisions for future protective devices.
 - c. Space for future protective devices.
 - d. Voltage, frequency, and phase ratings.
 - e. Enclosure type.
 - f. Bus and terminal bar configurations and current ratings.
 - g. Provisions for circuit terminations with wire range.
 - h. Short circuit current rating of assembled panelboard at system voltage.
 - i. Features, characteristics, ratings, and factory settings of auxiliary components.

- B. Informational Submittals: Manufacturer's recommended installation instructions.

1.03 QUALITY ASSURANCE

- A. Listing and Labeling: Provide products specified in this section that are listed and labeled as defined in NEC Article 100.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Materials, equipment, and accessories specified in this section shall be products of:
 1. Eaton/Cutler-Hammer.
 2. General Electric Co.
 3. Square D Co.

2.02 GENERAL

- A. Provide low voltage panelboards for application at 600V or less in accordance with this section.
- B. Provide equipment in accordance with NEMA PB 1, NFPA 70, and UL 67.
- C. Wire Terminations:
 1. Panelboard assemblies, including protective devices, shall be suitable for use with 75 degrees C or greater wire insulation systems at NEC 75 degrees C conductor ampacity.
 2. In accordance with UL 486E.

D. Load Current Ratings:

1. Unless otherwise indicated, load current ratings for panelboard assemblies, including bus and circuit breakers, are noncontinuous as defined by NEC. Continuous ratings shall be 80 percent of noncontinuous rating.
2. Where indicated “continuous”, “100 percent”, etc., selected components and protective devices shall be rated for continuous load current at value shown.

E. Short Circuit Current Rating (SCCR): Integrated equipment short circuit rating for each panelboard assembly shall be no less than the following:

1. Minimum SCCR at 208Y/120 or 120/240 volts shall be 10,000 amperes rms symmetrical.
2. Minimum SCCR at 480Y/277 volts shall be 35,000 amperes rms symmetrical.

F. Overcurrent Protective Devices:

1. In accordance with NEMA AB 1, NEMA KS 1, UL 98, and UL 489.
2. Protective devices shall be adapted to panelboard installation.
 - a. Capable of device replacement without disturbing adjacent devices and without removing main bus.
 - b. Spaces: Cover openings with easily removable cover.
3. Series-Connected Short Circuit Ratings: Devices shall be fully rated; series-connected ratings unacceptable.

G. Circuit Breakers:

1. General: Thermal-magnetic unless otherwise indicated, quick-make, quick-break, molded case, of indicating type showing ON/OFF and TRIPPED positions of operating handle.
2. Noninterchangeable: In accordance with NEC.
3. Bus Connection: Bolt-on circuit breakers in 480Y/277-volt, and plug-in circuit breakers in 208Y/120 and 240/120-volt branch circuit panelboards. In power distribution panelboards, 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal.
4. Trip Mechanism:
 - a. Individual permanent thermal and magnetic trip elements in each pole.
 - b. Variable magnetic trip elements with a single continuous adjustment 3X to 10X for frames greater than 100 amps.
 - c. Two and three pole, common trip.
 - d. Automatically opens all poles when overcurrent occurs on one pole.

- e. Test button on cover.
- f. Calibrated for 40 degrees C ambient, unless shown otherwise.
- 5. Unacceptable Substitution:
 - a. Do not substitute single-pole circuit breakers with handle ties for multi-pole breakers.
 - b. Do not use tandem or dual circuit breakers in normal single-pole spaces.
- 6. Ground Fault Circuit Interrupter (GFCI): Where indicated, equip breaker as specified above with ground fault sensor and rated to trip on 5-mA ground fault within 0.025 second (UL 943, Class A sensitivity, for protection of personnel).
 - a. Ground fault sensor shall be rated same as circuit breaker.
 - b. Push-to-test button.
 - c. Reset button.
- H. Enclosures:
 - 1. Material: Type 1, gasketed shall be Type 316 stainless steel with reinforced stainless steel frame.
 - 2. Finish: Rust inhibitor prime followed by manufacturer's standard gray baked enamel or lacquer.
- I. Bus:
 - 1. Material: Tin-plated copper full sized throughout length.
 - 2. Provide for mounting of future protective devices along full length of bus regardless of number of units and spaces shown. Machine, drill, and tap as required for current and future positions.
- J. Feeder Lugs: Main, feed-through, and neutral shall be replaceable, bolted mechanical or crimp compression type.
- K. Equipment Ground Terminal Bus: Tin-plated copper with suitably sized provisions for termination of ground conductors, and bonded to box.
 - 1. Provide individual mechanical termination points no less than the quantity of breaker pole positions.
 - 2. Provide individual termination points for all other grounding conductors such as feeder, grounding electrode, etc.
- L. Neutral Terminal Bus: Tin-plated copper with suitably sized provisions for termination of neutral conductors, and isolated from box.
 - 1. Provide individual mechanical termination points no less than the quantity of breaker pole positions.
 - 2. Provide individual termination points for all other neutral conductors.
 - 3. Oversize Neutral: Provide oversized neutral terminal bus as indicated.

- M. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances for future protective device ampere ratings indicated.
- N. Special Features: Where indicated, provide the following features:
 1. Service Equipment Approval: Listed for use as service equipment for panelboards having service disconnecting means.
 2. Subfeed: Protective device or lugs indicated, with additional terminals on neutral and ground bus to accommodate feeder.
 3. Feed-Through Lugs: At opposite end of phase bus from mains, with additional terminals on neutral and ground buses, sized to accommodate feeders indicated.
 4. Double Main Lugs: Furnish additional terminals on neutral and ground buses, sized to accommodate feeders indicated.
 5. Surge Arresters:
 - a. In accordance with NEMA LA 1, IEEE C62.1, and IEEE C62.11.
 - b. Coordinate impulse sparkover voltage with system voltage.
 - c. Provide protective device within panelboard as disconnecting means and short circuit protection per manufacturer's recommendation.
 - d. Provide factory mounting within panelboard utilizing UL-recognized mounting device.
 - e. Refer to specification Section 26 43 00, Transient Voltage Suppression, for additional requirements.

2.03 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

- A. Protective Device Locking: Furnish provisions for handle padlocking for main and subfeed devices; also provide for branch devices where indicated.
- B. NEMA 250 Type 1 Gasketed, Type 316 Stainless Steel Branch Panelboard Enclosure:
 1. Front trim shall be secured to box with concealed trim clamps.
 2. Surface-mount panelboard front trim shall have same dimensions as box.
 3. Flush panelboards front trims shall overlap box nominal 3/4 inch on all sides.
 4. Door in panelboard front trim, with concealed hinges, shall provide access to protective device operating handles.
 5. Doors over 30 inches in height shall have multi-point latching.
 6. Door lock shall be secure with flush catch and tumbler lock; all panelboards keyed alike, with two milled keys each lock.
 7. Circuit Directory: Metal frame with transparent plastic face and enclosed card, mounted inside each panel door.

8. Hinged Front Cover (Door In Door): Entire front trim hinged to surface box with standard door within hinged trim cover as detailed on Drawings.

2.04 POWER DISTRIBUTION PANELBOARDS

A. Branch Protective Devices:

1. Locking: Furnish devices with provisions for handle padlocking.
2. Load Connections: Wire lugs shall be mechanical or crimp compression type, removable/replaceable, and suitable for 75 degrees C rated conductors without derating switch nor conductor ampacity.
3. Provide a nameplate for each circuit, blanks for spares.

PART 3 EXECUTION

3.01 GENERAL

- A. Install in accordance with NECA 407, NEMA PB 1.1 and manufacturers' written installation instructions.
- B. Install securely, plumb, in-line and square with walls.
- C. Install top of cabinet trim 78 inches above floor, unless otherwise shown. Install cabinet so tops of protective device operating handles are no more than 72 inches above the floor.
- D. Ground Fault Protection: Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289.
- E. Install filler plates in unused spaces.
- F. Wiring in Panel Gutters: Train conductors neatly in groups; bundle, and wrap with nylon wire ties.

3.02 BRANCH CIRCUIT PANELBOARD

- A. Mount flush panels uniformly flush with wall finish.
- B. Provide typewritten circuit directory for each panelboard.

3.03 POWER DISTRIBUTION PANELBOARD

- A. Provide engraved identification for each protective device.

END OF SECTION

SECTION 26 29 23
LOW-VOLTAGE ADJUSTABLE FREQUENCY DRIVE SYSTEM

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Electronic Industries Alliance (EIA): 359-A-1, Special Colors.
2. Hydraulic Institute Standards (HIS).
3. Institute of Electrical and Electronics Engineers (IEEE):
 - a. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
 - b. 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
 - c. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
4. National Electrical Manufacturer's Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. CP 1, Shunt Capacitors.
 - c. MG 1, Motors and Generators.
 - d. WC 57, Standard for Control, Thermocouple Extensions, and Instrumentation Cables.
5. National Fire Protection Association (NFPA): 79, Electrical Standard for Industrial Machinery.

1.02 DEFINITIONS

A. Terms that may be used in this section:

1. AFD: Adjustable frequency drive.
2. CMOS: Complementary metal oxide semiconductor.
3. CSI: Current source inverter.
4. EMU: Energy monitoring unit.
5. GTO: Gate turn-off thyristor.
6. MPR: Motor protection relay.
7. MTBF: Mean time between failure.
8. PWM: Pulse width modulation.
9. ROM: Read only memory.
10. RTD: Resistance temperature detector.
11. RTU: Remote telemetry unit.
12. Rated Load: Load specified for equipment.

13. Rated Speed: Nominal rated (100 percent) speed specified for equipment.
14. TDD: Total demand distortion.
15. THD: Total harmonic distortion.
16. TTL: Transistor logic.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:

1. This specification covers supply, installation, testing and commissioning of AFDs. As a minimum all drives shall be 18-pulse. Manufacturers may choose to provide higher pulse convertors or harmonic filters as required to meet the current and voltage distortion limits.
2. Composite drive/motor efficiency (CE) is defined as ratio of motor shaft kW to drive input kW. AFD system minimum requirements:
 - a. At 60-Hz drive output and 100 percent load, CE equals 92 percent.
 - b. At 50-Hz drive output and 60 percent load CE equals 89 percent.
 - c. At 40-Hz drive output and 30 percent load CE equals 84 percent.
 - d. At 30-Hz drive output and 12.5 percent load CE equals 77 percent.
3. Rated Continuous Operation Capacity: Not less than 1.15 times full load current rating of driven motor, as indicated on motor nameplate, and suitable for continuous operation at continuous overload which may be imposed on motor by driven pump operating over specified speed range.
4. Basis for Harmonic Computations: Pump Station Riser Diagram on Drawing E-3 with normal source maximum short-circuit current of 10,000 A and normal source maximum demand load current of 376 A for current and voltage distortion computations, furnish harmonic filters, line reactors, isolation transformers, or higher pulse converter arrangements required to meet current/voltage distortion and line notching limits.
5. Normal Source Current Harmonic Distortion:
 - a. Compute normal source individual and total current harmonic distortion at the input terminals to power panel PP-1, in accordance with IEEE 519.

- b. Individual current harmonic distortion and total demand distortion expressed as percent of maximum demand load current I_L shall not exceed values specified in Table 1 below:

Table 1	
Individual Harmonic Order (Odd Harmonics)	Harmonic Current Distortion Percent of Max. Demand Load Current I_L
$h < 11$	1.0
$11 < h < 17$	0.50
$17 < h < 23$	0.375 (2.598 percent for $h=17.19$)
$23 < h < 35$	0.15
$35 < h$	0.075 (0.520 percent for $h=35.37$)
Total Demand Distortion (TDD)	5

- c. Limits specified in Table 1 are for drives using 18-pulse rectifiers.
d. For harmonic computations, assume both drives running at full load.
6. Standby Source Current Harmonic Distortion:
- a. Compute standby source individual and total current harmonic distortion at the input terminals to the Power Panel PP-1 in accordance with IEEE 519. Individual current harmonic distortion and total demand distortion expressed as percent of maximum demand load current I_L shall not exceed values specified in Table 2 below.

Table 2	
Individual Harmonic Order (Odd Harmonics)	Harmonic Current Distortion Percent of Max. Demand Load Current I_L
$h < 11$	1.0
$11 < h < 17$	0.5
$17 < h < 23$	0.375 (2.598 percent for $h=17.19$)
$23 < h < 35$	0.15
$35 < h$	0.075 (0.520 percent for $h=35.37$)
Total Demand Distortion (TDD)	5

- b. Limits specified in Table 2 are for drives using 18-pulse rectifiers.
 - c. For harmonic computations, assume both drives running at full load.
7. Normal Source Voltage Harmonic Distortion: Compute normal source voltage harmonic distortion at the input terminals of Power Panel PP-1. THD shall not exceed 5 percent, and individual voltage harmonic distortion shall not exceed 3 percent.
 8. Standby Source Voltage Harmonic Distortion: Compute standby source voltage harmonic distortion at the input terminals of Power Panel PP-1. THD shall not exceed 5 percent, and individual voltage harmonic distortion shall not exceed 3 percent.
 9. Furnish isolating transformers or series reactors, harmonic filters, or other devices necessary for proper system operation. Furnish necessary devices and circuits to prevent operation of one drive from adversely affecting operation of other drives supplied from same transformer or same bus.
 10. When isolation transformers are used, design to meet K-factor requirements of drive(s) connected.
 11. Furnish confirmation statement from the utility (Keys Energy) that the total harmonic distortion is within their requirements.

B. Design Requirements:

1. Design and provide drive system consisting of adjustable frequency controller, drive motor, auxiliary items, and components necessary for complete operating system.
2. Other equipment is being powered from same bus as adjustable frequency drives. Ensure proper operation of drives and other loads under normal and emergency conditions.
3. Furnish AFDs rated on basis of actual motor full load nameplate current rating times 1.15 service factor. (AFD rating = 1.15* full load nameplate motor currents.)
4. Drive System: Convert incoming three-phase, 60-Hz ac power to variable voltage, adjustable frequency output for adjustable speed operation of a standard ac induction squirrel-cage motor, using pulse-width-modulation (PWM) technique to produce adjustable frequency output.
5. System rated for continuous industrial duty and suitable for use with submersible motors specified in Section 44 42 56.04, Submersible Pumps.
6. Incoming Line Circuit Breaker: Provide positive means of disconnecting incoming power, and overcurrent protection for drive system.

7. Incoming Line Reactor: Design to minimize harmonic distortion on incoming power feeder.
8. Output Reactor or dV/Dt Filter: Design to minimize voltage spikes at motor where long motor leads are indicated.
9. Bypass: Provide reduced voltage solid state (RVSS) bypass starter with bypass run (shorting) contactor and DRIVE/BYPASS selector switch.
10. Line Isolation Contactors: Provide line isolation contactors to remove power from the RVSS starter when in drive mode and to remove power from the AFD controller when in bypass mode.
11. Load Isolation Contactors: Provide load isolation contactors to remove drive output power from the load terminals of the RVSS starter when in drive mode, and to remove output power from the RVSS starter from the output terminals of the AFD controller when in the bypass mode.
12. The equipment furnished, including filters, transformers, reactors, contactors, bypass RVSS, and AFD controller must fit within the enclosure dimensions shown on the Drawings.

1.04 SUBMITTALS

A. Action Submittals:

1. Overall drive system operating data, including efficiencies, input currents, and power factors, at driven equipment actual load and rated system input voltage, at 0, 40, 60, 80, 100, and 110 percent of rated speed.
2. Individual and total harmonic content (voltage and current) reflected in system normal source supply at driven equipment actual load at 70 percent and 100 percent of rated speed at incoming line terminals of power panel PP-1 for the load conditions specified. Normal source system short-circuit available at drive shall be calculated from data furnished by the Utility. Use TDD and THD factors as defined in IEEE 519 to designate total harmonic content.
3. Individual and total current and voltage harmonic content reflected in standby power source, at locations specified, at driven equipment actual load at 70 percent and 100 percent of rated speed determined by using actual size and subtransient reactance of standby system obtained from standby source manufacturer. Use TDD and THD factors as defined in IEEE 519 to designate total harmonic content.
4. AFD output pulse maximum peak voltage, pulse rise time, and pulse rate of rise including justification for proposed deviation from specified values. Include motor manufacturer's certification motor insulation will withstand long-term overvoltages caused at motor terminals due to specified output pulse data or proposed deviation from this data.
5. Data on shelf life of "dc link" capacitor.

6. Complete system rating, including nameplate data, continuous operation load capability throughout speed range of 0 percent to 120 percent of rated speed.
7. Complete adjustable frequency controller rating coordinated with motor full load nameplate current rating; list controller special features being supplied.
8. Controller, reactor, harmonic filter, and isolating transformer (if applicable) dimensional drawings; information on size and location of space for incoming and outgoing conduit.
9. Maximum heat dissipation from enclosure.
10. Layout of controller face showing pushbuttons, switches, instruments, and indicating lights.
11. Complete system operating description.
12. Complete system schematic (elementary) wiring diagrams.
13. Complete system interconnection diagrams between controller, drive motor, and related components or controls external to system, including wire numbers and terminal board point identification.
14. One-line diagram of system, including component ratings.
15. Description of diagnostic features being provided.
16. Descriptive literature for control devices such as relays and timers.
17. Itemized bill-of-materials listing system components.
18. Specific description of provisions, such as filtering and harmonic suppression, being made to ensure proper system operation when system is supplied from standby engine generator specified in these Documents.
19. Description of MPR being furnished or how these functions are accomplished within drive system, if applicable.

B. Informational Submittals:

1. Statement of Supplier qualifications.
2. Special shipping, storage and protection, and handling instructions.
3. Manufacturer's printed installation instructions.
4. Factory functional test reports.
5. Certified copy of test report for identical motor tested in accordance with NEMA MG 1-12.53a and IEEE 112, Test Method B, showing rated load, rated speed efficiency meeting or exceeding specified values; motors not as specified will be rejected.
6. Field test reports.
7. Suggested spare parts list to maintain equipment in service for period of 1 year and 5 years. Include list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
8. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.

9. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
10. Manufacturer's Certificate of Proper Installation.

1.05 QUALITY ASSURANCE

- A. Supplier: Minimum 5 years' experience in furnishing similar size and type adjustable frequency, controlled speed, drive systems.

1.06 EXTRA MATERIALS

- A. Furnish for each drive unit:
 1. Complete set of components likely to fail in normal service.
 2. Plug-in subassemblies.
 3. Printed circuit boards.
 4. Potentiometers.
 5. One complete power bridge and one spare printed circuit card for each modular, plug-in type card in controller.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Components and accessories specified in this section shall be products of:
 1. Allen-Bradley.
 2. Square D.

2.02 SERVICE CONDITIONS

- A. Ambient Operating Temperature: 32 to 104 degrees F.
- B. Storage Temperature: Minus 40 to 158 degrees F.
- C. Humidity: 0 to 95 percent relative (noncondensing).
- D. Altitude: 0 foot to 3,300 feet.
- E. Frequency Stability: Plus or minus 0.1 percent of maximum frequency.

2.03 COMPONENTS

- A. Drive Units:
 1. Incorporate a switching power supply operating from dc bus, to produce PWM output waveform simulating sine wave and providing power loss ride through of 2 milliseconds at full load, full speed.

2. Current-limiting semiconductor fuses for protection of internal power semiconductors.
3. Employ diode bridge rectifier providing constant displacement power factor of 0.95 minimum at all operating speeds and loads.
4. Use transistors for output section, providing a minimum 97 percent drive efficiency at full speed, full load.
5. Employ dc power discharge circuit so that after removal of input power dc link capacitor voltage level will decay below 50 volts dc within 1 minute after de-energizing following NEMA CP 1 and NFPA 79. Design dc link capacitor for a MTBF of 5 years.
6. Operate with open circuited output.
7. Input Voltage: 480V ac plus or minus 10 percent.
8. Output Voltage: 0 to 480 volts, three-phase, 0 to 66-Hz, minimum.
9. Maximum peak voltage of PWM AFD output pulse of 1,000 volts, with pulse rise time of not less than 2 microseconds, and maximum rate of rise of 500 volts per microsecond. Maximum frequency of PWM AFD output pulse (carrier) frequency of 3,000-Hz. Should magnitudes of these characteristics be more stressful to motor insulation than specified values, furnish insulation systems on motors suitable for proposed values.
10. Motor Audible Noise Level: When operating throughout speed range of PWM AFD, no more than 3 dBA above that designated in NEMA MG 1 for same motor operated at constant speed with a 60-Hz supply voltage.
11. Short-Time Overload Capacity: 125 percent of rated load in rms current for 1 minute following full load, full speed operation.
12. Equipment Short-Circuit Rating: Suitable for connection to system with maximum source three-phase, bolted fault, short-circuit available of 35,000 amps rms symmetrical at 480 volts.
13. Furnish drives with output current-limiting reactors mounted within equipment enclosure.
14. Diagnostics: Comprehensive for drive adjustment and troubleshooting:
 - a. Memory battery backup; 100-hour minimum during power loss.
 - b. Status messages will not stop drive from running but will prevent it from starting.
 - c. Fault Condition Messages and History: First fault protection function to be activated, ability to store six successive fault occurrences in order. Minimum faults numerically:
 - 1) Overcurrent (time and instantaneous).
 - 2) Overvoltage.
 - 3) Undervoltage (dc and ac).
 - 4) Overtemperature (drive, motor windings).
 - 5) High Moisture (motor housing).
 - 6) Serial communication fault.
 - 7) Short-circuit/ground fault (motor and drive).
 - 8) Motor stalled.

- 9) Semiconductor fault.
 - 10) Microprocessor fault.
 - 11) Single-phase voltage condition.
15. Drive Protection:
- a. Fast-acting semiconductor fuses.
 - b. Overcurrent, instantaneous overcurrent trip.
 - c. Dc undervoltage protection, 70 percent dropout.
 - d. Dc overvoltage protection, 130 percent pickup.
 - e. Overtemperature, drive, inverter, converter, and dc link components.
 - f. Overtemperature, motor, and pump.
 - g. Single-phase protection.
 - h. Reset overcurrent protection (manual or automatic reset).
 - i. Active current limit/torque limit protection.
 - j. Semiconductor fault protection.
 - k. Short-circuit/ground fault protection.
 - l. Serial communication fault protection.
 - m. Microprocessor fault.
 - n. Surge protection for transient overvoltage (6,000 volts, 80 joule surge, tested per IEEE C62.41).
 - o. Visual display of specific fault conditions.
16. Operational Features:
- a. Use manufacturer's standard unless otherwise indicated.
 - b. Sustained power loss.
 - c. Momentary power loss.
 - d. Power interruption.
 - e. Power loss ride through (0.1 second).
 - f. Start on the fly.
 - g. Electronic motor overload protection.
 - h. Stall protection.
 - i. Slip compensation.
 - j. Automatic restart after power return (ability to enable/disable function).
 - k. Critical frequency lockout (three selectable points minimum, by 1.5-Hz steps in 10-Hz bands, to prevent resonance of system).
 - l. Drive maintenance system software for complete programming and diagnostics.
 - m. Ground fault protection, drive, and motor.
 - n. Operate with no motor connected to output terminals.
- B. Rectifier: Three-phase 18-pulse full wave diode bridge rectifier to provide constant dc voltage to drive's dc bus.

C. Reduced Voltage Solid State Bypass Starter:

1. Rating: Horsepower rated at 600 volts with overload protection.
2. Three-phase, nonreversing with bypass run (shorting) contactor.
3. Control: As shown on Drawings.
4. Class 10/20/30 electronic overload relay, switch or dip switch selectable.
5. Kick start, with adjustable torque and time settings.
6. Ramp start, selectable current or torque, and adjustable time.
7. Smooth stop ramp, adjustable time.
8. Phase loss unbalance and phase reversal protection.
9. LED display or LCD of fault, N.O. contact to communicate fault conditions.

D. Line Isolation Contactors:

1. Rating: Horsepower rated at 600 volts.
2. Drive Mode: When the DRIVE/BYPASS selector switch is in the DRIVE position, the line isolation contactors shall be interlocked to provide power to the AFD and isolate the RVSS.
3. Bypass Mode: When the DRIVE/BYPASS selector switch is in the BYPASS position, the line isolation contactors shall be interlocked to provide power to the RVSS and isolate the AFD.

E. Load Isolation Contactors:

1. Rating: Horsepower rated at 600 volts.
2. Drive Mode: When the DRIVE/BYPASS selector switch is in the DRIVE position, the load isolation contactors shall be interlocked to provide output power from the AFD to the motor and isolate the RVSS output.
3. Bypass Mode: When the DRIVE/BYPASS selector switch is in the BYPASS position, the load isolation contactors shall be interlocked to provide output power from the RVSS to the motor and isolate the AFD output.

F. Furnish series choke and capacitors on dc bus to reduce ripple in rectifier output and to reduce harmonic distortion reflected into incoming power feeders.

G. Controller: Microprocessor-controller PWM inverter to convert to dc voltage to variable voltage, adjustable frequency, three-phase ac output. Output voltage shall vary proportionally with frequency to maintain constant ratio of volts to hertz up to 60-Hz; above 60-Hz, voltage shall remain constant with drive operating in constant horsepower output mode.

- H. Conformal Coating Requirements: All electronic circuit boards and components shall have a UL recognized conformal coating that meets the Military's MIL-I-46058C specification. The coating shall provide for moisture and environmental protection. All electronic circuit boards shall be impervious to moisture, fungus, dust, and corrosive atmospheres such as Hydrogen Sulfide, salt, and other environmental contaminants. Terminal pins and connectors shall be masked off such that the coating shall not impede operation. The coating shall be applied to both sides and all edges of the electronic circuit boards.
- I. Enclosure:
1. NEMA 250, Type 1, gasketed, freestanding, enclosure for mounting against wall, completely front accessible and hinged doors. Properly sized to dissipate heat generated by controller within limits of specified operating conditions (including ambient temperature and ambient airflow). Enclosure not to exceed dimensions shown on Drawings.
 2. Cable termination compartment door interlocked main circuit breaker, defeatable (lockable in the open position), emergency stop pushbutton, alphanumeric keypad and display, and operator's controls.
 3. Wire drive from below and above for power and control wiring.
 4. Size forced-ventilation for periodic operation to cool each unit with maximum room ambient temperature of 95 degrees F. Furnish redundant fans such that if one fan fails remaining fans furnish adequate ventilation for drive when operating at maximum capacity. Furnish filters on ventilation intakes.
 5. Wiring:
 - a. Bundle stranded copper wiring neatly with nylon tie wraps or with continuous plastic spiral binding.
 - b. Label each terminal for permanent identification of leads.
 - c. Identify each wire at each end with imprinted Mylar adhesive-back wire markers.
 - d. Incorporate in as-installed wiring diagrams for wire and terminal numbers shown.
 - e. Wiring across door hinge, use 19-strand, NEMA WC 57 Class C stranding looped for proper twist rather than bending at hinge.
 - f. Wire connections internal to panels by crimp-on terminal types.
 - g. For multiple enclosure systems, complete interconnection wiring with gasketed enclosure openings for wiring.
 - h. Multipoint plug receptacles for control wiring crossing equipment shipping splits.
 6. Selector switches, indicating lights, potentiometers, instruments, protective devices, and major system components identified by means of mechanically attached, engraved, laminated nameplates.

J. Operator Interface:

1. Controls: Mount drive local control on front door of enclosure and include control switch and membrane type keypad for the following operator functions:
 - a. Start (when in local mode).
 - b. Stop (when in local mode).
 - c. Speed increase (when in local mode).
 - d. Speed decrease (when in local mode).
 - e. Parameter mode selection (recall programmed parameters).
 - f. ON/OFF/LOCAL/REMOTE control selection:
 - 1) In remote, the drive shall be controlled via the DFS TCU RTU located in pump control panel CP-1. (Furnish for remote RUN command digital input and speed increase/decrease via remote 4 to 20 mA analog signal).
 - 2) In LOCAL, the drive shall be controlled via the SC2000 pump controller located in pump control panel CP-1. Furnish for remote command digital input and speed increase/decrease via remote 4 to 20 mA analog signal.
 - g. Fault reset, manual for faults, except loss of ac voltage which is automatic upon return.
 - h. RUN/preset speed.
 - i. Parameter lock, password or key switch lockout of changes to parameters.
 - j. Start disable, key switch or programmed code.
 - k. DRIVE/BYPASS control selection (in bypass mode feedback mode to HMI as to status).
 - l. Bypass overload reset.
2. Control circuit disconnect shall de-energize circuits in units that are not de-energized by main power disconnect device.
3. 120 volts, single-phase, 60-Hz circuits for control power and operator controls from internal control power transformer.
4. Arrange component and circuit such that failure of a single component cannot cause cascading failure(s) of other component(s).
5. Alphanumeric Display: During normal operation and routine test, the following parameters shall be available:
 - a. Motor current (percent of drive rated current).
 - b. Output frequency (Hertz).
 - c. Output voltage.
 - d. Running time.
 - e. Local/remote indicator.
 - f. Status of digital inputs and outputs.
 - g. Analog input and output values.
 - h. Output motor current per leg.
 - i. All test points.

6. Adjustable Parameters: Set drive operating parameters and indicate in numeric form. Potentiometers may not be used for parameter adjustment. Minimum setup parameters available:
 - a. Frequency range, minimum, maximum.
 - b. Adjustable acceleration/deceleration rate.
 - c. Volts per Hertz (field weakening point).
 - d. Active current limit/torque limit, 0 to 140 percent of drive rating.
 - e. Adjustable voltage boost (IR compensation).
 - f. Preset speed (adjustable, preset operating point).
 - g. Provision for adjustment of minimum and maximum pump speed to be furnished as function of 4 to 20 mA remote speed signal.
7. Motor Protection: Moisture detection and thermal protection relay (provided by pump supplier) shall be installed in the pump control panel. Provide inputs contacts configured to shut down the motor on either high winding temperature or high moisture inside the motor. Provide one alarm light for high temperature and one alarm light for high moisture.

K. Signal Interface:

1. Digital Input:
 - a. Accept a remote RUN command contact closure input for when the ON/OFF/LOCAL/REMOTE hand switch is in LOCAL.
 - b. Accept a remote RUN command contact closure input for when the ON/OFF/LOCAL/REMOTE hand switch is in REMOTE.
 - c. Accept a high temperature contact closure input from moisture detection and thermal protection relay.
 - d. Accept a high moisture contact closure input from moisture detection and thermal protection relay.
2. Digital Output: Furnish three discrete output dry contact closures rated 5 amps at 120 volts ac.
 - a. DRIVE/BYPASS RUNNING.
 - b. DRIVE FAULT (with common contact closure for all fault conditions).
 - c. RVSS Bypass FAULT (with common contact closure for all fault conditions).
 - d. IN REMOTE MODE.
 - e. IN BYPASS MODE.
3. Analog Inputs:
 - a. Drive shall be capable of accepting two analog inputs for speed control.
 - b. Make provisions for adjustment of minimum and maximum motor speed, which shall result from this signal.
 - c. Factory set this adjustment to comply with operating speed range designated in driven equipment specifications.
 - d. Frequency resolution shall be 0.1 percent of base speed.

- e. When ON/OFF/LOCAL/REMOTE hand switch is in REMOTE, control drive speed from the remote 4 to 20 mA dc signal from the DFS TCU RTU.
 - f. When ON/OFF/LOCAL/REMOTE hand switch is in LOCAL, control drive speed from the remote 4 to 20 mA dc signal from the SC2000 pump controller.
4. Analog Output: Furnish three 4 to 20 mA dc signals for actual frequency, actual load, motor current.

L. Accessories:

- 1. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in readily visible location.
- 2. Lifting Lugs: Equipment weighing over 100 pounds.
- 3. Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer.
- 4. Motor Protection Relay (MPR): For each drive include a MPR as specified in Section 26 05 01, Electrical, or furnish functions within drive system. Communications protocol and signal compatibility shall be as required for MPRs.

2.04 FACTORY FINISHING

A. Enclosure:

- 1. Primer: One coat of rust-inhibiting coating.
- 2. Finish:
 - a. Interior: One coat white enamel.
 - b. Exterior: One coat manufacturer's standard gray enamel or EIA 359-A-1, No. 61.

2.05 SOURCE QUALITY CONTROL

- A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.
- B. Factory Tests and Adjustments: Test all control panels furnished.
- C. Record test data for report.
- D. Motor Test: See Section 44 42 56.04, Submersible Pumps.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.

3.02 FIELD QUALITY CONTROL

A. Functional Test:

1. Conduct on each controller.
2. Inspect controller for electrical supply termination connections, interconnections, proper installation, and quiet operation.
3. Vibration Test:
 - a. Complete assembly, consisting of motor, load, and flexible shafting, connected and in normal operation shall not develop amplitudes of vibration exceeding limits recommended by HIS.
 - b. Where loads and drives are separated by intermediate flexible shafting, measure vibration both at top motor bearing and at two points on top pump bearing, 90 degrees apart.
4. Record test data for report.

B. Performance Test:

1. Conduct on each controller.
2. Perform under actual or approved simulated operating conditions.
3. Test for continuous 24-hour period without malfunction.
4. Demonstrate performance by operating continuous period while varying application load, as input conditions allow, to verify system performance.
5. With load connected to normal utility source, measure the following to show parameters within specified limits:
 - a. Total and individual current harmonic distortion, up to and including 35th harmonic, at the input terminals of pump control panel CP-1, under following load conditions:
 - 1) AFDs running at full load and half load.
 - 2) Half of specified AFDs running at full load and half load.
 - b. Power factor at input side of each drive. Documented verification that power factor is maintained at 95 percent as speed of drive goes down from 100 percent to 33 percent.
 - c. THD at the input terminals of pump control panel CP-1 under following conditions:
 - 1) AFDs running at full load and half load.
 - 2) Half of specified AFDs running at full load and half load.
6. With load connected to standby power source, measure the following to show parameters within specified limits:
 - a. Total and individual current harmonic distortion, up to and including 35th harmonic, at the input terminals of pump control panel CP-1 with drives running at:
 - 1) Full load.
 - 2) Half load.

- b. THD at location at the input terminals of pump control panel CP-1 with drives running at:
 - 1) Full load.
 - 2) Half load.
- 7. Record test data for report.

C. Test Equipment:

- 1. Use Dranetz, Model No. 626-PA, harmonic distortion monitor and Series 626 disturbance analyzer or equivalent instrument to document results.
- 2. Provide diagnostic plug-in test card complete with instructions, multiposition selector switch, and meters or built-in diagnostic control panel or ROM-based processor for monitoring ac, dc, and digital signals to assist in troubleshooting and startup of drive.

3.03 MANUFACTURERS' SERVICES

A. Manufacturer's Representative: Present at Site or classroom designated by Owner, for minimum person-days listed below, travel time excluded:

- 1. 1 person-day for installation assistance and inspection.
- 2. 1 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
- 3. 1 person-day for prestartup classroom or Site training.
- 4. 1 person-day for facility startup.
- 5. 1 person-day for post-startup training of Owner's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by Engineer.

END OF SECTION

SECTION 26 41 00
FACILITY LIGHTNING PROTECTION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Lightning Protection Institute (LPI): 175, Standard of Practice.
2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 780, Standard for the Installation of Lightning Protection Systems.
3. Underwriters Laboratories, Inc. (UL):
 - a. 96, Standard for Lightning Protection Components.
 - b. 96A, Standard for Installation Requirements for Lightning Protection Systems.

1.02 DESIGN REQUIREMENTS

A. Provide lightning protection system design for the following structures:
Electrical Building.

B. Design lightning protection system to comply with all applicable provisions of LPI 175, UL 96, UL 96A, and NFPA 780.

1.03 SUBMITTALS

A. Action Submittals:

1. Reproducible Drawings:
 - a. Lightning protection system layout.
 - b. Component locations.
 - c. Detailed plans.
2. Down conductor.
3. Connecting conductor.
4. Bond strap.
5. Air terminals.
6. Fittings.
7. Connectors.
8. Ground rods.

B. Informational Submittals:

1. Field test report.
2. Ground Witness Certification-Form LPI-175A.
3. Post-Installation Certification-Form LPI-175B.
4. UL 96 Master Label "C" Certification.

1.04 QUALITY ASSURANCE

- A. Designer: Lightning protection system design shall be prepared by an LPI-certified designer or recognized lightning protection manufacturer.
- B. System components shall be the product of a manufacturer regularly engaged in the manufacturing of lightning protection components in accordance with UL 96.
- C. Lightning protection system shall be installed under direct supervision of an LPI 175 Certified Master Installer.
- D. Inspection of final installation and grounding connection shall be performed by an LPI-certified inspector.
- E. Provide the Work in accordance with NFPA 70. Where required by authority having jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
- F. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Materials, equipment, and accessories specified in this section shall be products of:
 1. Thompson Lightning.
 2. IPC Protection.
 3. Erico Eritech Lightning Protection Systems.
 4. VFC, Inc.

2.02 GENERAL

- A. Complete system shall bear UL 96 Master Label C.
- B. System Material: Copper or high copper content, heavy-duty bronze castings, unless otherwise specified.
- C. Material shall comply in weight, size, and composition for the class of structure to be protected as established by NFPA 780.

2.03 COMPONENTS

- A. Air Terminal:
 - 1. Material: Solid copper rods with tapered or blunt points as required for application.
 - 2. Length: Sufficient to extend minimum 10 inches above object being protected.
 - 3. UL 96 Label B applied to each terminal.
- B. Conductors:
 - 1. Lightning System Conductors: Bare medium hard-drawn stranded copper, or stranded aluminum as required for the application.
 - 2. Main Down Conductor: Smooth twist stranding.
 - 3. Connecting Conductor: Concentric stranding.
 - 4. Bonding Conductor: Flexible strap.
 - 5. Main down and connecting conductors shall bear the UL 96 Label A, applied every 10 feet.
 - 6. Grounding Conductors: Stranded bare copper.
- C. Cable Fastener and Accessories: Capable of withstanding minimum pull of 100 pounds.
- D. Fittings:
 - 1. Heavy-duty.
 - 2. Bolts, Screws, and Related Hardware: Stainless steel.
- E. Ground Rods:
 - 1. Material: Copper-clad.
 - 2. Diameter: 3/4 inch.
 - 3. Length: 20 feet.

F. Grounding Connections:

1. Welds: Exothermic process.
2. Fasteners: Bolted clamp type, corrosion-resistant copper alloy.
3. Hardware: Silicone bronze.

G. Cable Connections and Splicers:

1. Welds: Exothermic process.
2. Fasteners: Bolted clamp type, corrosion-resistant copper alloy.
3. Through-Roof Connectors: Straight or right angle with bronze and lead seal flashing washer.

H. Conduit: Schedule 40 PVC.

PART 3 EXECUTION

3.01 GENERAL

- A. Workmanship to comply with all applicable provisions of LPI 175, UL 96, UL 96A, and NFPA 780.
- B. Aluminum materials shall be used where required to meet the galvanic corrosion requirements of UL 96A.
- C. Provide pitchpockets or method compatible with roofing to waterproof roof penetrations.
- D. Install system in inconspicuous manner so components blend with building aesthetics.

3.02 EXAMINATION

- A. Verify conditions prior to installation. Actual conditions may require adjustments in air terminal and ground rod locations.

3.03 INSTALLATION

A. Air Terminals:

1. Supports: Brackets or braces.
2. Parapet Bracket Attachment: Lag or expansion bolts.
3. Secure base to roof surface with adhesive or pitch compatible with roofing bond.
4. Provide terminal flashing at roof penetrations.

5. Perimeter Terminals:
 - a. Maximum Spacing: 20 feet.
 - b. Maximum Distance From Outside Edge of Building: 2 feet.
 6. Roof Ridge Terminals: Maximum spacing 20 feet.
 7. Mid-Roof Terminals: Maximum spacing 50 feet.
 8. Provide blunt point air terminals for applications exposed to personnel.
- B. Conductors:
1. Conceal whenever practical.
 2. Provide 1-inch PVC conduit in building walls or columns for main downleads and roof risers.
 3. Support: Maximum spacing for exposed conductors.
 - a. Vertical: 3 foot.
 - b. Horizontal: 4 foot.
 4. Maintain horizontal and vertical conductor courses free from dips or pockets.
 5. Bends: Maximum 90 degrees, with minimum 8-inch radius.
 6. Install air terminal conductors on the structural roof surface before roofing composition is applied.
- C. Bonding:
1. Bond to Main Conductor System:
 - a. Roof mounted ventilators, fans, air handlers, masts, flues, cooling towers, handrails, and other sizeable metal objects.
 - b. Roof flashing, gravel stops, insulation vents, ridge vents, roof drains, soil pipe vents, and other small metal objects if located within 6 feet of main conductors or another grounded object.
 2. Bond each steel column or major framing members to grounding system.
 3. Bond each main down conductor to grounding system.
- D. Grounding System:
1. Grounding Conductor:
 - a. Completely encircle building structure.
 - b. Bury minimum 1 foot below finished grade.
 - c. Minimum 2 feet from foundation walls.
 2. Interconnect ground rods by direct-buried copper cables.
 3. Maximum Resistance: 5 ohms when connected to ground rods.
 4. Connections:
 - a. Install ground cables continuous between connections.
 - b. Exothermic welded connections to ground rods, cable trays, structural steel, handrails, and buried and nonaccessible connections.

- c. Provide bolted clamp type mechanical connectors for all exposed secondary connections.
- d. Use bolted offset parapet bases or through-roof concealed base assemblies for air terminal connections.
- e. Provide interconnections with electrical and all underground water and metal pipes.
- f. Provide electric service arrestor ground wire to building water main.

3.04 FIELD QUALITY CONTROL

A. Field Testing:

1. Isolate lightning protection system from other ground conditions while performing tests.
2. Resistance: Test ground resistance of grounding system by the fall-of-potential method.
 - a. Test Resistance to Ground: Maximum 5 ohms.
 - b. Install additional ground rods as required to obtain maximum allowable resistance.
3. Test Report:
 - a. Description of equipment tested.
 - b. Description of test.
 - c. Test results.
 - d. Conclusions and recommendations.
 - e. Appendix, including appropriate test forms.
 - f. Identification of test equipment used.
 - g. Signature of responsible test organization authority.

END OF SECTION

SECTION 26 43 00
TRANSIENT VOLTAGE SUPPRESSION

PART 1 GENERAL

1.01 SUBMITTALS

- A. Submit product data on each suppressor type, indicating component values, part numbers, and conductor sizes. Include dimensional drawing for each, showing mounting arrangements.
- B. Submit manufacturer's UL certified test data and nameplate data for each TVSS.
- C. Submit electrical single-line diagram showing location of each TVSS.

1.02 QUALITY ASSURANCE

- A. UL Compliance and Labeling:
 - 1. For power and signal circuits, TVSS devices shall comply with UL 1449 and complimentary listed to UL 1283 as an electromagnetic interference filter. Provide units that are listed and labeled by UL.
 - 2. For telephone circuit protection, TVSS devices shall comply with UL 497A.
- B. ANSI Compliance: Use TVSS devices in compliance with the recommendations of IEEE C62.41.1, IEEE C62.41.2, and IEEE C62.45.

PART 2 PRODUCTS

2.01 GENERAL

- A. All TVSS devices for power circuits, provided under this section, shall be the product of a single manufacturer.
- B. TVSS devices shall be capable of performance at ambient temperatures between minus 40 and 60 degrees C, at relative humidity ranging from 0 to 95 percent, and at altitudes ranging from sea level to 12,000 feet.
- C. TVSS devices shall be fused to disconnect the suppressor from the electrical source should the suppressor fail. The fusing shall allow full surge handling capabilities and to afford safety protection from thermal overloads and short circuits.
- D. Design TVSS devices for the specific type and voltage of the electrical service. Single-phase and three-phase wye-configured systems shall have L-N,

L-G, and N-G protection. Grounded delta-configured systems shall have L-L and L-G protection.

- E. Power Filter: The TVSS shall include a high frequency extended range power filter complimentary listed to UL 1283 as an electromagnetic interference filter.

2.02 MANUFACTURER

- A. Innovative Technology, VanGuard Series.
- B. Advanced Protection Technologies, Inc.
- C. General Electric.

2.03 POWER DISTRIBUTION PANELBOARD TVSS

- A. Provide TVSS meeting IEEE C62.41.1 and IEEE C62.41.2 Location in accordance with Category C.
- B. Surge current capacity shall be not less than the following:
 - 1. L-N Capacity: 200 kA.
 - 2. L-G Capacity: 120 kA.
 - 3. N-G Capacity: 120 kA.
- C. Suppressor housing shall be in an enclosure that has the same NEMA rating as the equipment it protects and painted to match.
- D. UL 1449 maximum suppression voltage shall not be more than:

System Voltage	Phase	L-L or L-N Suppression Voltage
480Y/277	3	800

- E. Nominal Discharge Current (In): 20 kA or greater.

2.04 LIGHTING PANELBOARD TVSS

- A. Provide TVSS meeting IEEE C62.41.1 and IEEE C62.41.2 Location Category B.

- B. Surge current capacity shall be not less than the following:
1. L-L Capacity: 80 kA.
 2. L-N Capacity: 80 kA.
 3. L-G Capacity: 80 kA.
 4. N-G Capacity: 80 kA.
- C. Suppressor shall be in an enclosure that has the same NEMA rating as the panel it protects or the TVSS may be integral to a panelboard.
- D. UL 1449 maximum clamp voltage shall not be more than:

System Voltage	Phase	L-L or L-N Clamp Voltage
120	1	400
208Y/120	3	400
240	3	800

- E. Nominal Discharge Current (In): 20 kA or greater.

2.05 ANNUNCIATION

- A. Provide unit or separately mounted LED-type indication lights to show the normal and failed status of each module. Provide one normally open and one normally closed contacts which operate when the unit fails.

2.06 SURGE COUNTER

- A. Provide each TVSS rated above 100 kA with a counter displaying the number of voltage transients that have occurred on the unit input. The counter shall be battery backed and retain the count through system power outages.

2.07 PAIRED CABLE DATA LINE INTERIOR SUPPRESSORS

- A. Provide units meeting IEEE C62.41, Location Category A.
- B. Use bi-polar 1,500-watt silicon avalanche diodes between the protected conductor and earth ground.
- C. Provide units with a maximum single impulse current rating of 80 amperes (10 by 1,000 microsecond-waveform).
- D. Breakdown voltage shall not exceed 36 volts.

2.08 PAIRED CABLE DATA LINE EXTERIOR SUPPRESSORS

- A. Provide units meeting IEEE C62.41, Location Category A.
- B. Suppressors shall be a hybrid design with a minimum of three stages, utilizing solid-state components and operating bi-directionally.
- C. Suppressors shall meet or exceed the following criteria:
 - 1. Maximum single impulse current rating of 10,000 amperes (8 by 20 microsecond-waveform).
 - 2. Pulse Life Rating: 3,000 amperes (8 by 20 microsecond-waveform): 2,000 occurrences.
 - 3. Maximum clamping voltage at 10,000 amperes (8 by 20 microsecond current waveform), shall not exceed the peak of the normal applied signal voltage by 200 percent.

PART 3 EXECUTION

3.01 APPLICATION REQUIREMENTS

- A. Install TVSS when indicated on the Drawings and:
 - 1. Power distribution panelboard TVSS in or near each power distribution panelboard, unless otherwise indicated.
 - 2. Lighting panelboard TVSS In or near each lighting panelboard, unless otherwise indicated.
- B. Electronic Equipment Paired Cable Conductors: Install data line suppressors at the low voltage input and output of each piece of equipment, including telephone cable entrance.
 - 1. Use secondary protectors on lines that do not exit the structure.
 - 2. Use primary protectors on lines that exit and enter the structure.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install suppressors according to manufacturer's recommendations.
- B. Install suppressors directly to the cabinet which houses the circuit to be protected so that the suppressor leads are straight and short, with all conductors laced, running directly to the point of connection within the panel, without loops or bends. If bends are unavoidable, no bend may exceed 90 degrees and bending radius may not be less than 6 inches.
- C. Connecting wires shall be as short as possible with gently twisted conductors, tied together, to prevent separation. Connecting wires shall not exceed 24 inches in length at any point.

- D. Field installed conductors shall be the same as specified for building wire, not smaller than No. 8 AWG and not larger than No. 4 AWG. Device leads shall not be longer than the length recommended by the manufacturer, unless specifically reviewed and approved by the manufacturer.
- E. Provide dedicated disconnecting means for TVSS devices installed at main service entrance location, switchgear, and motor control centers. Provide dedicated 30 to 60-ampere circuit breakers (size dependent upon wire size used) with number of poles as required, as disconnecting means for TVSS devices installed at panelboards. The interrupting capacity of the circuit breakers shall be that specified for the other breakers at that location.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 DEFINITIONS

- A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.
- B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.
- C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 6 inches below subgrade.
- D. Project Limits: Areas, as shown or specified, within which Work is to be performed.

1.02 SCHEDULING AND SEQUENCING

- A. Prepare Site only after adequate erosion and sediment controls are in place.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Clear, grub areas actually needed for waste disposal, borrow, or Site improvements within limits shown or specified.
- B. Do not injure or deface vegetation that is not designated for removal.

3.02 LIMITS

- A. As follows, but not to extend beyond Project limits.
 - 1. Excavation Excluding Trenches: 5 feet beyond top of cut slopes.
 - 2. Trench Excavation: 4 feet from trench centerline, regardless of actual trench width.
 - 3. Fill:
 - a. Clearing and Grubbing: 5 feet beyond toe of permanent fill.
 - 4. Structures: 15 feet outside of new structures.
 - 5. Other Areas: As shown.

- B. Remove rubbish, trash, and junk from entire area within Project limits.

3.03 CLEARING

- A. Clear areas within limits shown or specified.
- B. Fell trees so that they fall away from facilities and vegetation not designated for removal.
- C. Cut stumps not designated for grubbing flush with ground surface.
- D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.04 GRUBBING

- A. Grub areas within limits shown or specified.

3.05 TREE REMOVAL OUTSIDE CLEARING LIMITS

- A. Remove within Project Limits: Dead, dying, leaning, or otherwise unsound trees that may strike and damage Project facilities in falling.
- B. Cut stumps off flush with ground, remove debris, and if disturbed, restore surrounding area to its original condition.

3.06 DISPOSAL

- A. Clearing and Grubbing Debris:
 - 1. Dispose of debris offsite.
 - 2. Burning of debris onsite will not be allowed.
 - 3. Woody debris may be chipped. Chips may be sold to Contractor's benefit or used for landscaping onsite as mulch or uniformly mixed with topsoil, provided that resulting mix will be fertile and not support combustion. Maximum dimensions of chipped material used onsite shall be 1/4 inch by 2 inches. Dispose of chips that are unsaleable or unsuitable for landscaping or other uses with unchipped debris.
 - 4. Limit offsite disposal of clearing and grubbing debris to locations that are approved by federal, state, and local authorities, and that will not be visible from Project.

END OF SECTION

SECTION 31 23 13
SUBGRADE PREPARATION

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
 - a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [2,400 ft-lb/ft³ (600 kN-m/m³)].
 - b. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [6,000 ft-lbf/ft³ (2,700 kN-m/m³)].

1.02 DEFINITIONS

- A. Optimum Moisture Content: As defined in Section 31 23 23.15, Trench Backfill.
- B. Prepared Ground Surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.
- C. Relative Compaction: As defined in Section 31 23 23.15, Trench Backfill.
- D. Subgrade: Layer of existing soil after completion of clearing, grubbing, scalping, and excavation prior to placement of stormwater structures.
- E. Proof-Rolling: Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement.

1.03 SEQUENCING AND SCHEDULING

- A. Complete applicable Work specified in Section 31 10 00, Site Clearing; and Section 31 23 16, Excavation, prior to subgrade preparation.

1.04 QUALITY ASSURANCE

- A. Notify Engineer when subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

PART 2 PRODUCTS

2.01 BASE ROCK

- A. Base rock shall be crushed gravel or crushed rock, free from dirt, clay balls, and organic material and conforming to size No. 57 gradation as specified in the FDOT Standard Specifications for Road and Bridge Construction or similar accepted material and shall be imported if necessary at the Contractor's own expense. Lime rock screenings or material resulting from trench excavation, except for lime rock which has been crushed and graded to size as specified, will not be accepted for base rock.

PART 3 EXECUTION

3.01 GENERAL

- A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.
- B. Bring subgrade to proper grade and cross-section and uniformly compact surface.
- C. Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.
- D. Maintain prepared ground surface in finished condition until next course is placed.

3.02 COMPACTION

- A. Granular Fill under Structures: Compact the upper 6 inches of subgrade to minimum of 100 percent relative compaction as determined in accordance with ASTM D1557. After compaction of subgrade, place a minimum of 6 inches of base rock in conformance with Section 911 of the FDOT Standard Specifications for Road and Bridge Construction and thoroughly compact with a mechanical vibrating or power tamper.
- B. Granular Fill under Pavement: Compact the upper 12 inches of subgrade to a minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

3.03 MOISTURE CONDITIONING

- A. Dry Subgrade: Add water, then mix to make moisture content uniform throughout.
- B. Wet Subgrade: Aerate material by blading, discing, harrowing, or other methods, to hasten drying process.

3.04 TESTING

- A. Proof-roll subgrade with equipment specified in Article Compaction to detect soft or loose subgrade or unsuitable material, as determined by Engineer.

3.05 CORRECTION

- A. Soft or Loose Subgrade:
 - 1. Adjust moisture content and recompact, or
 - 2. Over excavate as specified in Section 31 23 16, Excavation, and replace with suitable material from the excavation, as specified in Section 31 23 23.15, Trench Backfill.
- B. Unsuitable Material: Over excavate as specified in Section 31 23 16, Excavation, and replace with suitable material from the excavation, as specified in Section 31 23 23.15, Trench Backfill.

END OF SECTION

**SECTION 31 23 16
EXCAVATION**

PART 1 GENERAL

1.01 QUALITY ASSURANCE

- A. Provide adequate survey control to avoid unauthorized overexcavation.

1.02 WEATHER LIMITATIONS

- A. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.03 SEQUENCING AND SCHEDULING

- A. Clearing, Grubbing, and Stripping: Complete applicable Work specified in Section 31 10 00, Site Clearing, prior to excavating.
- B. Dewatering: Conform to applicable requirements of Section 31 23 19.01, Dewatering, prior to initiating excavation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.
- B. Do not overexcavate without written authorization of Engineer.
- C. It shall be the Contractor's responsibility to make exploratory excavations as required to verify location, size, and elevation of existing utilities that may interfere with installation of new pipelines. Contractor shall perform this Work well in advance of trenching and excavating. The Contractor shall call "48 hours before digging" the underground utilities location center at 1-800-432-4770.

3.02 UNCLASSIFIED EXCAVATION

- A. Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

3.03 SHORING, SHEETING, AND BRACING OF TRENCHES

- A. Sheet and brace the trench when necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public. Increase trench widths accordingly by the thickness of the sheeting. Maintain sheeting in-place until the pipe has been placed and backfilled at the pipe zone. Shoring and sheeting shall be removed, as the backfilling is done, in a manner that will not damage the pipe or permit voids in the backfill. All sheeting, shoring, and bracing of trenches shall conform to the safety requirements of the federal, state, or local public agency having jurisdiction. The most stringent of these requirements shall apply.

3.04 TRENCH WIDTH

- A. Minimum Width of Trenches:
 - 1. Single Pipes, Conduits, Direct-Buried Cables, and Duct Banks:
 - a. Less than or equal to 15-inch Outside Diameter or Width: As shown.
 - 2. Multiple Pipes, Conduits, Cables, or Duct Banks in Single Trench: As shown.
- B. Maximum Trench Width: Unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property, or completed Work.
- C. Confine trench widths to dedicated rights-of-way or construction easements, unless special written agreements have been made with the affected property owner.

3.05 STOCKPILING EXCAVATED MATERIAL

- A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.
- B. Post signs indicating proposed use of material stockpiled. Post signs that are readable from all directions of approach to each stockpile. Signs should be clearly worded and readable by equipment operators from their normal seated position.

- C. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets.
- D. Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.
- E. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce excessive settlement.

3.06 DISPOSAL OF SPOIL

- A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, offsite, in a county-approved disposal facility.
- B. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk as specified in Section 31 10 00, Site Clearing, for clearing and grubbing debris.

3.07 SUPPLEMENT

- A. The supplement listed below, following “End of Section” is a part of this Specification.
 - 1. Report of Geotechnical Exploration: VFD Wastewater Pump Station Upgrades, Key West, Florida.

END OF SECTION

**REPORT OF
GEOTECHNICAL EXPLORATION**

**VFD WASTEWATER PUMP STATION UPGRADES
KEY WEST, FLORIDA**

FOR

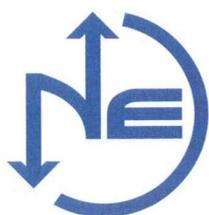
**CH2M HILL
6410 5TH STREET, SUITE 2A
KEY WEST, FLORIDA 33043**

PREPARED BY

**NUTTING ENGINEERS OF FLORIDA, INC.
2051 NW 112TH AVENUE, SUITE 126
MIAMI, FLORIDA 33172**

PROJECT No. 126.26

MARCH 2014 (REVISED APRIL 2014)

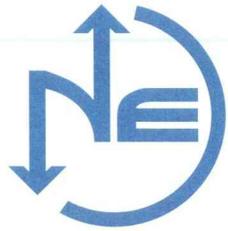


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March 17, 2014 (Revised April 9, 2014)

Mr. Sean McCoy
CH2M Hill
6410 5th Street, Suite 2A
Key West, Florida 33043
Phone: 305.294.1645//Fax: 305.294.1493
Email: Sean.McCoy@ch2m.com

Re: Report of Geotechnical Exploration
VFD Wastewater Pump Station Upgrades
Key West, Florida

Dear Mr. McCoy:

Nutting Engineers of Florida, Inc. has performed a geotechnical exploration for the referenced project in Key West, Florida. The purpose of the exploration was to obtain information concerning the site and subsurface conditions at specific test locations in order to provide soil parameters for the proposed improvements. This report presents our findings and recommendations.

PROJECT INFORMATION

Based on our conversations with you and review of available project plans, we understand that the City of Key West is planning on constructing auxiliary one story, approximately 170 square foot buildings at six locations, adjacent to existing pump stations. We anticipate that final grades will be within approximately one to two feet of existing grades. If any of the above assumptions or information is incorrect, we should be advised in writing in order to revise our recommendations accordingly.

GENERAL SUBSURFACE CONDITIONS

Soil Survey Maps

As part of the geotechnical exploration, we have reviewed available Soil Conservation Service (SCS) survey maps for Monroe County. These SCS maps provide qualitative information about potential general shallow soil conditions in the project vicinity. This information was derived from approximately 6 ft. deep manual auger borings, aerial

photo and surface feature interpretation at some point in the past (mid 1980's to early 1970's). The SCS data may or may not reflect actual current site conditions. As indicated in the Monroe County Soil Survey Map the series under exploration is the Udorthents-Urban land complex. The Udorthents series consists of unconsolidated or heterogeneous overburden material generally consisting of crushed coralline limestone and coarse sand used for land leveling as fill. Beneath the fill layer natural silt deposits may exist or the natural limestone formation. We note that the maximum depth of the survey is approximately six feet.

Subsurface Exploration

NUTTING ENGINEERS OF FLORIDA, INC. was requested to perform one Standard Penetration Test (SPT) boring (ASTM D-1586) to a depth of twenty feet below land surface at each site. The locations of the test borings are indicated on the attached site plans presented in the Appendix of this report. The boring locations, specified by CH2M Hill, were established in the field using approximate methods; namely, a measuring wheel and available surface controls. As such the soil boring locations should be considered to be approximate.

The appended boring logs present information and descriptions of the subsurface conditions at the test boring locations. Representative samples collected from the SPT boring were visually reviewed in the laboratory by a geotechnical engineer in order to confirm the field classifications. The Standard Penetration Test N-values, the number of successive blows required to drive the sampler into the soil one foot, are presented on the individual boring logs. The SPT N value has been empirically correlated with various soil properties and is considered to be indicative of the relative density of cohesionless soils and the consistency of cohesive soils. The correlation of penetration resistance with relative density is presented in the Soil Classification Criteria attached in the Appendix.

Site 1: Steven Ave. & Atlantic Blvd. Site Test Boring Results

In general, the review of the boring log indicates a surficial layer of topsoil to approximately two inches below grade, followed by limestone fragments to approximately four feet below grade. Medium dense to dense quartz fine sand and cemented sand was observed to a depth of approximately twelve feet, underlain by soft to medium hard cemented sand to twenty feet, the maximum depth explored. A detailed description of the soil/rock profile is presented on the test boring records provided in the Appendix.

Site 2: Thompson St. & Seminary St. Site
Test Boring Results

In general, the review of the boring log indicates a surficial layer of gravel, concrete fragments and other debris to a depth of approximately four feet below grade followed by medium dense quartz fine sand and cemented sand fragments to approximately twelve feet below grade. Soft to medium hard cemented sand was then observed to twenty feet, the maximum depth explored. A detailed description of the soil/rock profile is presented on the test boring record provided in the Appendix.

Site 3: Simonton St. & Greene St. Site
Test Boring Results

In general, the review of the boring log indicates a surficial layer of limestone fragments with interspersed sand to approximately three and a half feet below grade, followed by limestone fragments with trace debris to approximately four feet below grade. Medium dense, slightly silty quartz fine sand was observed to a depth of approximately eight feet, underlain by medium dense slightly silty quartz fine sand and cemented sand to twenty feet, the maximum depth explored. A detailed description of the soil/rock profile is presented on the test boring records provided in the Appendix.

Site 4: Thomas St. & Amelia St. Site
Test Boring Results

In general, the review of the boring log indicates a surficial layer of sand and limestone to approximately four feet below grade, followed by medium dense quartz fine sand to approximately twelve feet below grade. Soft to medium hard cemented sand was observed below this depth to twenty feet, the maximum depth explored. A detailed description of the soil/rock profile is presented on the test boring records provided in the Appendix.

Site 5: Flagler & N 14th St. Site
Test Boring Results

In general, the review of the boring log indicates a surficial two inch layer of asphalt underlain by limestone fragments to approximately four feet below grade. Medium dense quartz fine sand and cemented sand fragments was observed to approximately twelve feet below grade, followed by soft to medium hard cemented sand to twenty feet, the maximum depth explored. A detailed description of the soil/rock profile is presented on the test boring record provided in the Appendix.

Site 6: Palm Ave. & Eisenhower Dr. Site Test Boring Results

In general, the review of the boring log indicates a surficial layer of limestone fragments to approximately two feet below grade, followed by quartz fine silty sand to approximately three feet. Below this depth, very soft silt was observed to approximately seven feet below grade, underlain by medium dense to dense quartz fine sand to approximately twelve feet below grade. Medium hard to hard cemented sand was noted below this depth to twenty feet, the maximum depth explored. A detailed description of the soil/rock profile is presented on the test boring record provided in the Appendix.

Note: Substantially different subsurface conditions may exist at alternate locations. Buried debris may or may not be identified or adequately delineated by soil borings. Test pit excavation can provide more insight into such conditions and rock lithology if present. Such conditions may be revealed during site development activities or other related activities. Should additional assurance be desired by the client, further subsurface investigation could be performed.

Groundwater Information

The immediate groundwater level was measured at the boring locations at the time of drilling. The groundwater level was encountered at depths of approximately two to three and a half feet below the existing ground surface during our subsurface exploration. Groundwater elevation should be expected to vary with tidal conditions due to the proximity to the Atlantic Ocean and Gulf of Mexico. Please review the paragraphs presented below regarding water table information and accuracy.

The immediate depth to groundwater measurements presented in this report may not provide a reliable indication of stabilized or more long term depth to groundwater at this site. Water table elevations can vary dramatically with time through rainfall, droughts, storm events, flood control activities, nearby surface water bodies, tidal activity, pumping and many other factors. For these reasons, this immediate depth to water data **should not** be relied upon alone for project design considerations.

Further information regarding stabilized groundwater elevations at the site could be developed upon specific request. Additional evaluation, which was not part of this study, might include a pumping test, monitoring of piezometers, survey of the project area for evidence of current groundwater elevation influences such as well fields, obvious construction dewatering, tidal activity, flood control canals and other surface water bodies.

ENGINEERING EVALUATION AND RECOMMENDATIONS

The test borings performed for this project generally revealed that the subsurface soils at the sites consist primarily of sand, limestone formation and/or cemented sand. These soils typically provide adequate bearing capacity for support of lightly loaded structures on shallow foundations with relatively small settlements. It should be noted, however, that a layer of very soft silt was noted in the soil profile of the Palm Ave & Eisenhower Dr site. The following sections present our recommendations for foundation design and site preparation.

Palm Ave & Eisenhower Dr. Site Recommendations

As discussed above, the boring performed for the Palm Ave. and Eisenhower Dr. site revealed that the subsurface soils at the site consist primarily of limestone fragments and sand, however with a layer of silt noted from approximately three to seven feet below grade. Based on this condition we estimate settlements on the order of approximately 2 inches if the proposed structure is supported on a shallow foundation. Typically acceptable settlements are 1 inch or less, therefore we recommend supporting the structure on a deep foundation system. Depending on space available for construction equipment access, we have provided recommendations for two types of deep foundation systems for the proposed construction; helical piers or pin piles. The decision as to which foundation type will be best for this project will depend on accessibility, cost, structural loading conditions, and other factors. We recommend that discussions be held with us and other interested parties to determine the best alternative for this project. The following sections present our recommendations for the two foundation types.

Pin Piles: Pin piles are small diameter (3-inch) galvanized steel pipes, which are driven into the ground until refusal is encountered, and the interior of the pipe is then filled with grout and, subsequently, a full length rebar. This type of deep foundation is typically used where access is limited, structural loads are relatively light, and where only a few piles are needed for support.

Based on our experience with the soils in this area, and discussions with local contractors familiar with the installation of this type of pile, we anticipate that a 3-inch diameter pin pile installed to refusal should provide an allowable compressive capacity of approximately 5 tons.

The test borings indicate that refusal may be encountered at depths of approximately 12 to 13 feet below the existing ground surface, however, where small solution holes are encountered, the piles could go deeper.

The installation of this type of foundation system is highly contractor dependent and therefore, a representative of Nutting Engineers should monitor the installation of the piles to verify the compressive loads have been obtained.

Helical Piers: Helical Piers consist of a galvanized solid steel shaft with a ten-inch (can be variable) plate on the bottom, called a helix. The shaft and helix are hydraulically augured into the ground with a measured amount of torque. The torque used to install the helix can be converted to the amount of weight that the pier can hold. Helical anchors can provide an allowable compressive capacity of up to 20 tons when installed to competent material. Based on the test boring performed, helical piers will need to be installed to depths of approximately 13 feet below the existing ground surface, but may go deeper in some locations.

This type of pile is generally used where accessibility is limited, and in small addition areas, where only a few piles are needed. The shaft size and number of helices are variable and are designed to meet the needs of each individual project, therefore, the structural loads, and preliminary layout will need to be accomplished prior to determining the helical pier configuration.

The installation of the pile system should be monitored by a representative of Nutting Engineers on a full-time basis to verify that the engineering intent is accomplished.

Recommendations for All Other Sites

For the balance of the sites, excepting Palm Ave & Eisenhower site, the following sections present our recommendations for foundation design and site preparation.

Once the sites are prepared in accordance with the recommendations presented in this report, the sites may be developed using a shallow foundation system designed for an allowable soil bearing pressure of **2,000 pounds per square foot**. All work should be completed in accordance with applicable building codes, other regulations as appropriate, and good standard local practice.

We recommend that the bottom of footings be at least 12 inches below the lowest adjacent finished grade.

Settlement Analysis

Settlement analysis was performed using the Schmertmann method based upon a hypothetical improved soil profile following completion of the compaction using a moderately sized vibratory compactor. It was estimated that upon proper completion, long-term total settlements should be on the order of less than approximately one inch.

Differential settlements should be approximately one-half of the total settlement. Distortions that occur along wall footings should not be more than 1 in 500. Most of this settlement should occur upon the application of the dead load during construction.

Site Preparation

The surficial topsoil and any unsuitable soils as determined by the Geotechnical Engineer will need to be completely removed within the construction area. A Nutting Engineer's representative should be present to observe that the stripping operations are performed as we have discussed herein.

The surface should then be compacted until a density equivalent to at least 98 percent of the modified Proctor maximum dry density (ASTM D-1557) is achieved to a depth of at least 12 inches below the compacted surface.

Any structural fill needed to bring the site to construction grade may then be placed in lifts not exceeding twelve inches in loose thickness. Each lift should be thoroughly compacted until densities equivalent to at least 98 percent of the Modified Proctor maximum dry density are uniformly obtained. Fill should consist of granular soil, with less than 10% passing the No. 200 sieve, free of rubble, organics (5% or less) clay, debris and other unsuitable material. The floor slab area should also be compacted in the same manner.

The fill should have ASTM designation (D-2487) of GP, GW, SP, or SW, with a maximum particle size of no more than 3 inches or as otherwise approved by the geotechnical engineer.

GENERAL INFORMATION

Our client for this geotechnical evaluation was:

CH2M Hill
6410 5th Street, Suite 2A
Key West, Florida 33043

The contents of this report are for the exclusive use of the client, the client's design & construction team and governmental authorities for this specific project exclusively. Information conveyed in this report shall not be used or relied upon by other parties or for other projects without the expressed written consent of NE. This report discusses geotechnical considerations for this site based upon observed conditions and our understanding of proposed construction for foundation support. Environmental issues including (but not limited to), soil and/or groundwater contamination, methane are

beyond our scope of service for this project. As such, this report shall not be used or relied upon for evaluation of environmental issues.

Benefit may be realized by the performance of exploratory test pits on the site to develop additional subsurface information. The client may wish to consider performance of test pits on this project to supplement information already developed.

Prior to initiating compaction operations, we recommend that representative samples of the structural fill material to be used and acceptable in-place soils be collected and tested to determine their compaction and classification characteristics. The maximum dry density, optimum moisture content, gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill and existing soils, and to determine if the fill material is acceptable.

If conditions are encountered which are not consistent with the findings presented in this report, or if proposed construction is moved from the location investigated, this office shall be notified in writing immediately so that the condition or change can be evaluated and appropriate action taken.

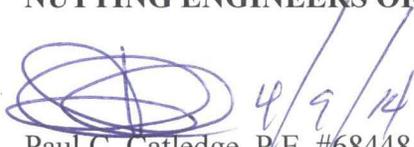
The vibratory compaction equipment may cause vibrations that could be felt by persons within nearby buildings and could potentially induce structural settlements. Additionally, preexisting settlements may exist within these structures that could be construed to have been caused or worsened by the proposed vibratory compaction after the fact. Pre- and post conditions surveys of these structures along with the vibration monitoring during vibratory compaction could be performed to better evaluate this concern. The contractor should exercise due care during the performance of the vibratory compaction work with due consideration of potential impacts on existing structures. If potential vibrations and impacts are not considered tolerable, then alternate foundation modification techniques should be considered and the Geotechnical Engineer notified in writing immediately.

NE shall bear no liability for the implementation of recommended inspection and testing services as described in this report if implemented by others. NE has no ability to verify the completeness, accuracy or proper technique of such procedures if performed by others.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with general accepted professional practice in the field of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

We appreciate the opportunity to provide these services for you and look forward to completing this and other projects with you. If we can be of any further assistance with the design or construction services, or if you need additional information, please feel free to contact us at your convenience.

Sincerely,
NUTTING ENGINEERS OF FLORIDA, INC.


Paul C. Catledge, P.E. #68448
Senior Engineer

Attachments: Boring Location Plans
Test Boring Reports
Limitations of Liability
Soil Classification Criteria



Imagery Date: 3/7/2013 24° 32.950' N 81° 46.985' W elev 2 ft eye alt 895 ft

© 2013 Google



VFD WASTEWATER PUMP STATION UPGRADES
 STEVEN AVE. & ATLANTIC BLVD.
 KEY WEST, FLORIDA

APPROXIMATE
 TEST LOCATION

NOT TO SCALE

FIGURE 1



VFD WASTEWATER PUMP STATION UPGRADES
 THOMPSON ST. & SEMINARY ST.
 KEY WEST, FLORIDA

APPROXIMATE
 TEST LOCATION

NOT TO SCALE

FIGURE 2



Imagery Date: 3/7/2013 24° 33.625' N 81° 48.202' W elev 2 ft eyealt 988 ft

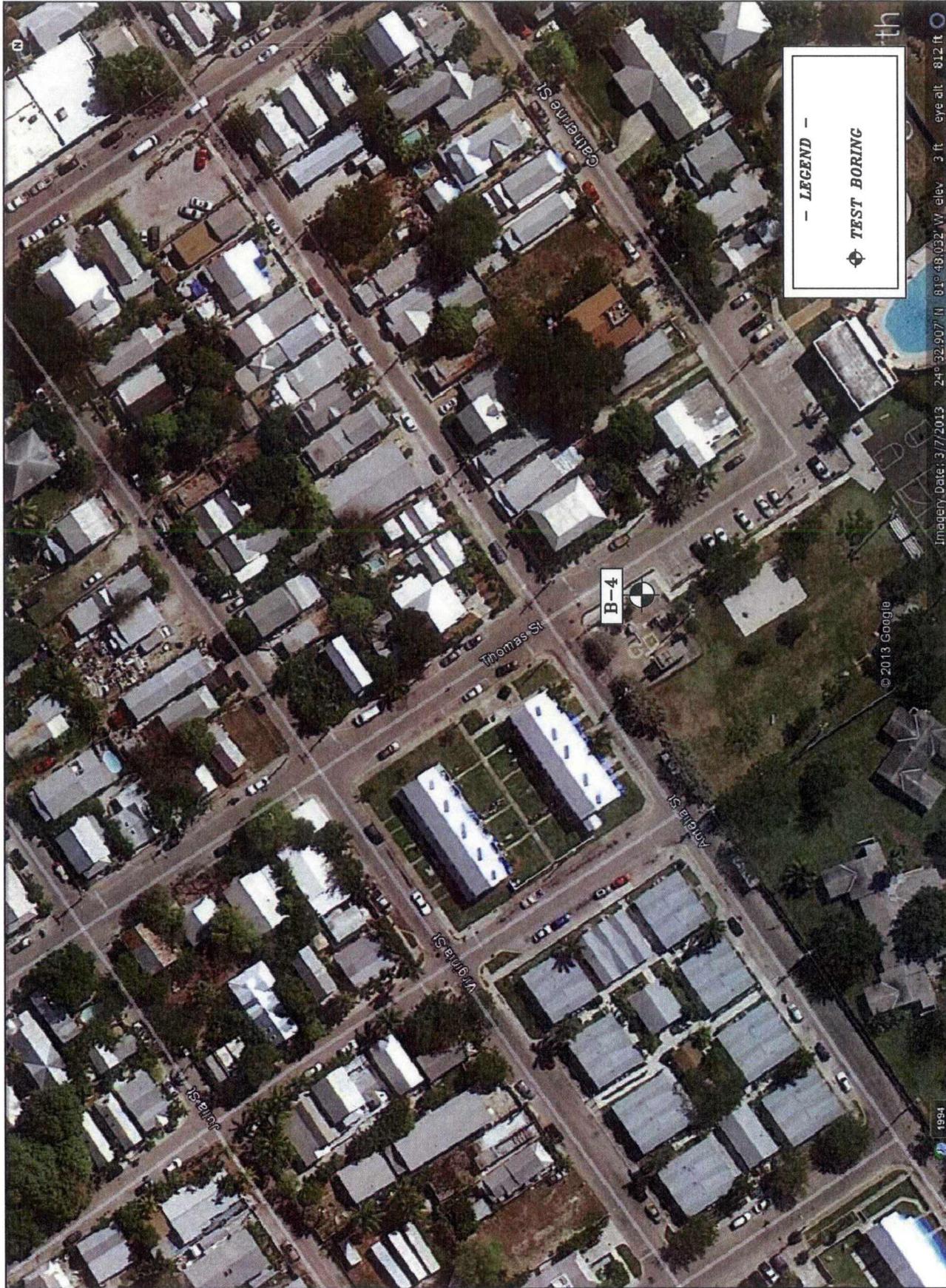


VFD WASTEWATER PUMP STATION UPGRADES
 SIMONTON ST. & GREENE ST.
 KEY WEST, FLORIDA

APPROXIMATE
 TEST LOCATION

NOT TO SCALE

FIGURE 3

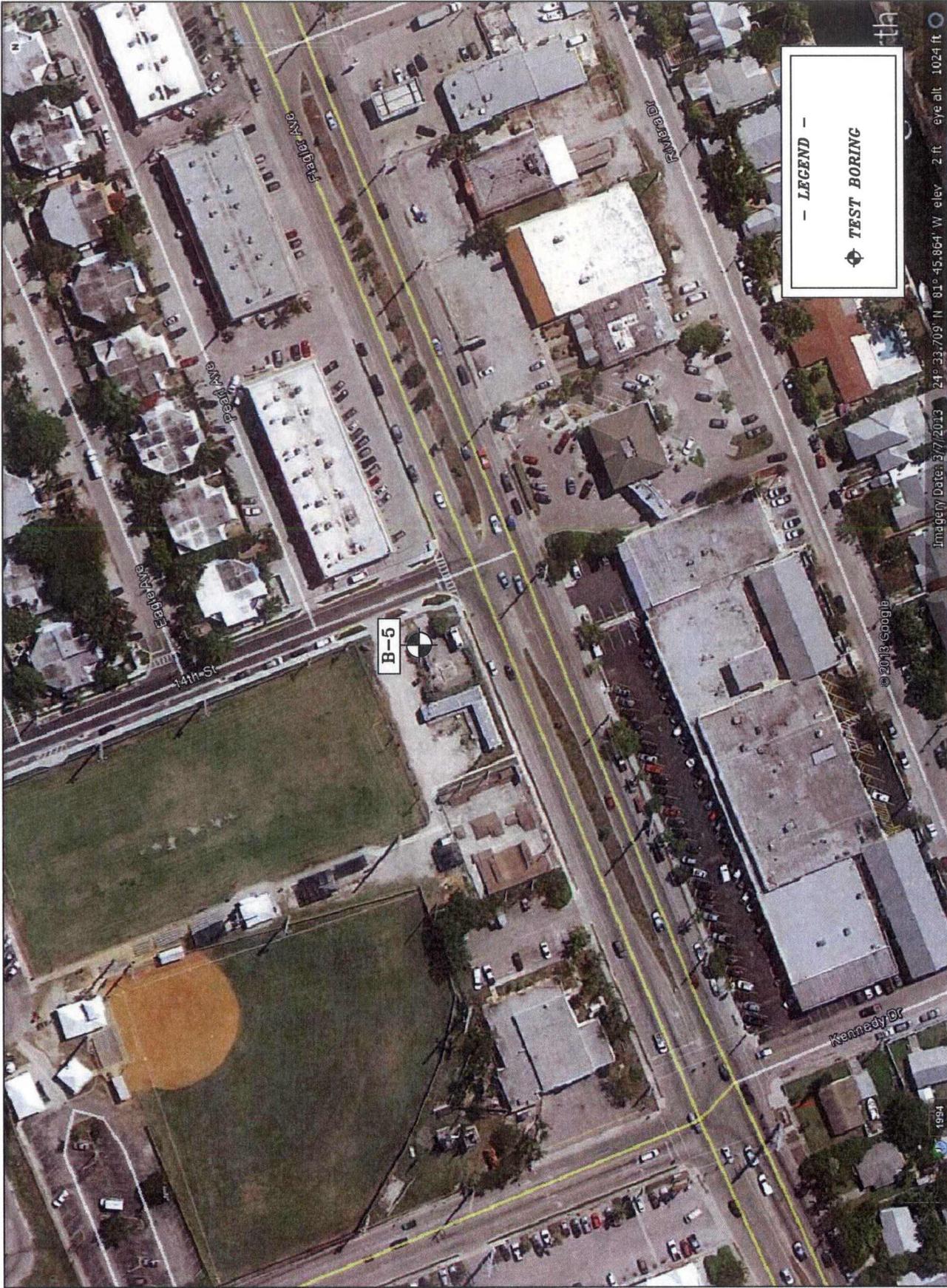


VFD WASTEWATER PUMP STATION UPGRADES
 THOMAS ST. & AMELIA ST.
 KEY WEST, FLORIDA

APPROXIMATE
 TEST LOCATION

NOT TO SCALE

FIGURE 4



— LEGEND —
 ☩ TEST BORING

Imagery Date: 3/7/2013 24° 33.709' N 81° 45.864' W elev. 2 ft eye alt. 1024 ft © 2013 Google

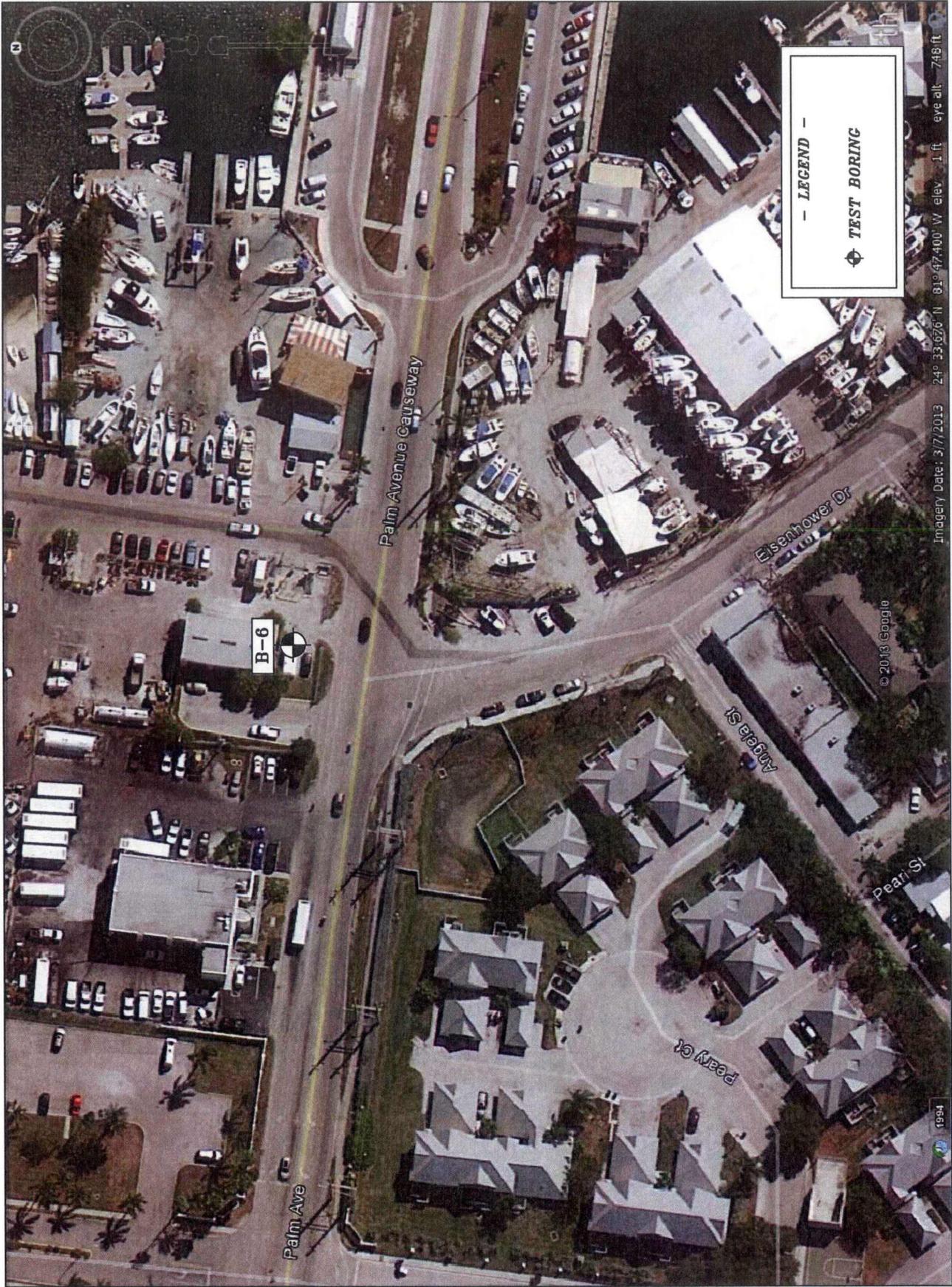


VFD WASTEWATER PUMP STATION UPGRADES
 FLAGLER AVE. & 14TH ST.
 KEY WEST, FLORIDA

APPROXIMATE
 TEST LOCATION

NOT TO SCALE

FIGURE 5



VFD WASTEWATER PUMP STATION UPGRADES
 PALM AVE. & EISENHOWER DR.
 KEY WEST, FLORIDA

APPROXIMATE
 TEST LOCATION

NOT TO SCALE

FIGURE 6



1310 Neptune Drive
 Boynton Beach, FL 33426
 Telephone: 561-736-4900
 Fax: 561-737-9975

CLIENT CH2M Hill **PROJECT NUMBER** 126.26
PROJECT NAME VFD Wastewater Pump Station Upgrades
PROJECT LOCATION Steven Avenue and Atlantic Blvd., City of Key West, FL

DATE STARTED 2/25/14 COMPLETED 2/25/14 SURFACE ELEVATION REFERENCE Approx. 6" above road crown
 DRILLING METHOD Standard Penetration Boring GROUND WATER LEVELS:
 LOGGED BY P. Tyson CHECKED BY C. Gworek ∇ AT TIME OF DRILLING 2.1 ft
 APPROXIMATE LOCATION OF BORING As located on site plan

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL — MC — LL 20 40 60 80			
						□ FINES CONTENT (%) □			
						20 40 60 80			
0		2-inch TOPSOIL Tan LIMESTONE FRAGMENTS, trace quartz medium sand	AU 1						
			AU 2						
5		Lt. tan quartz medium SAND and CEMENTED SAND, little shell	SS 3	18-21-27-19	48				
			SS 4	15-17-18-18	35				
			SS 5	16-15-12-11	27				
10			SS 6	9-11-8-10	19				
		Lt. tan CEMENTED SAND FRAGMENTS and quartz medium SAND							
15			SS 7	9-10-7	17				
		Lt. tan CEMENTED SAND FRAGMENTS, trace quartz medium sand							
			SS 8	6-8-8	16				
20		Bottom of hole at 20.0 feet.							

TEST NUTTING BOREHOLE 2-126.26.5 CH2M HILL - VFD WASTEWATER PUMP STATION UPGRADES (A. B. C. D. AND DA) GPJ GINT US GDT 4/9/14



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 Boynton Beach, FL 33426
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 Fax: 561-737-9975

BORING NUMBER B-2

PAGE 1 OF 1

CLIENT CH2M Hill

PROJECT NUMBER 126.26

PROJECT NAME VFD Wastewater Pump Station Upgrades

PROJECT LOCATION Thompson Street and Seminary Street, City of Key West, FL

DATE STARTED 2/25/14 COMPLETED 2/25/14 SURFACE ELEVATION REFERENCE Approx. 6" above road crown

DRILLING METHOD Standard Penetration Boring GROUND WATER LEVELS:

LOGGED BY P. Tyson CHECKED BY C. Gworek AT TIME OF DRILLING 3.3 ft ft

APPROXIMATE LOCATION OF BORING As located on site plan

TEST NUTTING BOREHOLE 2-126.26.4 CH2M HILL - VFD WASTEWATER PUMP STATION UPGRADES (A, B, C, AND D) GPJ GINT US GDT 4/9/14

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL — MC — LL 20 40 60 80			
						<input type="checkbox"/> FINES CONTENT (%) <input type="checkbox"/> 20 40 60 80			
0		GRAVEL, CONCRETE, DEBRIS	AU 1						
			AU 2						
5		Lt. tan quartz medium SAND and CEMENTED SAND, little shell	SS 3	15-11-13-12	24				
			SS 4	16-18-9-7	27				
			SS 5	10-13-11-13	24				
10			SS 6	9-10-8-7	18				
		CEMENTED SAND, little shell, trace quartz medium sand							
15			SS 7	11-9-10	19				
20			SS 8	7-8-8	16				
		Bottom of hole at 20.0 feet.							



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 Fax: 561-737-9975

BORING NUMBER B-3

PAGE 1 OF 1

CLIENT CH2M Hill

PROJECT NUMBER 126.26

PROJECT NAME VFD Wastewater Pump Station Upgrades

PROJECT LOCATION Simonton Street and Greene Street, City of Key West, FL

DATE STARTED 2/25/14 COMPLETED 2/25/14 SURFACE ELEVATION REFERENCE Approx. 6" above road crown

DRILLING METHOD Standard Penetration Boring GROUND WATER LEVELS:

LOGGED BY P. Tyson CHECKED BY C. Gworek AT TIME OF DRILLING 3.5 ft

APPROXIMATE LOCATION OF BORING **As located on site plan**

TEST NUTTING BOREHOLE 2-126.26.2 CH2M HILL - VFD WASTEWATER PUMP STATION UPGRADES (A, B, C, D, AND DA) GPJ, GINT US, GDT 4/9/14

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL — MC — LL 20 40 60 80			
						<input type="checkbox"/> FINES CONTENT (%) <input type="checkbox"/> 20 40 60 80			
0		Tan LIMESTONE FRAGMENTS	AU 1						
		Gray quartz medium SAND, trace organic							
		Gray LIMESTONE FRAGMENTS, trace quartz medium sand	AU 2						
		Gray LIMESTONE FRAGMENTS, trace DEBRIS							
5		Gray slightly silty quartz medium SAND, trace limestone fragments	SS 3	6-8-11-15	19				
			SS 4	10-14-11-12	25				
		Gray slightly silty quartz medium SAND and CEMENTED SAND, trace shell	SS 5	11-13-15-12	28				
10			SS 6	11-9-12-13	21				
			SS 7	13-1-12	13				
15			SS 8	9-11-11	22				
20		Bottom of hole at 20.0 feet.							



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 Fax: 561-737-9975

CLIENT CH2M Hill PROJECT NUMBER 126.26
 PROJECT NAME VFD Wastewater Pump Station Upgrades
 PROJECT LOCATION Thomas Street and Amelia Street, City of Key West, FL

DATE STARTED 2/25/14 COMPLETED 2/25/14 SURFACE ELEVATION REFERENCE Approx. 6" above road crown
 DRILLING METHOD Standard Penetration Boring GROUND WATER LEVELS:
 LOGGED BY P. Tyson CHECKED BY C. Gworek AT TIME OF DRILLING 3.0 ft
 APPROXIMATE LOCATION OF BORING As located on site plan

TEST NUTTING BOREHOLE 2-126.26.1 CH2M HILL - VFD WASTEWATER PUMP STATION UPGRADES (A, B, C, D, AND DA). GPJ. GINT US.GOT. 4/9/14

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL ——— MC ——— LL 20 40 60 80			
						<input type="checkbox"/> FINES CONTENT (%) <input type="checkbox"/> 20 40 60 80			
0		Brown slightly silty quartz medium SAND and LIMESTONE FRAGMENTS	AU 1						
			AU 2						
5		Lt. tan quartz medium SAND, trace cemented sand, little shell	SS 3	6-7-9-11	16				
			SS 4	13-11-12-10	23				
			SS 5	10-14-16-15	30				
10			SS 6	16-11-13-12	24				
		Brown CEMENTED SAND FRAGMENTS, trace quartz fine sand							
15			SS 7	9-12-15	27				
20			SS 8	8-7-9	16				
		Bottom of hole at 20.0 feet.							



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 Fax: 561-737-9975

BORING NUMBER B-5

PAGE 1 OF 1

CLIENT CH2M Hill

PROJECT NUMBER 126.26

PROJECT NAME VFD Wastewater Pump Station Upgrades

PROJECT LOCATION Flagler Avenue and 14th Street, City of Key West, FL

DATE STARTED 2/25/14 COMPLETED 2/25/14 SURFACE ELEVATION REFERENCE Same as road crown

DRILLING METHOD Standard Penetration Boring GROUND WATER LEVELS:

LOGGED BY P. Tyson CHECKED BY C. Gworek ∇ AT TIME OF DRILLING 3.2 ft

APPROXIMATE LOCATION OF BORING As located on site plan

TEST NUTTING BOREHOLE 2-126.26.7 CH2M HILL - VFD WASTEWATER PUMP STATION UPGRADES (A, B, C, D, AND DA) GPJ_GINT US GDT 4/9/14

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL — MC — LL 20 40 60 80 <input type="checkbox"/> FINES CONTENT (%) <input type="checkbox"/> 20 40 60 80			
0		2-inch ASPHALT Tan LIMESTONE FRAGMENTS, little quartz fine sand	AU 1						
			AU 2						
5		Lt. tan quartz medium SAND and CEMENTED SAND, little shell	SS 3	13-12-11-11	23				
			SS 4	15-18-17-11	35				
			SS 5	10-9-8-8	17				
10			SS 6	9-7-10-11	17				
		CEMENTED SAND, little shell, trace quartz medium sand							
15			SS 7	10-9-8	17				
20			SS 8	7-8-7	15				
		Bottom of hole at 20.0 feet.							



1310 Neptune Drive
 Boynton Beach, FL 33426
 Telephone: 561-736-4900
 Fax: 561-737-9975

CLIENT CH2M Hill PROJECT NUMBER 126.26
 PROJECT NAME VFD Wastewater Pump Station Upgrades
 PROJECT LOCATION Palm Avenue and Eisenhower Drive, City of Key West, FL

DATE STARTED 2/25/14 COMPLETED 2/25/14 SURFACE ELEVATION REFERENCE Approx. 6" above road crown
 DRILLING METHOD Standard Penetration Boring GROUND WATER LEVELS:
 LOGGED BY P. Tyson CHECKED BY C. Gworek ▽ AT TIME OF DRILLING 3.3 ft
 APPROXIMATE LOCATION OF BORING As located on site plan

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL ——— MC ——— LL 20 40 60 80			
						□ FINES CONTENT (%) □			
						20 40 60 80			
0		Tan LIMESTONE FRAGMENTS, trace clayey sand	AU 1						
		Lt. tan silty quartz fine SAND	AU 2						
		▽ Lt. tan SILT							
5			SS 3	1-0-0-1	0				
		Tan quartz medium SAND, some cemented sand, little shell	SS 4	1-0-9-11	9				
			SS 5	18-21-33-41	54				>>
10			SS 6	44-37-29-33	66				>>
		Tan slightly silty CEMENTED SAND, little shell, some quartz fine sand							
			SS 7	21-27-23	50				
15									
			SS 8	18-27-19	46				▲
20		Bottom of hole at 20.0 feet.							

TEST NUTTING BOREHOLE 2-126.26.3 CH2M HILL - VFD WASTEWATER PUMP STATION UPGRADES (A, B, C, D, & DA) GPJ GINT US GDT 4/9/14

LIMITATIONS OF LIABILITY

WARRANTY

We warrant that the services performed by Nutting Engineers of Florida, Inc. are conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession in our area currently practicing under similar conditions at the time our services were performed. **No other warranties, expressed or implied, are made.** While the services of Nutting Engineers of Florida, Inc. are a valuable and integral part of the design and construction teams, we do not warrant, guarantee or insure the quality, completeness, or satisfactory performance of designs, construction plans, specifications we have not prepared, nor the ultimate performance of building site materials or assembly/construction.

SUBSURFACE EXPLORATION

Subsurface exploration is normally accomplished by test borings; test pits are sometimes employed. The method of determining the boring location and the surface elevation at the boring is noted in the report. This information is represented in the soil boring logs and/or a drawing. The location and elevation of the borings should be considered accurate only to the degree inherent with the method used and may be approximate.

The soil boring log includes sampling information, description of the materials recovered, approximate depths of boundaries between soil and rock strata as encountered and immediate depth to water data. The log represents conditions recorded specifically at the location where and when the boring was made. Site conditions may vary through time as will subsurface conditions. The boundaries between different soil strata as encountered are indicated at specific depths; however, these depths are in fact approximate and dependent upon the frequency of sampling, nature and consistency of the respective strata. Substantial variation between soil borings may commonly exist in subsurface conditions. Water level readings are made at the time and under conditions stated on the boring logs. Water levels change with time, precipitation, canal level, local well drawdown and other factors. Water level data provided on soil boring logs shall not be relied upon for groundwater based design or construction considerations.

LABORATORY AND FIELD TESTS

Tests are performed in *general* accordance with specific ASTM Standards unless otherwise indicated. All criteria included in a given ASTM Standard are not always required and performed. Each test boring report indicates the measurements and data developed at each specific test location.

ANALYSIS AND RECOMMENDATIONS

The geotechnical report is prepared primarily to aid in the design of site work and structural foundations. Although the information in the report is expected to be sufficient for these purposes, it shall not be utilized to determine the cost of construction nor to stand alone as a construction specification. Contractors shall verify subsurface conditions as may be appropriate prior to undertaking subsurface work.

Report recommendations are based primarily on data from test borings made at the locations shown on the test boring reports. Soil variations commonly exist between boring locations. Such variations may not become evident until construction. Test pits sometimes provide valuable supplemental information that derived from soil borings. If variations are then noted, the geotechnical engineer shall be contacted in writing immediately so that field conditions can be examined and recommendations revised if necessary.

The geotechnical report states our understanding as to the location, dimensions and structural features proposed for the site. **Any significant changes of the site improvements or site conditions must be communicated in writing to the geotechnical engineer immediately** so that the geotechnical analysis, conclusions, and recommendations can be reviewed and appropriately adjusted as necessary.

CONSTRUCTION OBSERVATION

Construction observation and testing is an important element of geotechnical services. The geotechnical engineer's field representative (G.E.F.R.) is the "owner's representative" observing the work of the contractor, performing tests and reporting data from such tests and observations. **The geotechnical engineer's field representative does not direct the contractor's construction means, methods, operations or personnel.** The G.E.F.R. does not interfere with the relationship between the owner and the contractor and, except as an observer, does not become a substitute owner on site. The G.E.F.R. is responsible for his/her safety, but has no responsibility for the safety of other personnel at the site. The G.E.F.R. is an important member of a team whose responsibility is to observe and test the work being done and report to the owner whether that work is being carried out in general conformance with the plans and specifications. The enclosed report may be relied upon solely by the named client.

SOIL AND ROCK CLASSIFICATION CRITERIA

SAND/SILT

N-VALUE (bpf)	RELATIVE DENSITY
0 – 4	Very Loose
5 – 10	Loose
11 – 29	Medium
30 – 49	Dense
>50	Very dense
100	Refusal

CLAY/SILTY CLAY

N-VALUE (bpf)	UNCONFINED COMP. STRENGTH (tsf)	CONSISTENCY
<2	<0.25	v. Soft
2 – 4	0.25 – 0.50	Soft
5 – 8	0.50 – 1.00	Medium
9 – 15	1.00 – 2.00	Soft
16 – 30	2.00 – 4.00	v. Stiff
>30	>4.00	Hard

ROCK

N-VALUE (bpf)	RELATIVE HARDNESS	ROCK CHARACTERISTICS
$N \geq 100$	Hard to v. hard	Local rock formations vary in hardness from soft to very hard within short vertical and horizontal distances and often contain vertical solution holes of 3 to 36 inch diameter to varying depths and horizontal solution features. Rock may be brittle to split spoon impact, but more resistant to excavation.
$25 \leq N \leq 100$	Medium hard to hard	
$5 \leq N \leq 25$	Soft to medium hard	

PARTICLE SIZE

Boulder	>12 in.
Cobble	3 to 12 in.
Gravel	4.76 mm to 3 in.
Sand	0.074 mm to 4.76 mm
Silt	0.005 mm to 0.074 mm
Clay	<0.005 mm

DESCRIPTION MODIFIERS

0 – 5%	Slight trace
6 – 10%	Trace
11 – 20%	Little
21 – 35%	Some
>35%	And

Major Divisions		Group Symbols	Typical names	Laboratory classification criteria		
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 Not meeting all gradation requirements for GW	
		Poorly graded gravels, gravel-sand mixtures, little or no fines	GP			
		Gravels with fines (Appreciable amount of fines)	GW*	$\frac{d}{u}$	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 Not meeting all gradation requirements for SW	
		Poorly graded sands, gravelly sands, little or no fines	SP			
Sands with fines (Appreciable amount of fines)		SM*	$\frac{d}{u}$	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual system.	
		SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. more than 7	
Fine-grained soils (More than half of material is smaller than No. 200 sieve size)	Silt and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	<p style="text-align: center;">Plasticity Chart</p>		
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
		OL	Organic silts and organic silty clays of low plasticity			
	Silt and clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
		CH	Inorganic clays or high plasticity, fat clays			
		OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils	PT	Peat and other highly organic soils			

**SECTION 31 23 19.01
DEWATERING**

PART 1 GENERAL

1.01 SUBMITTALS

- A. Quality Control Submittals: Copies of any authorization and permits required to perform work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor shall be responsible for design, installation, and operation of a dewatering system to keep excavations and trenches free of water.
- B. Remove and control water during periods when necessary to properly accomplish Work.
- C. Prior to beginning work, the Contractor shall develop a dewatering method and submit it to the Engineer and the Owner. The Contractor's dewatering method shall take into account limitations in the existing operating conditions of the Owner's sewage collection and pumping facilities. Final acceptance of the Contractor's dewatering method will be based on demonstrated performance of the system to satisfy the requirements of dewatering as specified herein.
- D. The Contractor shall not discharge water into the storm sewer system. The Contractor shall discharge water into the sanitary sewer system and prescreening is to be provided to prevent excess sand or trench materials from entering the system. The Contractor shall provide an acceptable plan to receive approval from the City of Key West prior to discharging into the sanitary sewer system.
- E. The Contractor shall be responsible and bear the cost for any sanitary sewer system breakdowns and associated repair costs if they are directly attributed to his dewatering operation.
- F. If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, then loosening of the foundation material, instability of the slopes, or damage to the foundations or structures may occur, or other additional work or handling of materials may be required of the Contractor. The supply of all labor, materials, and equipment, and the performance of all

work necessary to carry out additional work resulting from such inadequacy, premature shutdown, or failure of the dewatering system shall be undertaken by the Contractor to the satisfaction of the Engineer, and at no additional expense to the Owner.

- G. Dewatering shall be considered incidental to the construction and included in the applicable unit prices stated in the Proposal.

3.02 DEWATERING SYSTEMS

- A. Contractor shall design, furnish, install, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in dry and to lower and maintain groundwater level a minimum of 2 feet below the lowest point of excavation. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.
- B. For excavations and trenches, dewatering systems shall include equipment and appurtenances installed outside structural limits and sufficiently below lowest point of excavation when possible, or to maintain specified groundwater elevation.
- C. Design and Operate Dewatering Systems:
 - 1. To prevent loss of ground as water is removed.
 - 2. To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.
 - 3. To relieve artesian pressures and resultant uplift of excavation bottom.

3.03 DISPOSAL OF WATER

- A. Obtain discharge permit for water disposal from authorities having jurisdiction.
- B. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge.
- C. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property. Drainage of trench water through the pipeline under construction is prohibited.
- D. Remove solids from treatment facilities and perform other maintenance of treatment facilities as necessary to maintain their efficiency.

3.04 WELL POINT REMOVAL

- A. If well points are used, after removing the well point dewatering system, well point holes shall be filled with sand which shall be washed into the hole. Well point holes located in asphalt pavement surfaces or concrete pavements shall be filled with sand to the subgrade and the remaining portion of holes shall be filled with nonshrink grout.

3.05 CLEANING OF WASTEWATER PUMP STATION WET WELLS

- A. After all work has been completed, and before final acceptance, the Contractor shall clean the wet wells of the wastewater pump stations that receive flow from the sanitary sewers into which the Contractor discharged water from his dewatering operations. The Contractor is advised that the cleaning can only be performed during periods of low wastewater flow into the stations. The Contractor shall coordinate the cleaning with the Owner at least two weeks in advance of the cleaning operations.
- B. Cleaning of the wet wells shall be considered incidental to the construction and included in the applicable unit prices stated in the Proposal.

3.06 ALTERNATE METHODS OF CONSTRUCTION

- A. A combination of extremely porous substrata and relatively high ground water table exist at the sites of the proposed work. It is recognized that it may be very difficult and costly to dewater excavations. In view of this, the foregoing requirements for dewatering may be waived if the Contractor, at his option, chooses to employ an alternate method of construction. Prior to his selection of an alternate method of construction, the Contractor shall demonstrate that all reasonable means to dewater the excavation have been employed without success and shall obtain the concurrence of the Owner that the method selected is applicable to the conditions existing in the particular area. Concurrence by the Owner of the method selected, shall by no means relieve the Contractor of his obligation to install the system in accordance with the Contract Documents and to provide a completed functioning system.
- B. Any alternate method of construction proposed by the Contractor shall include provision such that the trenches shall be undercut a minimum of 8 inches. The resulting excavation shall then be backfilled with approved pipe bedding material.

- C. No additional payment will be made to the Contractor for excavation, backfill, sheeting, or any costs incurred for work or materials, or any other costs incurred, as a result of alternate methods of construction selected by the Contractor, but the prices established in the Proposal shall be full payment for the various items of work to be done.
- D. The alternate method of construction, if selected by the Contractor, shall in no way be construed as relieving the Contractor of his basic responsibility for satisfactory completion of the work in accordance with these Contract Documents.

END OF SECTION

**SECTION 31 23 23.15
TRENCH BACKFILL**

PART 1 GENERAL

1.01 DEFINITIONS

- A. Bedding Material: Granular material upon which pipes, conduits, cables, or duct banks are placed.
- B. Imported Material: Material obtained by Contractor from source(s) offsite.
- C. Lift: Loose (uncompacted) layer of material.
- D. Optimum Moisture Content: shall be determined by the ASTM standard specified to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the 3/4-inch sieve.
- E. Pipe Zone: Backfill zone that includes full trench width and extends from prepared trench bottom to an upper limit above top outside surface of pipe, conduit, cable or duct bank.
- F. Prepared Trench Bottom: Graded trench bottom after excavation and installation of stabilization material, if required, but before installation of bedding material.
- G. Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D1557. Corrections for oversize material may be applied to either as-compacted field dry density or maximum dry density, as determined by Engineer.
- H. Selected Backfill Material: Material available onsite that Engineer determines to be suitable for a specific use.
- I. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes producing a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Manufacturer’s descriptive literature for marking tapes.

B. Quality Control Submittals:

1. Certified Gradation Analysis: Submit not less than 30 days prior to delivery for imported materials or anticipated use for excavated materials, except for trench stabilization material that will be submitted prior to material delivery to Site.

PART 2 PRODUCTS

2.01 MARKING TAPE

A. Detectable:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.
2. Foil Thickness: Minimum 0.35 mils.
3. Laminate Thickness: Minimum 5 mils.
1. Width: 3 inches.
4. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
5. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.
6. Manufacturers and Products:
 - a. Reef Industries; Terra Tape, Sentry Line detectable.
 - b. Mutual Industries; detectable tape.
 - c. Presco; detectable tape.

B. Color: In accordance with APWA Uniform Color Code for Temporary Marking of Underground Facilities.

Color*	Facility
Red	Electric power lines, cables, conduit, and lightning cables
Orange	Communicating alarm or signal lines, cables, or conduit
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Green	Sewers and drain lines
Blue	Potable water
Purple	Reclaimed water, irrigation, stormwater and slurry lines
*As specified in NEMA Z535.1, Safety Color Code.	

2.02 TRENCH STABILIZATION MATERIAL

- A. Granular Backfill: Shall be 2-1/2 inches minus crushed rock, reasonably well-graded from coarse to fine, and free from excessive dirt or other organic material with no more than 2 percent by weight passing the No. 200 sieve. The material shall be non-plastic and shall be wrapped in Geotextile.

2.03 BEDDING MATERIAL AND PIPE ZONE MATERIAL

- A. Friable, free from dirt, and no clay balls, roots, or other organic material. Free from organic material shall be interpreted as less than or equal to 2.5 percent organic material by weight and containing no roots with caliper greater than 1/2 inch.
- B. 1-inch minus crushed rock or sand.
- C. Well-graded from coarse to fine and containing sufficient fines to bind material when compacted, with maximum 3 percent by weight passing the No. 200 sieve.

2.04 TRENCH BACKFILL

- A. Excavated material from required excavations free from rocks larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.
- B. Provide imported material of equivalent quality, if required to accomplish work.

2.05 SOURCE QUALITY CONTROL

- A. Contractor's testing laboratory to perform gradation analysis in accordance with ASTM C136:
- B. Certify Laboratory Performance of Mix Designs: Concrete.

PART 3 EXECUTION

3.01 TRENCH PREPARATION

- A. Water Control:
 - 1. As specified in Section 31 23 19.01, Dewatering.
 - 2. Remove water in a manner that minimizes soil erosion from trench sides and bottom.
 - 3. Provide continuous water control until trench backfill is complete.

- B. Remove foreign material and backfill contaminated with foreign material that falls into trench.

3.02 TRENCH BOTTOM

- A. Firm Subgrade: Grade with hand tools, remove loose and disturbed material, and trim off high areas and ridges left by excavating bucket teeth. Allow space for bedding material if shown or specified.
- B. Soft Subgrade: If subgrade is encountered that may require removal to prevent pipe settlement, notify Engineer. Engineer will determine depth of overexcavation, if any required.

3.03 TRENCH STABILIZATION MATERIAL INSTALLATION

- A. Rebuild trench bottom with trench stabilization material.
- B. Place material over full width of trench in 6-inch lifts to required grade, providing allowance for bedding thickness.
- C. Compact each lift so as to provide a firm, unyielding support for the bedding material prior to placing succeeding lifts.

3.04 BEDDING

- A. Furnish imported bedding material where, in the opinion of Engineer, excavated material is unsuitable for bedding or insufficient in quantity.
- B. Place over the full width of the prepared trench bottom in two equal lifts when the required depth exceeds 8 inches.
- C. Hand grade and compact each lift to provide a firm, unyielding surface.
- D. Minimum Thickness: As follows
 - 1. Conduit: 4 inches.
 - 2. Direct-Buried Cable: 4 inches.
 - 3. Duct Banks: 4 inches.
- E. Check grade and correct irregularities in bedding material. Loosen top 1 inch to 2 inches of compacted bedding material with a rake or by other means to provide a cushion before laying each section of pipe, conduit, direct-buried cable, or duct bank.
- F. Install to form continuous and uniform support except at bell holes, if applicable, or minor disturbances resulting from removal of lifting tackle.

- G. Bell or Coupling Holes: Excavate in bedding at each joint to permit proper assembly and inspection of joint and to provide uniform bearing along barrel of pipe or conduit.

3.05 BACKFILL PIPE ZONE

- A. Upper limit of pipe zone shall not be less than following:
 - 1. Conduit: 3 inches, unless shown otherwise.
 - 2. Direct-Buried Cable: 3 inches, unless shown otherwise.
 - 3. Duct Bank: 3 inches, unless shown otherwise.
- B. Restrain pipe, conduit, cables, and duct banks as necessary to prevent their movement during backfill operations.
- C. Place material simultaneously in lifts on both sides of pipe and, if applicable, between pipes, conduit, cables, and duct banks installed in same trench.
 - 1. Pipe 10-Inch and Smaller Diameter: First lift less than or equal to 1/2 pipe diameter.
- D. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.
- E. After the full depth of the pipe zone material has been placed as specified, compact the material by a minimum of three passes with a vibratory plate compactor only over the area between the sides of the pipe and the trench walls.
- F. Do not use power-driven impact compactors to compact pipe zone material. Care shall be taken to prevent damage to the pipe. Deflection of pipe shall be kept to a minimum and in no case shall it exceed 5 percent of the pipe inside diameter.

3.06 MARKING TAPE INSTALLATION

- A. Continuously install marking tape along centerline of all buried piping, on top of last lift of pipe zone material. Coordinate with piping installation drawings.
 - 1. Detectable Marking Tape: Install with nonmetallic piping. Use connecting clips.

3.07 BACKFILL ABOVE PIPE ZONE

A. General:

1. Process excavated material to meet specified gradation requirements.
2. Adjust moisture content as necessary to obtain specified compaction.
3. Do not allow backfill to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over the top of pipe.
4. Do not use power driven impact type compactors for compaction until at least 4 feet of backfill is placed over top of pipe.
5. Backfill to grade with proper allowances for crushed rock surfacing, and pavement thicknesses, wherever applicable.
6. Backfill around structures with same class backfill as specified for adjacent trench unless otherwise shown or specified.

- B. Trench Backfill: Place in lifts not to exceed 6 inches. Compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

3.08 UTILITY LINE CROSSINGS

- A. Crushed stone backfill in accordance with Paragraph Bedding Material and Pipe Zone Material shall be used under all culverts, water, gas, gravity sewer lines, force mains, buried telephone conduit, and any other miscellaneous buried pipelines that cross the excavated trench. Crushed stone backfill shall be carried a minimum of 2 feet beyond the edge of the buried utility. Crushed stone backfill beneath these facilities shall be considered incidental to the work and no additional payment will be made to the Contractor.

3.09 MAINTENANCE OF TRENCH BACKFILL

- A. After each section of trench is backfilled, maintain the surface of the backfilled trench even with the adjacent ground surface until final surface restoration is completed.
- B. Concrete Pavement: Replace settled.
- C. Asphaltic Pavement: Replace settled areas or fill with asphalt as specified in Section 32 12 16, Asphalt Paving.
- D. Other Areas: Add excavated material where applicable and keep the surface of the backfilled trench level with the adjacent ground surface.

3.10 SETTLEMENT OF BACKFILL

- A. Settlement of trench backfill, or of fill, or facilities constructed over trench backfill will be considered a result of defective compaction of trench backfill and shall be corrected at no cost to the Owner. Structures damaged by settlement shall be restored to their original condition by the Contractor at no cost to the Owner.

END OF SECTION

SECTION 31 62 16.23
HELICAL PILES AND ANCHORS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work specified herein consists of designing, furnishing, and installing helical piles, anchors, brackets, and all required appurtenance to support the proposed concrete mat foundation at Pump Station C.
- B. The Work shall be done by a Specialty Contractor with relevant experience designing, installing and testing helical pile foundation. Specialty Contractor shall produce design calculations, drawings, and specifications signed and sealed by a professional Engineer registered in the State of Florida.
- C. Contractor shall provide proof that the helical piles will be able to support the required loading.

1.02 REFERENCES

- A. Nutting Engineers of Florida Inc. – Report of Geotechnical Exploration, VFD Wastewater Pump Station Upgrades Palm Ave. & Eisenhower Dr., Key West, Florida dated March 17, 2014.
- B. The following is a list of standards which may be referenced in this section:
 - 1. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. ASTM A123, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 - c. ASTM A153, Standard Specification for Zinc Coating (Hot Dip) for Iron and Steel Hardware.
 - d. ASTM A450, Standard Specification for General Requirements for Carbon and Low Alloy Steel Tubes.
 - e. ASTM A588, Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 inch (100 mm) Thick.
 - f. ASTM A913, Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST).
 - g. ASTM A992, Standard Specification for Structural Steel Shapes.
 - h. ASTM B633, Standard Specification for Electro deposited Coatings of Zinc on Iron and Steel.

- i. ASTM B695, Standard Specification for Coating of Zinc Mechanically Deposited on Iron and Steel.
- j. ASTM D1143, Standard Test Method for Piles Under Static Axial Compressive Load.
- 2. American Society of Mechanical Engineers (ASME): ANSI/ASME Standard B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flanged, Lobed Head, and Lag Screws (Inch Series).
- 3. American Welding Society:
 - a. AWS B2.1, Standard for Welding Procedures and Performance Qualification.
 - b. AWS D1.1, Structural Welding Code - Steel.
 - c. AWS D1.5, Bridge Welding Code.
- 4. SSPC: The Society for Protective Coatings:
 - a. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
 - b. SSPC SP 5, White Metal Blast Cleaning.

1.03 DEFINITIONS

- A. Design Position: The location of the centroid of the pile at bottom of footing elevation (x, y, and z coordinates) as shown.
- B. Specialty Contractor: The person/firm responsible for performing the Helical Pile work.
- C. Coupling: Central steel shaft connection means formed as integral part of the plain extension shaft material. For Type SS & RS Helical Piles, couplings are internal or external sleeves, or hot upset forged sockets.
- D. Coupling Bolt(s): High strength, structural steel fasteners used to connect Helical Pile segments together. For Type SS segments, the coupling bolt transfers axial load. For Type RS segments, the coupling bolts transfer both axial and torsional forces.
- E. Helical Piles: Piles that consist of a central steel tube containing single or multiple helical bearing plates which are designed to resist axial compression. The helical pile is typically constructed by rotating into the ground using a direct-drive hydraulic motor mounted on a suitable piece of equipment.
- F. Helical Extension: Helical Pile foundation component installed immediately following the lead or starter section, if required. This component consists of one or more helical plates welded to a central steel shaft of finite length. Function is to increase bearing area.

- G. Helix Plate: Generally round steel plate formed into a ramped spiral. The helical shape provides the means to install the helical pile, plus the plate transfers load to soil in end bearing. Helix plates are available in various diameters and thickness.
- H. Installation Torque: The resistance generated by a Helical Pile when installed into soil. The installation resistance is a function of the soil type, and size and shape of the various components of the Helical Pile.
- I. Lead Section: The first Helical Pile foundation component installed into the soil, consisting of single or multiple helix plates welded to a central steel shaft. A.k.a. Starter Section.
- J. Pile Cap: Connection means by which structural loads are transferred to the Helical Pile. The type of connection varies depending upon the requirements of the project and type of Helical Pile material used.
- K. Round Shaft (RS): Round steel pipe central Shaft elements ranging in diameter from 2-7/8 inches to 5 inches.
- L. Plain Extension: Central steel shaft segment without helix plates. It is installed following the installation of the lead section or helical extension (if used). The segments are connected with integral couplings and bolts. Plain extensions are used to extend the helix plates beyond the specified minimum depth and into competent load bearing stratum.
- M. Safety Factor: The ratio of the ultimate capacity to the working or design load used for the design of any structural element.
- N. Square Shaft (SS): Solid steel, round-cornered-Square central Shaft elements ranging in size from 1-1/4 inches to 2-1/4 inches.
- O. Torque Strength Rating: The maximum torque energy that can be applied to the helical pile foundation during installation in soil, a.k.a. allowable, or safe torque.
- P. Elevations: Referenced to NAVD88.
- Q. Obstruction: Sudden and significant increase of penetration resistance and deviation of pile out of tolerance resulting from encountering a subsurface or physical condition.

1.04 PERFORMANCE REQUIREMENTS

- A. Each helical pile carries an estimated maximum total load of 15 tons, with a total service load of 120 tons for the entire structure. Design pile to carry the estimated maximum load using a Safety Factor of 2. Capacity determination to be based on measured torsional force for each pile.
- B. Design Life: 50 years.

1.05 SUBMITTALS

- A. Submit the following information at least 7 calendar days prior to planned start of installation:
 - 1. Design Calculations for the helical piles, helical anchors, and brackets intended for use on the project. Design calculations shall consider downdrag and buckling, as appropriate.
 - 2. Shop Drawings and specifications of products.
 - 3. Pile configuration plan.
 - 4. Manufacture's recommended capacity to installation torque ratio and correlations between hydraulic drive pressure and torque delivered to pile head.
 - 5. Minimum final installation torque to achieve design capacity.
 - 6. Product Data: Submit details of collars, tips, helixes, connections, attachments, and corrosion protection coating.
 - 7. Proposed method(s) to align and maintain pile alignment, including type of leads to be used with details on methods and equipment to be used to measure alignment.
 - 8. Calibration information certified by an independent testing agency for the torque measurement device and all load testing and monitoring equipment to be used on the project. Calibration certification shall be no older than 1 year.
- B. Project Record Documents:
- C. Daily Log and Record: At end of each working day, submit two copies of each record for every pile installed that day.
 - 1. Sizes, lengths, ground surface or reference elevations and design position of piles.
 - 2. Helix diameter and pitch.
 - 3. Identify piles that require downhole hammer including depths.
 - 4. Final toe and top elevations and include elevation of (each) helix.
 - 5. Torque vs. depth at increments no greater than 5 feet within fill material, and 1 foot within native soil.

1.06 STORAGE AND HANDLING

- A. Do not subject piles to damage by impact bending stresses in transporting to and storing piles onsite.
- B. Store and handle piles such that corrosion protection coatings will not be damaged.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Helical piles, brackets, bearing plates, shafts: As designed by Specialty Contractor's Professional Engineer; sizes and lengths as required to achieve design performance loads.
- B. Mechanical Splices: As designed by Specialty Contractor's Professional Engineer.
- C. Accessories: Points, driving system to fit top of pile.
- D. Corrosion Protection: Helical piles, brackets, anchors, plates, shafts, bolts and nuts shall be hot-dip galvanized.
- E. Products Warranty: Minimum one year warranty against manufacturing defects.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Specialty Contractor shall review Contract Drawings and geotechnical data to determine subsurface conditions for sizing and installing the piles.
- B. Confirm and establish the locations and extents of all underground structures, services and utilities in the work area prior to commencement of piling work. This may require potholing to determine the exact location of underground utilities. Clearly mark such locations to prevent disturbance or damage.
- C. Use installation method which will not cause damage to nearby structures or to completed work.
- D. Protect existing structures including overhead and buried utilities near the Work, from damage.
- E. Prepare to place piles from existing site elevations or excavated working elevation, as proposed.

F. Field Touchup Pile Coating:

1. Provide touchup system for repair of coating defects compatible with shop coating.
2. Before installation, touchup abraded surfaces in coating. Clean and touchup field welds.
3. Apply touchup coating to match shop coating.

3.02 HYDRAULIC DRIVER

- A. Use hydraulic driver and equipment with adequate torque and crowd pressure to install piles to the required feet into bearing layer and capacities shown on the Drawings.
- B. Keep hydraulic driver in good mechanical condition.
- C. Operate hydraulic driver at speed and crowd pressure recommended by manufacturer.
- D. Record pertinent information during pile installation including rotation speed, crowd pressure, penetration rate (inches/minute), and any outstanding issues such as wobble, noise, rubble or rock encountered.

3.03 INSTALLATION

- A. Install piles only in presence of Engineer and Specialty Contractor's Professional Engineer.
- B. Use the type of driving/installation equipment capable of supporting pile firmly in vertical position or to required batter.
- C. Align top of pile normal to driving force of pile, limit crowd pressure to minimize bowing of pile during installation.
- D. Where groups of piles are required, install center pile of group first and then install remaining piles in group progressing outward from center.
- E. When installation resistance prohibits advancing pile to required minimum tip penetration, provide pre-drilled hole, downhole hammer, or use other means as necessary and as approved by the Engineer to advance pile to required minimum tip penetration. Pre-drilling or pre-auguring hole of maximum diameter 10 percent smaller than the pile shaft dimension may be used to advance pile past obstruction and to penetration no deeper than required minimum tip penetration.

- F. Deliver rotational torque directly to central axis of pile.
- G. Re-install piles which have lifted due to installation of adjacent piles, or by soil uplift.
- H. Do not damage piles during installation or handling operations.
- I. Cut off tops of piles to elevations indicated and prepare pile top to receive pile caps attachments.
- J. Compact soil around top of pile to correct heave and/or annular space surrounding pile.

3.04 TERMINATION CRITERIA

- A. Helical piles and anchors shall be advanced until all of the following criteria are satisfied:
 - 1. Axial capacity is verified by achieving the final installation torque as provided by the Specialty Contractor's Design Engineer.
 - 2. Minimum depth: Five feet into competent material in which the installation torque exceeds the required final installation torque.

3.05 ERECTION TOLERANCES

- A. Maximum Variation from Vertical for Plumb Piles: 1 in 60.
- B. Maximum Variation from Pile Cut-Off Elevation: 1 inch.
- C. Maximum Out-of-Position: 2 inches.

3.06 FIELD QUALITY CONTROL

- A. Unacceptable Piles: Piles that have installation deficiencies, are placed out of position, are below cut-off elevations, does not reach final installation torque, or are damaged during transport, handling or installation.
- B. Provide additional piles or replace piles to conform to specified requirements.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M17, Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
 - b. M81, Standard Specification for Cut-Back Asphalt (Rapid Curing Type).
 - c. M82, Standard Specification for Cut-Back Asphalt (Medium Curing Type).
 - d. M140, Standard Specification for Emulsified Asphalt.
 - e. M208, Standard Specification for Cationic Emulsified Asphalt.
 - f. T166, Standard Method of Test for Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens.
 - g. T176 Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.
 - h. T230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.
 - i. T245, Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
 - j. T246, Standard Method of Test for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
 - k. T247, Standard Method of Test for Preparation of Test Specimens of Bituminous Mixtures by Means of California Kneading Compactor.
 - l. T283, Standard Method of Test for Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.
 - m. T304, Standard Method of Test for Uncompacted Void Content of Fine Aggregate (Method A).
2. Asphalt Institute (AI):
 - a. Manual Series No. 2 (MS-2), Mix Design Methods for Asphalt Concrete.
 - b. Superpave Series No. 2 (SP-2), Superpave Mix Design.

3. ASTM International (ASTM):
 - a. D2041, Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
 - b. D4318, Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - c. D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
 - d. D5821, Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
 - e. E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.02 DEFINITIONS

- A. Combined Aggregate: All mineral constituents of asphalt concrete mix, including mineral filler and separately sized aggregates.
- B. RAP: Reclaimed asphalt pavement.
- C. Standard Specifications: Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.03 DESIGN REQUIREMENTS

- A. Prepare asphalt concrete mix design, meeting the design criteria, tolerances, and other requirements of Section 334 of the Standard Specifications.

1.04 SUBMITTALS

- A. Informational Submittals:
 1. Asphalt Concrete Mix Formula:
 - a. Submit minimum of 15 days prior to start of production.
 - b. Submittal to include the following information: Properties as stated in Section 334 of the Standard Specifications.
 2. Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services, for the following materials:
 - a. Aggregate: Gradation, source test results as defined in Section 334 of the Standard Specifications.
 - b. Asphalt for Binder: Type, grade, and viscosity-temperature curve.
 - c. Prime Coat: Type and grade of asphalt.
 - d. Tack Coat: Type and grade of asphalt.
 - e. Additives.
 - f. Mix: Conforms to job-mix formula.

3. Statement of qualification for independent testing laboratory.
4. Test Results:
 - a. Mix design.
 - b. Asphalt concrete core.
 - c. Gradation and asphalt content of uncompacted mix.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Independent Testing Laboratory: In accordance with ASTM E329.
2. Asphalt concrete mix formula shall be prepared by approved certified independent laboratory under the supervision of a certified asphalt technician.

1.06 ENVIRONMENTAL REQUIREMENTS

- ##### A. Moisture: Do not apply asphalt materials or place asphalt mixes when application surface is wet.

PART 2 PRODUCTS

2.01 ASPHALT CONCRETE MIX

A. General:

1. Mix formula shall not be modified except with written approval of Engineer.
2. Source Changes:
 - a. Should material source(s) change, establish new asphalt concrete mix formula before new material(s) is used.
 - b. Make adjustments in gradation or asphalt content as necessary to meet design criteria.

- ##### B. Asphalt Concrete: as specified on the Drawings in accordance with Section 334 of the Standard Specifications.

- ##### C. Composition: Hot-plant mix of aggregate, mineral filler, if required, and paving grade asphalt cement. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that resulting mixture meets grading requirements of mix formula.

D. Aggregate:

1. General: As specified in Section 334 of the Standard Specifications

- ##### E. Mineral Filler: In accordance with Section 334 of the Standard Specifications.

- F. Asphalt Cement: Paving Grade as shown on the Drawings in accordance with Section 334 of the Standard Specifications.

PART 3 EXECUTION

3.01 GENERAL

- A. Traffic Control:
 - 1. In accordance with Section 01 50 00, Temporary Facilities and Controls.
 - 2. Minimize inconvenience to traffic, but keep vehicles off freshly treated or paved surfaces to avoid pickup and tracking of asphalt.
- B. Driveways: Repave asphalt driveways from which pavement was removed. Leave driveways in as good or better condition than before start of construction.

3.02 LINE AND GRADE

- A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.
- B. Shoulders: Construct to line, grade, and cross-section shown.

3.03 APPLICATION EQUIPMENT

- A. In accordance with Section 320 of the Standard Specifications.

3.04 PREPARATION

- A. Existing Roadway:
 - 1. Modify profile by grinding, milling, or overlay methods as approved, to provide meet lines and surfaces and to produce smooth riding connection to existing facility.
 - 2. Remove existing material to a minimum depth of 25 millimeters (1 inch).
 - 3. Paint edges of meet line with tack coat prior to placing new pavement.
- B. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

3.05 PAVEMENT APPLICATION

- A. General: Place asphalt concrete mixture on approved, compacted backfill in conformance with Section 31 23 23.15, Trench Backfill.

- B. Pavement Mix:
1. Prior to Paving:
 - a. Sweep primed surface free of dirt, dust, or other foreign matter.
 - b. Patch holes in primed surface with asphalt concrete pavement mix.
 - c. Blot excess prime material with sand.
 2. Place asphalt concrete pavement mix as specified on the Drawings.
 3. Total Compacted Thickness: As shown.
 4. Apply such that meet lines are straight and edges are vertical.
 5. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.
 6. Joints:
 - a. Offset edge of each layer a minimum of 150 millimeters (6 inches) so joints are not directly over those in underlying layer.
 - b. Offset longitudinal joints in roadway pavements so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.
 - c. Form transverse joints by cutting back on previous day's run to expose full vertical depth of layer.
 7. Succeeding Lifts: Apply tack coat to pavement surface between each lift.
 8. After placement of pavement, seal meet line by painting a minimum of 150 millimeters (6 inches) on each side of joint with cut-back or emulsified asphalt. Cover immediately with sand.
- C. Compaction: In accordance with Section 330 of the Standard Specifications.
- D. Tolerances:
1. General: In accordance with Section 330 of the Standard Specifications.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
 - a. A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
 - b. A313/A313M, Standard Specification for Stainless Steel Spring Wire.
 - c. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - d. A491, Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
 - e. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - f. A615/A615M, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - g. A780, Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings.
 - h. A824, Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence.
 - i. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - j. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - k. C150, Standard Specification for Portland Cement.
 - l. C387, Standard Specifications for Packaged, Dry, Combined Materials for Mortar and Concrete.
 - m. F552, Standard Terminology Relating to Chain Link Fencing.
 - n. F567, Standard Practice for Installation of Chain-Link Fence.
 - o. F626, Standard Specification for Fence Fittings.
 - p. F668, Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
 - q. F900, Standard Specification for Industrial and Commercial Swing Gates.

- r. F934, Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
 - s. F1043, Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
 - t. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
 - u. F1183, Standard Specifications for Aluminum Alloy Chain Link Fence Fabric.
 - v. F1184, Standard Specifications for Industrial and Commercial Horizontal Slide Gates.
 - w. F1379, Standard Terminology Relating to Barbed Tape.
 - x. F1911, Standard Practice for Installation of Barbed Tape.
 - y. F1916, Standard Specification for Selecting Chain Link Barrier Systems with Coated Chain Link Fence Fabric and Round Posts for Detention Applications.
- 2. Institute of Electrical and Electronic Engineers (IEEE), Inc.: C2, National Electrical Safety Code.
 - 3. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 volts max.).

1.02 DEFINITIONS

- A. Terms as defined in ASTM F552.

1.03 SUBMITTALS

- A. Action Submittals:

- 1. Shop Drawings:
 - a. Product Data: Include construction details, material descriptions, dimensions of individual components, and finishes for chain link fences and gates.
 - 1) Fence, gate posts, rails, and fittings.
 - 2) Chain link fabric.
 - 3) Gates and hardware.
 - 4) Accessories: Barbed wire.

- B. Informational Submittals:

- 1. Manufacturer's recommended installation instructions.
- 2. Evidence of supplier and installer qualifications.

1.04 QUALITY ASSURANCE

- A. Design, supply of equipment and components, installation, and on-call service shall be product of individual company with record of installations meeting requirements specified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Site in undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

1.06 SCHEDULING AND SEQUENCING

- A. Complete necessary Site preparation and grading before installing chain link fence and gates.
- B. Interruption of Existing Utility Service: Notify owner of utility 72 hours prior to interruption of utility services. Do not proceed with interruption of utility service without written permission from utility owner.

1.07 SPECIAL GUARANTEE

- A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of the following items found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.
 1. Faulty operations of gates.
 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 3. Deflection of fence fabric beyond limits.
 4. Loosening of posts and rails.

PART 2 PRODUCTS

2.01 GENERAL

- A. Match style, finish, and color of each fence component with that of other fence components and with the existing fence components at each site.

2.02 CHAIN LINK FENCE FABRIC

- A. Galvanized fabric conforming to ASTM A392, Type II, Class 2, 2.0 ounces per square foot; galvanized after weaving.
- B. PVC-coated or polymer-coated galvanized fabric conforming to ASTM F668, Class 1 or Class 2a over metallic-coated steel wire.
 1. Color: Green (match existing color), complying with ASTM F934.

- C. Height: Match existing fence height at each Site.
- D. Core Wire Gauge: No. 9.
- E. Pattern: 2-inch diamond-mesh.
- F. Diamond Count: Manufacturer's standard and consistent for fabric furnished of same height.
- G. Loops of Knuckled Selvages: Closed or nearly closed with space not exceeding diameter of wire.
- H. Wires of Twisted Selvages:
 - 1. Twisted in a closed helix three full turns.
 - 2. Cut at an angle to provide sharp barbs that extend minimum 1/4 inch beyond twist.

2.03 POSTS

A. General:

- 1. Strength and Stiffness Requirements: ASTM F1043, light industrial fence, except as modified in this section.
- 2. Round Steel Pipe, Schedule 40: ASTM F1083.
- 3. Roll-Formed Steel Shapes: Roll-formed from ASTM A1011/A1011M, Grade 45, High-Strength Low-Alloy steel.
- 4. Lengths: Manufacturer's standard with allowance for minimum embedment below finished grade of 34 inches.
- 5. Protective Coatings:
 - a. Zinc Coating: ASTM F1043, Type A external and internal coating.
- 6. Color Coating: ASTM F1043, minimum 10 mils thickness over zinc coating to match color of chain link fabric.

B. Line Posts:

- 1. Round Steel Pipe:
 - a. Outside Diameter: 2.375 inches.
 - b. Weight: 2.96 pounds per foot.

C. End, Corner, Angle, and Pull Posts:

- 1. Round Steel Pipe:
 - a. Outside Diameter: 2.875 inches.
 - b. Weight: 4.69 pounds per foot.

- D. Posts for Removable Fence Panels: As specified for end, corner, angle, and pull posts.
- E. Posts for Swing Gates 8 Feet High and Under:
 - 1. ASTM F900.
 - 2. Round Steel Pipe:
 - a. Outside Diameter: 2.875 inches.
 - b. Weight: 4.64 pounds per foot.

2.04 TOP AND BRACE RAILS

- A. Galvanized Round Steel Pipe:
 - 1. ASTM F1083.
 - 2. Outside Diameter: 1.66 inches.
 - 3. Weight: 2.27 pounds per foot.
- B. Galvanized Roll-Formed Steel C Shapes:
 - 1. Roll formed from ASTM A1011/A1011M, Grade 45.
 - 2. Outside Dimensions: 1.625 inches by 1.25 inches.
 - 3. Weight: 1.40 pounds per foot.
- C. Protective Coatings: As specified for posts.
- D. Color Coating: ASTM F1043, minimum 10-mil thickness over zinc coating to match color of chain link fabric.
- E. Strength and Stiffness Requirements: ASTM F1043, top rail, light industrial fence.

2.05 FENCE FITTINGS

- A. General: In conformance with ASTM F626, except as modified by this article.
- B. Post and Line Caps: Designed to accommodate passage of top rail through cap, where top rail required.
- C. Tension and Brace Bands: No exceptions to ASTM F626.
- D. Tension Bars:
 - 1. One-piece vinyl-clad.
 - 2. Length not less than 2 inches shorter than full height of chain link fabric.
 - 3. Provide one bar for each gate and end post, and two for each corner and pull post.

- E. Truss Rod Assembly: 3/8-inch diameter, steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- F. Tie Wires, Clips, and Fasteners: According to ASTM F626.

2.06 TENSION WIRE

- A. Zinc-coated steel marcelled tension wire conforming to ASTM A824 Type II, Class 2.

2.07 GATES

A. General:

1. Gate Operation: Opened and closed easily by one person.
2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1043 and ASTM F1083 for materials and protective coatings.
3. Frames and Bracing: Fabricate members from round galvanized steel tubing with outside dimension and weight according to ASTM F900.
4. Gate Fabric Height: Same as for adjacent fence height.
5. Welded Steel Joints: Paint with zinc-based paint.
6. Chain Link Fabric: Attached securely to gate frame at intervals not exceeding 15 inches.
7. Latches: Arranged for padlocking so padlock will be accessible from both sides of gate.

B. Swing Gates: Comply with ASTM F900 for double-swing gate types.

1. Leaf Width: As shown.
2. Hinges: Offset type, malleable iron.
 - a. Furnished with large bearing surfaces for clamping in position.
 - b. Designed to swing either 180 degrees outward, 180 degrees inward, or 90 degrees in or out, as shown, and not twist or turn under action of gate.
3. Latches: Plunger bar arranged to engage stop, except single gates of openings less than 10 feet wide may each have forked latch.
4. Gate Stops: Mushroom type or flush plate with anchors, suitable for setting in concrete.
5. Locking Device and Padlock Eyes: Integral part of latch, requiring one padlock for locking both leaves of double gate.
6. Hold-Open Keepers: Designed to automatically engage gate leaf and hold it in open position until manually released.

2.08 CONCRETE

- A. Provide as specified in Section 03 30 10, Reinforced Concrete.

2.09 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1-inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic welded type.
 - 2. Grounding Rods: Copper-clad steel.

PART 3 EXECUTION

3.01 GENERAL

- A. Install chain link fences and gates in accordance with ASTM F567, except as modified in this section, and in accordance with fence manufacturer's recommendations, as approved by Engineer. Erect fencing in straight lines between angle points.
- B. Provide necessary hardware for a complete fence and gate installation.
- C. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A780.

3.02 PREPARATION

- A. Clear area on either side of fence to the extent specified in Section 31 10 00, Site Clearing. Eliminate ground surface irregularities along fence line to the extent necessary to maintain a 2-inch clearance between bottom of fabric and finish grade.
- B. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- C. Embedment Coating: Coat portion of galvanized or aluminum-coated steel posts that will be embedded in concrete as specified in Section 09 90 04, Painting (Condensed). Extend coating 1 inch above top of concrete.

3.03 POST SETTING

- A. Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed soil. Driven posts are not acceptable. Postholes shall be clear of loose materials. Waste materials from postholes shall be removed from Site or regraded into slopes on Site.
- B. Posthole Depth:
 - 1. Minimum 3 feet below finished grade.
 - 2. 2 inches deeper than post embedment depth below finish grade.
- C. Set posts with minimum embedment below finished grade of 34 inches and with top rail at proper height above finished grade. Verify posts are set plumb, aligned, and at correct height and spacing. Brace posts, as necessary, to maintain correct position and plumbness until concrete sets.
- D. Backfill postholes with concrete to 2 inches above finished grade. Vibrate or tamp concrete for consolidation. Protect above ground portion of posts from concrete splatter.
- E. Before concrete sets, crown and finish top of concrete to readily shed water.
- F. Terminal Posts: Locate terminal end, corner, and gate posts in accordance with ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- G. Line Posts: Space line posts uniformly at 10 feet on centers between terminal end, corner, and gate posts.

3.04 POST BRACING

- A. Install according to ASTM F567, maintaining plumb position, and alignment of fencing. Install braces at gate, end, pull, and corner posts diagonally to adjacent line posts to ensure stability. Install braces on both sides of corner and pull posts.
 - 1. Locate horizontal braces at mid-height of fabric or higher, on fences with top rail, and 2/3-fabric height on fences without top rail. Install so posts are plumb when diagonal truss rod assembly is under proper tension.

3.05 TOP RAILS

- A. Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps and terminating into rail end attached to posts or posts caps fabricated to receive rail at terminal posts. Install top rail sleeves with springs at 105 feet maximum spacing to permit expansion in rail.

3.06 TENSION WIRE

- A. Install according to ASTM F567 and ASTM F1916, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with tie wires at a maximum spacing of 24 inches on center.
- B. Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

3.07 CHAIN LINK FABRIC

- A. Do not install fabric until concrete has cured minimum 7 days.
- B. Install fabric with twisted and barbed selvage at top.
- C. Apply fabric to outside of enclosing framework. Pull fabric taut to provide a smooth and uniform appearance free from sag, without permanently distorting fabric diamond or reducing fabric height. Tie fabric to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- D. Splicing shall be accomplished according to ASTM F1916 by weaving a single picket into the ends of the rolls to be joined.
- E. Leave 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated.
- F. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches on center.
- G. Tie Wires: Fasten ties to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends of tie wire three full twists, and cut off protruding ends to preclude untwisting by hand.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches on center and to brace and top rails at 24 inches on center.

3.08 GATES

- A. Install gates according to manufacturer's written instructions, level, plumb and secure for full opening without interference. Attach fabric and hardware to gate using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary so gates operate satisfactorily from open or closed position.
- B. Set gate stops in concrete to engage center drop rod or plunger bar.

3.09 ELECTRICAL GROUNDING

- A. Ground fences at a maximum interval of 1,000 feet in accordance with applicable requirements of IEEE C2, National Electrical Safety Code.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.
- C. Grounding Method: At each grounding location, drive a grounding rod vertically until top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

3.10 FIELD QUALITY CONTROL

- A. Post and Fabric Testing: Test fabric tension and line post rigidity according to ASTM F1916.
- B. Gate Tests:
 - 1. Prior to acceptance of installed gates, demonstrate proper operation of gates under each possible open and close condition specified.
 - 2. Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.
 - 3. Confirm that latches and locks engage accurately and securely without forcing and binding.

3.11 MANUFACTURER'S SERVICES

- A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, to train Owner's personnel to adjust, operate, and maintain gates.

3.12 CLEANUP

- A. Remove excess fencing materials and other debris from Site.

END OF SECTION

SECTION 32 31 14
ALUMINUM FENCE AND GATE

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section covers the work necessary for the aluminum fence and gate at the Pump Station B site.

1.02 GENERAL

- A. Like items of materials provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B. See Conditions of the Contract and Section 01 01 00, General Requirements, which contain information and requirements that apply to the Work specified herein and are mandatory for this Project.

1.03 SUBMITTALS

- A. Submittals shall be made in accordance with Section 01 01 00, General Requirements. In addition, the following specific information shall be provided:
 - 1. Shop Drawings: Submit Shop Drawings and installation drawings for the Engineer's review prior to fabrication and delivery. These Drawings shall provide detailed information and Specifications for all materials, finishes, dimensions, and erection instructions.

1.04 REFERENCE STANDARDS

- A. Aluminum fence style, gauge, height shall be in accordance with City of Key West Specifications and match fencing from the City's existing pumping station.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

- B. Materials shall be new and products of recognized, reputable manufacturers. Used, rerolled, or regalvanized materials are not acceptable.

2.02 GATES

- A. Gates shall be swing complete with latches, stops, keepers, hinges.
- B. Gate fabric shall be the same type as used in the fence construction. The fabric shall be attached securely to the gate frame at intervals not exceeding 15 inches.
- C. Gate hinges shall be of adequate strength for gate and with large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by one person.
- D. Gate latches, stops, and keepers shall be provided for all gates.

2.03 CONCRETE

- A. Materials as specified in Section 03 30 10, Reinforced Concrete. Proportions shall be 1:2:4. Compressive strength shall not be less than 2,000 psi at 28 days.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation of fencing shall meet the requirements of ASTM F567.

3.02 CLEANUP

- A. Upon completion of the fence installation, clean up all waste material resulting from the operation.

END OF SECTION

**SECTION 32 92 00
TURF AND GRASSES**

PART 1 GENERAL

1.01 DEFINITIONS

- A. Maintenance Period: Begin maintenance immediately after each area is planted (sod) and continue for a period of 8 weeks after all planting under this section is completed.
- B. Satisfactory Stand: Grass or section of grass that has:
 - 1. No bare spots larger than 3 square feet.
 - 2. Not more than 10 percent of total area with bare spots larger than 1 square foot.
 - 3. Not more than 15 percent of total area with bare spots larger than 6 square inches.

1.02 SUBMITTALS

- A. Action Submittals: Product labels/data sheets.
- B. Informational Submittals: Certification of sod; include source and harvest date of sod, and sod seed mix.

1.03 DELIVERY, STORAGE, AND PROTECTION

- A. Sod:
 - 1. Do not harvest if sod is excessively dry or wet to the extent survival may be adversely affected.
 - 2. Harvest and deliver sod only after laying bed is prepared for sodding.
 - 3. Roll or stack to prevent yellowing.
 - 4. Deliver and lay within 24 hours of harvesting.
 - 5. Keep moist and covered to protect from drying from time of harvesting until laid.

1.04 WEATHER RESTRICTIONS

- A. Perform Work under favorable weather and soil moisture conditions as determined by accepted local practice.

1.05 SEQUENCING AND SCHEDULING

- A. Lay sod at the completion of all other construction activities.

1.06 MAINTENANCE SERVICE

- A. Contractor: Perform maintenance operations during maintenance period to include:
 - 1. Watering: Keep surface moist.
 - 2. Washouts: Repair by filling with topsoil, liming, fertilizing, seeding, and mulching.
 - 3. Mulch: Replace wherever and whenever washed or blown away.
 - 4. Mowing: Mow to 2 inches after grass height reaches 3 inches, and mow to maintain grass height from exceeding 3-1/2 inches.
 - 5. Reseed unsatisfactory areas or portions thereof immediately at the end of the maintenance period if a satisfactory stand has not been produced.

PART 2 PRODUCTS

2.01 SOD

- A. Certified, containing grass mix:

<u>Species</u>	<u>Proportion By Weight</u>
St. Augustine Floratam	100

- B. Strongly rooted pads, capable of supporting own weight and retaining size and shape when suspended vertically from a firm grasp on upper 10 percent of pad.
 - 1. Grass Height: Normal.
 - 2. Strip Size: Supplier's standard.
 - 3. Soil Thickness: Uniform; 1 inch plus or minus 1/4 inch at time of cutting.
 - 4. Age: Not less than 10 months or more than 30 months.
 - 5. Condition: Healthy, green, moist; free of diseases, nematodes and insects, and of undesirable grassy and broadleaf weeds. Yellow sod, or broken pads, or torn or uneven ends will not be accepted.

PART 3 EXECUTION

3.01 PREPARATION

- A. Grade areas to smooth, even surface with loose, uniformly fine texture.
 - 1. Roll and rake, remove ridges, fill depressions to meet finish grades.
 - 2. Limit such Work to areas to be planted within immediate future.
 - 3. Remove debris, and stones larger than 1-1/2-inch diameter, and other objects that may interfere with planting and maintenance operations.

- B. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry off before seeding. Do not create muddy soil.
- C. Restore prepared areas to specified condition if eroded or otherwise disturbed after preparation and before planting.

3.02 SODDING

- A. Do not plant dormant sod.
- B. Lay sod to form solid mass with tightly fitted joints; butt ends and sides, do not overlap.
 - 1. Stagger strips to offset joints in adjacent courses.
 - 2. Work from boards to avoid damage to subgrade or sod.
 - 3. Tamp or roll lightly to ensure contact with subgrade; work sifted soil into minor cracks between pieces of sod, remove excess to avoid smothering adjacent grass.
 - 4. Complete sod surface true to finished grade, even, and firm.
- C. Water sod with fine spray immediately after planting. During first week, water daily or more frequently to maintain moist soil to depth of 4 inches.

END OF SECTION

SECTION 40 90 01
INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
 - a. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - b. A276, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
 - c. A312, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
 - d. B32, Standard Specification for Solder Metal.
 - e. B88, Standard Specification for Seamless Copper Water Tube.
 2. Instrumentation, Systems, and Automation Society (ISA):
 - a. S5.1, Instrumentation Symbols and Identification (NRC ADOPTED).
 - b. PR12.6, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.
 - c. S5.4, Standard Instrument Loop Diagrams.
 - d. S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
 - e. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.
 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. ICS 1, General Standards for Industrial Control and Systems.
 4. National Institute of Standards and Technology (NIST).
 5. Underwriters Laboratory, Inc. (UL): 508A, Standard for Safety, Industrial Control Panels.

1.02 SUMMARY

- A. Work Includes:
1. Engineering, furnishing, installing, calibrating, adjusting, testing, documenting, starting up, and Owner training for complete process instrumentation and control (PIC) for pump station.

2. Major parts are:
 - a. Provide new pump control panel for each of the following lift stations:
 - 1) Lift Station A: CP-A.
 - 2) Lift Station B: CP-B.
 - 3) Lift Station C: CP-C.
 - 4) Lift Station D: CP-D.
 - 5) Lift Station DA: CP-DA.
 - b. New bubbler system and local pump controller for each lift station.
 - c. New flow element and transmitter for Lift Stations A and B.
 - d. New conductivity element and transmitter for Lift Stations A and B.
 - e. A Data Flow Systems (DFS) radio system including remote telemetry units (RTUs) housed in the pump control panel and antenna cabling assemblies to monitor and control the pump station.
 - f. Coordination between DFS and the Contractor on the existing towers and antennas. DFS will provide new coaxial cable for the existing antenna.
 - g. Coordination between DFS and the Contractor, on the testing of the DFS radio systems at the remote pump stations. Coordinate with DFS the testing of the radio communications between the RTU unit located in the pump control panels and the existing supervisor computer system central telemetry unit (CTU) at the existing Key West Richard A. Heyman Environmental Protection Facility. DFS will provide software modifications at the CTU to incorporate a new human machine interface (HMI) screen for the pump station. Graphical HMI screen is to be consistent with existing lift station screens. Verify proper operation, from the DFS provided HMI screen over the radio system, of all pump station commands and status indications as outlined in the performance acceptance test (PAT). The existing antenna will be used at each site.
 - h. Coordination with the Contractor and the Owner on each lift station downtime. Each lift station shall remain operational until the new pump control with RTU system is installed, wired, and tested.
- B. Detailed Design: PIC as shown and specified includes functional and performance requirements and component specifications. Complete detailed PIC design.

1.03 DEFINITIONS

A. Abbreviations:

1. AI: Analog input.
2. AO: Analog output.
3. CS: Computer subsystem.
4. CTU: Central telemetry unit.
5. DI: Discrete input.
6. DO: Discrete output.
7. I/O: Input/output.
8. PAT: Performance acceptance test.
9. PIC: Process instrumentation and control.
10. RTU: Remote telemetry unit.
11. TS: Telemetry subsystem.

B. Rising/Falling: Terms used to define actions of discrete devices about their setpoints.

1. Rising: Contacts close when an increasing process variable rises through setpoint.
2. Falling: Contacts close when a decreasing process variable falls through setpoint.

C. Signal Types:

1. Analog Signals, Current Type:
 - a. 4 mA to 20 mA dc signals conforming to ISA S50.1.
 - b. Unless otherwise indicated for specific PIC subsystem components, use the following ISA 50.1 options:
 - 1) Transmitter Type: Number 2, two-wire.
 - 2) Transmitter Load Resistance Capacity: Class L.
 - 3) Fully isolated transmitters and receivers.
2. Analog Signals, Voltage Type: 1 to 5 volts dc within panels where a common high precision dropping resistor is used.
3. Discrete signals, two-state logic signals using dc or 120V ac sources as indicated.
4. Pulse Frequency Signals:
 - a. Direct current pulses whose repetition rate is linearly proportional to process variable.
 - b. Pulses generated by contact closures or solid state switches as indicated.
 - c. Power source less than 30V dc.
5. Special Signals: Other types of signals used to transmit analog and digital information between field elements, transmitters, receivers, controllers, and digital devices.

D. Instrument Tag Numbers:

1. A shorthand tag number notation is used in the Loop Specifications. For example: AI-1-2(2)(3)[pH].

<u>Notation</u>	<u>Explanation</u>
AI	ISA designator for Analysis Indicator.
1	Unit process number.
2	Loop number.
(2)	First unit number; number of same component types in a given loop; -1 and -2 in this example.
(3)	Second unit number; number of same component types with same first unit number in a given loop; -1, -2, and -3 in this example.
[pH]	Same notation shown at 2 o'clock position on ISA circle symbol on P&ID.

2. In this example, AI-1-12(2)(3)[pH] is shorthand for:

AI-1-12-1-1[pH], AI-1-12-1-2[pH], AI-1-12-1-3[pH]
AI-1-12-2-1[pH], AI-1-12-2-2[pH], AI-1-12-2-3[pH]

1.04 SUBMITTALS

A. Action Submittals:

1. General:
 - a. Shop Drawings, full-scaled details, wiring diagrams, catalog cuts, and descriptive literature.
 - b. Identify proposed items and options. Identify installed spares and other provisions for future work (for example, reserved panel space; unused components, wiring, and terminals).
 - c. Legends and Abbreviation Lists: Complete definition of symbols and abbreviations used on this Project (for example, engineering units, flow streams, instruments, structures, and other process items used in nameplates, legends, and data sheets).
2. Overview Block Diagram: Show major assemblies and interrelationships of TS and CS, including CS/RTU and CS/remote peripheral communication links. Diagram similar in content and format as shown on Drawings. Identify each major assembly with the same name and tag numbers as on Overview Equipment List.

3. Overview Description: Comprehensively describe function, operations, and interrelationship of TS and CS. Emphasize explanation of overview block diagram in minimum of five 8-1/2-inch by 11-inch pages.
4. CS/RTU Communication Link Definition:
 - a. Protocol definition of the following:
 - 1) Control.
 - 2) Functions.
 - 3) Format.
 - 4) Message security techniques.
 - 5) Message sequences.
 - b. Timing definition of the following:
 - 1) Station scan timing.
 - 2) TS data base update timing.
 - 3) TS output command timing.
5. Bill of Materials: List of required equipment.
 - a. Group equipment items by enclosure and field, and within an enclosure, as follows:
 - 1) I&C Components: By component identification code.
 - 2) Other Equipment: By equipment type.
 - b. Data Included:
 - 1) Equipment tag number.
 - 2) Description.
 - 3) Manufacturer, complete model number, and all options not defined by model number.
 - 4) Quantity supplied.
 - 5) Component identification code where applicable.
6. Catalog Cuts: I&C Components, Electrical Devices, and Mechanical Devices:
 - a. Catalog information, mark to identify proposed items and options.
 - b. Descriptive literature.
 - c. External power and signal connections.
 - d. Scaled drawings showing exterior dimensions and locations of electrical and mechanical interfaces.
7. Component Data Sheets: Data sheets for I&C components.
 - a. Format and Level of Detail: In accordance with ISA-S20.
 - b. Include component type identification code and tag number on data sheet.
 - c. Specific features and configuration data for each component:
 - 1) Location or service.
 - 2) Manufacturer and complete model number.
 - 3) Size and scale range.
 - 4) Setpoints.
 - 5) Materials of construction.
 - 6) Options included.

- d. Name, address, and telephone number of manufacturer's local office, representative, distributor, or service facility.
- 8. Sizing and Selection Calculations:
 - a. Primary Elements: Complete calculations plus process data used. Example, for flow elements, minimum and maximum values, permanent head loss, and assumptions made.
 - b. Controlling, Computing and Function Generating Modules: Actual scaling factors with units and how they were computed.
- 9. Panel Construction Drawings:
 - a. Scale Drawings: Show dimensions and location of panel mounted devices, doors, louvers, and subpanels, internal and external.
 - b. Panel Legend: List front of panel devices by tag numbers, nameplate inscriptions, service legends, and annunciator inscriptions.
 - c. Bill of Materials: List devices mounted within panel that are not listed in panel legend. Include tag number, description, manufacturer, and model number.
 - d. Construction Details: NEMA rating, materials, material thickness, structural stiffeners and brackets, lifting lugs, mounting brackets and tabs, door hinges and latches, and welding and other connection callouts and details.
 - e. Construction Notes: Finishes, wire color schemes, wire ratings, wire and terminal block, numbering and labeling scheme.
- 10. Panel Control Diagrams: For discrete control and power circuits.
 - a. Diagram Type: Ladder diagrams in format same as shown on Drawings. Include devices, related to discrete functions, that are mounted in or on the panel and that require electrical connections. Show unique rung numbers on left side of each rung.
 - b. Item Identification: Identify each item with attributes listed.
 - 1) Wires: Wire number and color. Cable number if part of multiconductor cable.
 - 2) Terminals: Location (enclosure number, terminal junction box number, or MCC number), terminal strip number, and terminal block number.
 - 3) Discrete Components:
 - a) Tag number, terminal numbers, and location ("FIELD," enclosure number, or MCC number).
 - b) Switching action (open or close on rising or falling process variable), set point value and units, and process variable description (for example, Sump Level High).
 - 4) Relay Coils:
 - a) Tag number and its function.
 - b) On right side of run where coil is located, list contact location by ladder number and sheet number. Underline normally closed contacts.

- 5) Relay Contacts: Coil tag number, function, and coil location (ladder rung number and sheet number).
 - c. Show each circuit individually. No “typical” diagrams or “typical” wire lists will be permitted.
 - d. Ground wires, surge protectors, and connections.
 - e. Circuit Names: Show names corresponding to Circuit and Raceway Schedule for circuits entering and leaving a panel. Refer to Division 26, Electrical.
11. Panel Wiring Diagrams: Show point-to-point and terminal-to-terminal wiring within panel.
 12. Loop Diagrams: Individual wiring diagram for each analog or pulse frequency loop.
 - a. Conform to the minimum requirements of ISA S5.4.
 - b. Under Paragraph 5.3 of ISA S5.4, include the information listed under subparagraphs 2 and 6.
 - c. Drawing Size: Individual 11-inch by 17-inch sheet for each loop.
 - d. Divide each loop diagram into areas for panel face, back-of-panel, and field.
 - e. Show:
 - 1) Terminal numbers, location of dc power supply, and location of common dropping resistors.
 - 2) Switching contacts in analog loops and output contacts of analog devices. Reference specific control diagrams where functions of these contacts are shown.
 - 3) Tabular summary on each diagram:
 - a) Transmitting Instruments: Output capability.
 - b) Receiving Instruments: Input impedance.
 - c) Loop Wiring Impedance: Estimate based on wire sizes and lengths shown.
 - d) Total loop impedance.
 - e) Reserve output capacity.
 - 4) Circuit and raceway schedule names.
 13. Interconnecting Wiring Diagrams:
 - a. Diagrams, device designations, and symbols in accordance with NEMA ICS 1.
 - b. Diagrams shall bear electrical Subcontractor’s signature attesting diagrams have been coordinated with Division 26, Electrical.
 - c. Show:
 - 1) Electrical connections between equipment, consoles, panels, terminal junction boxes, and field mounted components.
 - 2) Component and panel terminal board identification numbers, and external wire and cable numbers.
 - 3) Circuit names matching Circuit and Raceway Schedule.

- 4) Intermediate terminations between field elements and panels (for example, to terminal junction boxes and pull boxes).
 - 5) Pull boxes.
14. Installation Details: Include modifications or further details required to adequately define installation of I&C components.
 15. List of spares, expendables, test equipment and tools.
 16. Additional Equipment Recommended: List of, and descriptive literature for, additional spares, expendables, test equipment and tools recommended. Include unit prices and total costs as specified in Section 01 29 00, Payment Procedures.
- B. Informational Submittals: For PIC equipment, provide Manufacturer's Certificate of Proper Installation and readiness for operation.
1. Operation and Maintenance (O&M) Manuals: In accordance with Section 01 78 23, Operation and Maintenance Data, unless otherwise specified in this section.
 - a. Content and Format:
 - 1) Complete sets O&M manuals.
 - 2) Sufficient detail to allow operation, removal, installation, adjustment, calibration, maintenance and purchasing replacements for each PIC component.
 - 3) Final versions of Legend and Abbreviation Lists.
 - 4) Manual format in accordance with Section 01 78 23, Operation and Maintenance Data.
 - b. Include:
 - 1) Refer to paragraph Shop Drawings for the following items:
 - a) Bill of materials.
 - b) Catalog cuts.
 - c) Component data sheets.
 - d) Panel control diagrams.
 - e) Panel wiring diagrams, one reproducible copy.
 - f) Panel plumbing diagrams, one reproducible copy.
 - g) Loop diagrams, one reproducible copy.
 - h) Interconnecting wiring diagrams, one reproducible copy.
 - i) Application software documentation.
 - 2) Device O&M manuals for components, electrical devices, and mechanical devices include:
 - a) Operations procedures.
 - b) Installation requirements and procedures.
 - c) Maintenance requirements and procedures.
 - d) Troubleshooting procedures.
 - e) Calibration procedures.

- f) Internal schematic and wiring diagrams.
- g) Component calibration sheets from field quality control calibrations.
- 3) List of spares, expendables, test equipment and tools provided.
- 4) List of additional spares, expendables, test equipment and tools recommended.
- 2. Unwitnessed Factory Test: No submittals required.
- 3. Performance Acceptance Tests (PAT) Submittals:
 - a. Preliminary Test Procedures: Outlines of proposed tests, forms, and checklists.
 - b. Final Test Procedures: Proposed test procedures, forms, and checklists.
 - c. Test Documentation: Copy of signed off test procedures when tests are completed.

1.05 QUALITY ASSURANCE

- A. Calibration Instruments: Each instrument used for calibrating PIC equipment shall bear the seal of a reputable laboratory certifying that instrument has been calibrated within the previous 12 months to a standard endorsed by the NIST.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide Site and warehouse storage facilities for PIC equipment.
- B. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers, and related equipment as recommended by the capsule manufacturer.
- C. Prior to installation, store items in dry indoor locations. Provide heating in storage areas for items subject to corrosion under damp conditions.
- D. Cover panels and other elements that are exposed to dusty construction environments.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Environmental Design Requirements: Following defines the types of environments referred to in the above.
 - 1. Outside:
 - a. Temperature: 50 to 104 degrees F.
 - b. Relative Humidity: 10 to 95 percent noncondensing, rain.
 - c. NEC Classification: Nonhazardous.

2. Outside, Corrosive:
 - a. Temperature: 50 to 104 degrees F.
 - b. Relative Humidity: 10 to 95 percent noncondensing, rain.
 - c. Corrosive Environment: Sea air.
 - d. NEC Classification: Nonhazardous.

1.08 SEQUENCING AND SCHEDULING

- A. Activity Completion: The following is a list of key activities and their completion criteria:
 1. Shop Drawings: Reviewed and approved.
 2. Quality Control Submittals: Reviewed and accepted.
 3. Hardware Delivery: Hardware delivered to Site and inventoried by Owner.
 4. PAT: Completed and required test documentation accepted.

- B. PIC Substantial Completion: When Engineer issues Certificate of Substantial Completion.
 1. Prerequisites:
 - a. All PIC Submittals have been completed.
 - b. PIC has successfully completed PAT.
 - c. All spares, expendables, and test equipment have been delivered to Owner.

- C. PIC Acceptance: When Engineer issues a written notice of Final Payment and Acceptance.
 1. Prerequisites:
 - a. Certificate of Substantial Completion issued for PIC.
 - b. Punch-list items completed.
 - c. Final revisions to O&M manuals accepted.
 - d. Maintenance service agreements for PIC accepted by Owner.

- D. Prerequisite Activities and Lead Times: Do not start the following key Project activities until the prerequisite activities and lead times listed below have been completed and satisfied:

<u>Activity</u>	<u>Prerequisites and Lead Times</u>
Submittal reviews by Engineer	Engineer acceptance of Submittal breakdown and schedule.
Hardware purchasing, fabrication, and assembly	Associated shop drawing Submittals completed.

<u>Activity</u>	<u>Prerequisites and Lead Times</u>
Shipment	Completion of PIC Shop Drawing Submittals and preliminary O&M manuals.
PAT	Startup, Owner training, and PAT procedures completed; notice 4 weeks prior to start.

PART 2 PRODUCTS

2.01 GENERAL

- A. PIC functions as shown on Drawings and as required for each loop. Furnish equipment items as required. Furnish all materials, equipment, and software, necessary to effect required system and loop performance.
- B. First-Named Manufacturer: PIC design is based on first-named manufacturers of equipment and materials.
 - 1. If an item is proposed from other than first-named manufacturer, obtain approval from Engineer for such changes in accordance with Article Submittals.
 - 2. If using proposed item requires other changes, provide work and equipment to implement these changes. Changes that may be required include, but are not limited to: Different installation, wiring, raceway, enclosures, connections, isolators, intrinsically safe barriers, software, and accessories.
- C. Like Equipment Items:
 - 1. Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.
 - 2. Implement all same or similar functions in same or similar manner. For example, control logic, sequence controls, and display layouts.

2.02 PUMP CONTROL PANELS

- A. Panels: Provide the following control panels.
 - 1. Tag Numbers: CP-A, CP-B, CP-C, CP-D, CP-DA.
 - a. Material: Aluminum with Type 316 stainless steel hardware.
 - b. NEMA Rating: 12.
 - c. Size: Maximum 36 inches wide by 24 inches deep by 72 inches high.

2. As a minimum, provide the following within control panel CP-1: Main circuit breaker, terminal blocks for all incoming or outgoing conductors, pump thermal protection modules, relays, alarms, DFS furnished RTU, input/output (I/O) module, and accessories.
3. Power Input: 120V.

B. Operator Controls and Indications:

1. As a minimum, provide for each pump the following operator controls and indications on the panel face (all components shall be rated NEMA 4X):
 - a. Elapsed time meter, one per pump.
 - b. Elapsed time meter, both pumps.
 - c. Alarm silence pushbutton.
 - d. RESET pushbutton.
 - e. Horn disable selector switch.
 - f. Trouble light selector switch.

C. External Interfaces:

1. Signal interface of the DFS furnished TCU/RTU and DFS RIO032 module and external equipment:
 - a. Refer to Article Supplements, RTU I/O Lists. RTU I/O Lists were provided based on the latest information at the time of design. Coordinate with the Owner to obtain the latest control panel wiring drawings. Coordinate with DFS to obtain the latest RTU configuration files. Submit the hardwired RTU I/O list for each station.
2. Signal interface of the SC2000 and external equipment:
 - a. Provide the following discrete outputs:
 - 1) Pump 1 run command.
 - 2) Pump 2 run command.
 - b. Accept the following analog inputs (4 to 20mA):
 - 1) Level.
 - c. Provide the following analog outputs (4 to 20 mA):
 - 1) Pump 1 speed command.
 - 2) Pump 2 speed command.
3. Retransmit the incoming low level discrete signal to each AFD drive and to the DFS TCU. The low level signal will be hardwired at each drive to shut down the pump in LOCAL and REMOTE modes on falling low level.
4. Transmit the incoming high temperature alarm and moisture alarm to the respective AFD drive.

D. Functional Requirements:

1. There will be a HAND/OFF/LOCAL/REMOTE hand switch on each AFD. When the switch is in LOCAL, control is provided by the SC2000 controller. When the switch is in REMOTE, control is provided by the DFS TCU/RTU controller.
2. Provide LOCAL and REMOTE control modes as follows:
 - a. Local Manual: Pumps are controlled by hand switches on front of the pump's respective AFD as follows: When the pump HAND/OFF/LOCAL/REMOTE hand switch is in HAND, the pump on/off and speed control is done at the front of the AFD.
 - b. Local Automatic: Pumps are controlled by the SC2000 pump controller in CP-1 as follows: When the pump HAND/OFF/LOCAL/REMOTE hand switch is in LOCAL, the pump is controlled by the SC2000 pump controller based off of level.
 - c. Remote Automatic: Pumps are controlled by the DFS furnished TCU as follows:
 - 1) When the pump HAND/OFF/LOCAL/REMOTE hand switch on the AFD is in REMOTE and the HAND/OFF/AUTO hand switch on the DFS TCU/RTU is in AUTO, the pumps operate as follows:
 - a) Pumps operate in a LEAD/LAG configuration. The DFS furnished TCU/RTU provides automatic alternation of the LEAD and LAG pumps.
 - b) Per the DFS standard variable level controller function where the wet well level will travel up and down between the LEAD OFF and LAG ON setting. The pump speed is proportional to level.
 - d. Remote Manual: Pumps are controlled by a remote run command from the central telemetry unit (CTU) via the radio telemetry system:
 - 1) When the pump HAND/OFF/LOCAL/REMOTE hand switch on the AFD is in REMOTE and the HAND/OFF/AUTO hand switch on the DFS TCU/RTU is in HAND, the pump is controlled as follows: The pump shall run in response to a remote run command.
3. Upon resumption of power after an outage, pumps shall resume operation without manual intervention. (Pumps shall reset automatically, not manually.)

E. Special Requirements:

1. DFS TCU/RTU:
 - a. Install the DFS-furnished TAC pack TCU with radio RTU, RIO032 I/O module and accessories inside respective control panel. Install all hardwired signals to the TCU/RTU.

- b. Furnish and install all other interface wiring, terminals, circuit breakers, etc., required to interface and power the telemetry unit from the control panel.
 - c. Coordinate space requirements and installation requirements with DFS.
 - d. DFS will configure the TCU/RTU once the control panel has been installed on site and prior to the performance acceptance test (PAT).
2. The SC2000 and DFS TCU/RTU control shall be independent (i.e., signals shall not be looped through one controller and routed to the other). Provide an analog signal splitter to send one analog signal to the SC2000 and the other to the DFS TCU/RTU.
3. Continuous operation of the Owner's facilities are of critical importance. Coordinate with the Owner downtime of each facility. Each existing pump control panel shall remain online until the new control panel has been installed, wired, and tested.
4. The existing thermal protection devices for each pump will be relocated from the existing pump control panel to the new pump control panel. Provide sufficient space in the new panel for thermal protection devices. Thermal protection devices for each station are summarized as follows:
 - a. CP-A: Two pumps using Flygt 24V ac Mini-CAS.
 - b. CP-B: Two pumps using Flygt 24V ac Mini-CAS.
 - c. CP-C: Two pumps using Flygt 24V ac Mini-CAS.
 - d. CP-D: Three pumps using Flygt 24V ac CAS.
 - e. CP-DA: Two pumps using Flygt 24V ac Mini-CAS.
5. Transmit the high temperature and leak signals for each pump to its respective adjustable frequency drive.
6. Provide either intrinsically safe devices or explosion proof devices for all components in classified hazardous locations.
7. Provide intrinsically safe relays in the control panels for signals entering panel from classified area in accordance with the NEC. Provide intrinsically safe circuits as specified. As a minimum, intrinsic safety barriers shall be used for float signals, thermal switch, and moisture sensor circuits. Intrinsically safe relays are not required if field device is explosion proof.
 - a. Obtain the latest control panel wiring diagrams from the Owner to determine which existing devices require intrinsically safe relays/barriers.
8. For each lift station (CP-A, CP-B, CP-C, CP-D, CP-DA): Provide horn that will generate a loud audible alarm when activated by 115V ac power. The horn shall surface mount to the side of the building with sealable side conduit entry and shall be suitable for outdoor use. Unit shall be Ronan Model 350W or equal.

9. For each lift station (CP-A, CP-B, CP-C, CP-D, CP-DA): Provide flashing or revolving alarm light units that produce 360-degree beams of colored light. Flashing rate shall be 60 to 80 flashes per minute. The building mounted beacons shall consist of one RED for the High Level alarm. Beacon shall operate at 120V ac.
 - a. Housing shall be weatherproof, suitable for use in severe outdoor environments without other protection.
 - b. Unit shall be Pauluhn Type EPC7003ARED, or equal.
10. For each lift station (CP-A, CP-B, CP-C, CP-D, CP-DA): Provide a complete bubbler system with the following minimum features: redundant compressors with automatic failover, purge tank and moisture dump, automatic bubbler tube purge and air tank moisture dump cycle performed every 6 hours, 4 to 20 mA analog output, 120V ac power input, compressor automatically turns on/off based on air tank pressure, and push button for alarm reset or manual purge/dump. The following dry contact outputs shall be available for monitoring by the RTU: air compressor failure alarm, and clogged bubbler tube alarm. Provide a bubbler system with the following ranges: To be Determined during construction.
 - a. Manufacturer and Products: Motor Protection Electronics, Inc.; Bubbler System BS2000.
11. For each lift station (CP-A, CP-B, CP-C, CP-D, CP-DA): Provide the MPE Inc. SC2000 Station Controller to provide local automatic control of the pump station. Station controller shall be capable of accepting 4 to 20 mA analog signal for level and transmitting two 4 to 20 mA analog outputs for speed control for each pump.
 - a. Manufacturer and Product: Motor Protection Electronics, Inc.; SC2000 station controller.

2.03 DFS TELEMETRY SYSTEM EXPANSION

- A. Includes all work to provide a complete and functioning telemetry system expansion as specified and shown.
- B. The Contractor shall provide a complete radio telemetry system as specified herein for the pump station. The telemetry system shall consist of the following minimum components: TAC pack TCU with radio RTU, RTU surge suppression, three-phase surge suppression, coaxial cable, coaxial surge suppression, RIO032 rail I/O device, din-mount power supply, and backup battery. The system shall integrate into an existing system manufactured by Data Flow Systems Inc., 605 N. John Rodes Blvd., Melbourne, FL 32934, Phone: 321-259-5009.

- C. RTU: Provide the telemetry control unit (TCU) pump controller with integral radio. As a minimum, the TCU shall include the following features:
1. General:
 - a. Type: The TCU shall be a microprocessor-based multi-pump controller module designed for automatic pump station control.
 - b. Components: Integral radio, RIO032 fail I/O device, backup battery, installation kit, power supply, three-phase surge suppressor, RF pigtail, RTU surge protection kit, coaxial surge suppressor.
 2. Operator Indicators and Controls:
 - a. Three H/O/A hand switches.
 - b. LCD Display and Keypad:
 - 1) 4x20-character LCD display.
 - 2) 12-button keypad.
 - 3) Configuration parameters adjustable via the 12-button keypad or RS-232 port.
 - c. LCD shall display the following minimum information:
 - 1) Elapsed runtime of each pump.
 - 2) Average runtime of each pump.
 - 3) Flow of each pump.
 - 4) Pump station flow.
 - 5) Time of day.
 3. Control Features:
 - a. Configurable for duplex pump control via on-board keyboard.
 - b. Integral pump alternation.
 - c. The unit shall provide local automatic level control from bubbler input.
 4. Electrical:
 - a. Power Input: 120V ac.
 - b. Includes on-board 480V ac three-phase power monitor. Power monitor shall be transformer-isolated and detect loss of phase, phase reversal, low phase and high phase faults. All phase monitor adjustments shall be adjustable from the keypad.
 - c. The unit's internal power supply shall keep the backup battery at a float charge.
 5. Signal Interface: Refer to Article Supplements.
 6. Enclosure:
 - a. UL listed.
 - b. Surge tested for EMI Susceptibility to IEC 61000-4-5 Surge Immunity Tests.
 7. Ports: One RS-232.
 8. Environmental:
 - a. Operating temperature (with Battery Backup): 14 to 122 degrees F.

9. Integral Radio:
 - a. Includes a radio transceiver and associated electronics.
 - b. Mounted inside the TCU radio compartment.
 - c. Minimum features:
 - 1) Surge protected radio power.
 - 2) On-board communications and firmware.
 - 3) Watchdog timer.
 - 4) On-board voltage regulation and radio power supply control.
 - 5) System diagnostics including radio current, receiver sensitivity, and operating temperature.
 10. RIO032 Rail I/O Device:
 - a. I/O capacity:
 - 1) Discrete Inputs: 8.
 - 2) Discrete Outputs: 8.
 - 3) Analog Inputs: 8 (12 bit resolution).
 - 4) Analog Outputs: 8 (12 bit resolution).
 - b. Ports:
 - 1) One RS-232.
 - 2) One RS-485.
 11. Accessories:
 - a. Backup Battery:
 - 1) 3.0 AHr backup.
 - 2) Manufacturer and Model: Portalac, PE12V3A.
 - b. Din-mount power supply.
 - c. Three-phase surge protector kit.
 - d. RTU surge protection kit.
 - e. Snap-in installation kit with harness.
 - f. Coaxial Surge Suppressor:
 - 1) Manufacturer and Model: Polyphaser, Model IS-B50LN-C2.
 12. Model: TAC pack TCU with radio RTU.
- D. Antenna System: The antenna and tower system is existing. Provide coaxial cable and connectors to replace the existing with the following minimum features:
1. Type N connectors shall be used at both ends of the coax. The Type N connectors shall be sealed with 3-inch sections of Alpha FIT321-1-0 sealant shrink tubing. The coax cable shall be secured to the mast/pole with E.V.A.-coated Type 316 stainless steel cable ties. The cable ties shall meet or exceed the quality, reliability and performance of AE112 cable ties manufactured by Band-It.

2. The coaxial cable utilized shall be provided and shall be the type that uses an inert semi liquid compound to flood the copper braid. The coax cable shall be of the RG-8 construction type and have the RF loss characteristic of foam flex. The coax cable shall be RTC 400 as supplied by Data Flow Systems, Inc.
 3. The completed antenna system and tower shall withstand sustained 150 mph winds minimum. The design shall be certified by a registered professional engineer registered in the State of Florida.
- E. Warranty: The Contractor for Owner-furnished equipment shall warrant all hardware and software provided under this Contract against all defects in material and workmanship for a period of 18 months from the date of shipment to the City or 12 months from the date of startup, whichever comes first.
- F. Functional Requirements:
1. Provide monitoring and local and remote control of the duplex pump station including:
 - a. Monitoring wet well level.
 - b. Monitoring flow.
 - c. Monitoring pump current.
 - d. Monitoring pump station salinity.
 - e. Monitoring and control of the generator at select stations. Refer to RTU I/O List in Article Supplements.
 - f. Monitoring and control of variable speed pumps.
 - g. Monitoring of ATS status at select stations. Refer to RTU I/O List in Article Supplements.
 - h. Shunt trip control to main circuit breaker.
 2. Provide radio communication with the existing central telemetry unit at the Key West Richard A. Heyman Environmental Protection Facility.
- G. Application Software:
1. Provided by Data Flow Systems.
 2. Provide modifications to the existing HMI screen at the existing CTU workstation. Modifications include incorporation of the generator monitoring and control, flow and pressure monitoring, changes incorporated with the change from constant speed to variable speed pumps, changes to go from the pump control module (PCM) to the TAC pack TCU RTU, and changes in analog ranges. Software modifications require software modification to an existing application.
- H. Manufacturer: Data Flow Systems, 605 N John Rodes Blvd., Melbourne, FL 32934, 321-259-5009.

2.04 INSTRUMENTATION

A. A3 Conductivity Element and Transmitter:

1. General:
 - a. Function: Measure, indicate, and transmit conductivity of noted process liquid.
 - b. Sensor Type: Probe with electrodeless sensor, as noted.
 - c. Transmitter Type: Four wire.
 - d. Parts: Element, transmitter, interconnecting cable, junction box (if specified) and expendables.
2. Performance:
 - a. Process Liquid: Raw Sewage.
 - b. Process Range: NaCl 0-25%.
 - c. Accuracy: Plus or minus 0.5 percent of measured range.
3. Features: Temperature Compensation: Automatic thermocompensator for process liquid temperatures 0 degrees to 200 degrees C.
4. Element:
 - a. Type: Electrodeless.
 - b. Electrode Material: Type 316 stainless steel or titanium, unless otherwise noted.
 - c. Other Wetted Parts: Type 316 stainless steel or nonmetallic synthetic materials; manufacturer to confirm material compatibility with process liquid.
 - d. Probe Constant: As Required.
 - e. Process Connection: In Situ, follow recommendations by manufacturer for in situ installation.
 - f. Installation Type: In Situ Installation.
 - g. Mounting Hardware: As recommended by manufacturer for specific application and as shown on Drawings. At a minimum, provide 3/4-inch NPT coupling, liquid-tight connector, and 3/4-inch pipe to support the sensor. Per manufacturer installation recommendations, provide potting compound and pot the sensor at the coupling.
5. Transmitter:
 - a. Type: Two wire, unless otherwise noted.
 - b. Features:
 - 1) Indicator: LCD Back-lit digital display.
 - 2) Scale Range: As noted.
 - 3) Contact Setpoint: Setpoint adjustable from 0 percent to 100 percent of full range, initial setting as noted.
 - c. Signal Interface:
 - 1) Output: Isolated 4 mA to 20 mA dc for load impedance 0 ohm to 500 ohms minimum for 24V dc supply without load adjustments.
 - 2) Digital Communications: Not required.
 - 3) Contacts:
 - a) When noted, SPST rated 3A continuous at 120V ac, minimum.
 - b) Setpoint, as noted.

- d. Enclosure:
 - 1) Type: NEMA 4X/IP65.
 - 2) Mounting:
 - a) Wall, unless otherwise noted.
 - b) Mounting brackets.
- e. Power:
 - 1) Two-wire, Loop powered.
- f. Additional Features:
 - 1) FM Approved Class I Div 1: Required. Provide FM entity approved intrinsic safety barrier.
- 6. Cable: Length as required to accommodate device locations.
- 7. Junction Box (weather proof): If noted.
- 8. Expendables (for Each Unit Provided): One 16-oz bottle 2,000 microS/cm conductivity standardizing solution if appropriate for noted range.
- 9. Manufacturers and Products (Two-Wire Units):
 - a. Foxboro:
 - 1) Electrodeless Type: Model 871EC electrodeless conductivity element and Model 870ITEC transmitter.

B. F34 Flow Element and Transmitter, Ultrasonic, Doppler:

- 1. General:
 - a. Function: Measure flowrate of aerated liquids or liquids containing solids.
 - b. Type: Doppler operating principle, digital signal processing, clamp-on transducer.
 - c. Parts: Dual head transducer, transmitter, interconnecting cable, and support software.
- 2. Service:
 - a. Process Fluid: Raw Sewage.
 - b. Pipe Material: Ductile Iron.
 - c. Pipe Size: Field confirm.
- 3. Performance:
 - a. Process Flow Range: As noted.
 - b. Accuracy: Plus or minus 1 percent velocity full scale.
 - c. Transducer Certification (unless otherwise noted):
 - 1) Class I, Division 2, Groups A, B, C, and D.
 - 2) Class II, Division 2, Groups E, F, and G.
- 4. Transducer:
 - a. Dual head.
 - b. Weatherproof.
 - c. Suitable for submersible/underground service.
 - d. Operating Temperature: Minus 40 degrees F to 250 degrees F.
- 5. Transmitter:
 - a. Enclosure: NEMA 4X fiberglass, reinforced polyester, unless otherwise noted.
 - b. Operating Temperature: Minus 20 degrees F to 140 degrees F.
 - c. Keypad: 19-key with tactile action.

- d. Screen:
 - 1) Backlit LCD.
 - 2) Display current flowrate, totalized flow, and signal strength.
- e. Datalogger:
 - 1) 90,000 data point capacity, minimum.
 - 2) Programmable in 1-second intervals.
 - 3) Time stamped data.
- 6. Interconnecting Cable:
 - a. Length: As required.
 - b. Temperature: Up to 176 degrees F.
- 7. Signal Interface:
 - a. 4 mA to 20 mA dc output for load impedance of 0 ohm to 750 ohms for 24V dc power supply without load adjustments.
 - b. RS-232 serial interface.
 - c. Alarm Relays:
 - 1) One SPDT rated for 5 amps continuous at 120V ac, unless otherwise noted.
 - 2) Programmable for totalization pulses, flow limits, and power loss.
- 8. Support Software:
 - a. Instrument Configuration: Included.
 - b. Data Download: Included.
 - c. Diagnostics: Including graphical presentation of current time and frequency domain responses.
- 9. Power: 120/240V ac, 50/60Hz, switch selectable, unless indicated otherwise.
- 10. Manufacturer and Product: Thermo Fisher Scientific Polysonics; Model SX40 with Hydrascan software.

C. Schedule: Provide instrumentation as follows:

Tag Number	Code	Description	State/Span	Remarks
PSA-AE/AIT-1-1	A3	PS A Salinity	0-25% NaCl	
PSB-AE/AIT-1-1	A3	PS B Salinity	0-25% NaCl	
PSA-FE/FIT-1-1	F34	PS A Flow	TBD	
PSB-FE/FIT-1-1	F34	PS B Flow	TBD	

- 1. Provide field mounted surge suppression for each device. Provide surge suppression as follows: With 120V ac outlet, ac circuit breaker, and 10-ohm resistors on signal lines, all in enclosure.
 - a. Enclosure: NEMA 4X fiberglass or Type 316 stainless steel with door.
 - 1) Maximum Size: 12 inches by 12 inches by 8 inches deep.
 - b. Manufacturer and Product: EDCO; SLAC series.

2.05 NAMEPLATES AND TAGS

- A. Panel Nameplates: Enclosure identification located on the enclosure face.
 - 1. Location and Inscription: As shown.
 - 2. Materials: Laminated plastic attached to panel with stainless steel screws.
 - 3. Letters: 1/2-inch white on black background, unless otherwise noted.
- B. Component Nameplates—Panel Face: Component identification located on panel face under or near component.
 - 1. Location and Inscription: As shown.
 - 2. Materials: Laminated plastic attached to panel with stainless steel screws.
 - 3. Letters: 3/16-inch white on black background, unless otherwise noted.
- C. Component Nameplates—Back of Panel: Component identification located on or near component inside of enclosure.
 - 1. Inscription: Component tag number.
 - 2. Materials: Adhesive backed, laminated plastic.
 - 3. Letters: 3/16-inch white on black background, unless otherwise noted.
- D. Legend Plates for Panel Mounted Pushbuttons, Lights, and Switches.
 - 1. Inscription: Refer to:
 - a. Table under paragraph Standard Pushbutton Colors and Inscriptions.
 - b. Table under paragraph Standard Light Colors and Inscriptions.
 - c. P&IDs in Drawings.
 - 2. Materials: Stainless steel, keyed legend plates. Secured to panel by mounting nut for pushbutton, light, or switch.
 - 3. Letters: Black on gray or white background.
- E. Service Legends: Component identification nameplate located on face of component.
 - 1. Inscription: As shown.
 - 2. Materials: Adhesive backed, laminated plastic.
 - 3. Letters: 3/16-inch white on black background, unless otherwise noted.
- F. Nametags: Component identification for field devices.
 - 1. Inscription: Component tag number.
 - 2. Materials: 16-gauge, Type 304 stainless steel.

3. Letters: 3/16-inch imposed.
4. Mounting: Affix to component with 16- or 18-gauge stainless steel wire or stainless steel screws.

2.06 ELECTRICAL REQUIREMENTS

- A. In accordance with Division 26, Electrical.
- B. I&C and electrical components, terminals, wires, and enclosures: UL recognized or UL listed.
- C. Wires within Enclosures:
 1. ac Circuits:
 - a. Type: 300-volt, Type MTW stranded copper.
 - b. Size: For current to be carried, but not less than 18 AWG.
 2. Analog Signal Circuits:
 - a. Type: 300-volt stranded copper, twisted shielded pairs.
 - b. Size: 18 AWG, minimum.
 3. Other dc Circuits.
 - a. Type: 300-volt, Type MTW stranded copper.
 - b. Size: For current carried, but not less than 18 AWG.
 4. Special Signal Circuits: Use manufacturer's standard cables.
 5. Wire Identification: Numbered and tagged at each termination.
 - a. Wire Tags: Machine printed, heat shrink.
 - b. Manufacturers:
 - 1) Brady PermaSleeve.
 - 2) Tyco Electronics.
- D. Wires entering or leaving enclosures, terminate and identify as follows:
 1. Analog and discrete signal, terminate at numbered terminal blocks.
 2. Special signals, terminated using manufacturer's standard connectors.
 3. Identify wiring in accordance with Section 26 05 01, Electrical.
- E. Terminal Blocks for Enclosures:
 1. Quantity:
 - a. Accommodate present and spare indicated needs.
 - b. Wire spare RTU I/O points to terminal blocks.
 - c. One wire per terminal for field wires entering enclosures.
 - d. Maximum of two wires per terminal for 18-WG wire for internal enclosure wiring.
 - e. Spare Terminals: 20 percent of all connected terminals, but not less than 5 per terminal block.

2. General:
 - a. Connection Type: Screw compression clamp.
 - b. Compression Clamp:
 - 1) Complies with DIN-VDE 0611.
 - 2) Hardened steel clamp with transversal grooves that penetrate wire strands providing a vibration-proof connection.
 - 3) Guides strands of wire into terminal.
 - c. Screws: Hardened steel, captive and self-locking.
 - d. Current Bar: Copper or treated brass.
 - e. Insulation:
 - 1) Thermoplastic rated for minus 55 to plus 110 degree C.
 - 2) Two funneled shaped inputs to facilitate wire entry.
 - f. Mounting:
 - 1) Standard DIN rail.
 - 2) Terminal block can be extracted from an assembly without displacing adjacent blocks.
 - 3) End Stops: Minimum of one at each end of rail.
 - g. Wire preparation: Stripping only permitted.
 - h. Jumpers: Allow jumper installation without loss of space on terminal or rail.
 - i. Marking System:
 - 1) Terminal number shown on both sides of terminal block
 - 2) Allow use of preprinted and field marked tags.
 - 3) Terminal strip numbers shown on end stops.
 - 4) Mark terminal block and terminal strip numbers as shown on Panel Control Diagrams and Loop Diagrams.
 - 5) Fuse Marking for Fused Terminal Blocks: Fuse voltage and amperage rating shown on top of terminal block.
 - j. Test Plugs: Soldered connections for 18 AWG wire.
 - 1) Pin Diameter: 0.079 inch.
 - 2) Quantity: 10.
 - 3) Manufacturer and Product: Entrelec; Type FC2.
3. Terminal Block, General-Purpose:
 - a. Rated Voltage: 600V ac.
 - b. Rated Current: 30 amp.
 - c. Wire Size: 22 AWG to 10 AWG.
 - d. Rated Wire Size: 10 AWG.
 - e. Color: Grey body.
 - f. Spacing: 0.25 inch, maximum.
 - g. Test Sockets: One screw test socket 0.079-inch diameter.
 - h. Manufacturer and Product: Entrelec; Type M4/6.T.
4. Terminal Block, Ground:
 - a. Wire Size: 22 AWG to 12 AWG.
 - b. Rated Wire Size: 12 AWG.
 - c. Color: Green and yellow body.

- d. Spacing: 0.25 inch, maximum.
 - e. Grounding: Ground terminal blocks electrically grounded to the mounting rail.
 - f. Manufacturer and Product: Entrelec; Type M4/6.P.
5. Terminal Block, Blade Disconnect Switch:
- a. Rated Voltage: 600V ac.
 - b. Rated Current: 10-amp.
 - c. Wire Size: 22 AWG to 12 AWG.
 - d. Rated Wire Size: 12 AWG.
 - e. Color: Grey body, orange switch.
 - f. Spacing: 0.25 inch, maximum.
 - g. Manufacturer and Product: Entrelec; Type M4/6.SN.T.
6. Terminal Block, Fused, 24V dc:
- a. Rated Voltage: 600V dc.
 - b. Rated Current: 16-amp.
 - c. Wire Size: 22 AWG to 10 AWG.
 - d. Rated Wire Size: 10 AWG.
 - e. Color: Grey body.
 - f. Fuse: 0.25 inch by 1.25 inches.
 - g. Indication: LED diode 24V dc.
 - h. Spacing: 0.512 inch, maximum.
 - i. Manufacturer and Product: Entrelec; Type M10/13T.SFL.
7. Terminal Block, Fused, 120V ac:
- a. Rated Voltage: 600V ac.
 - b. Rated Current: 16-amp.
 - c. Wire Size: 22 AWG to 10 AWG.
 - d. Rated Wire Size: 10 AWG.
 - e. Color: Grey body.
 - f. Fuse: 0.25 inch by 1.25 inches.
 - g. Indication: Neon Lamp 110V ac.
 - h. Leakage Current: 1.8 mA, maximum.
 - i. Spacing: 0.512 inch, maximum
 - j. Manufacturer and Product: Entrelec; Type M10/13T.SFL.
8. Terminal Block, Fused, 120V ac, High Current:
- a. Rated Voltage: 600V ac.
 - b. Rated Current: 35 amps.
 - c. Wire Size: 18 AWG to 8 AWG.
 - d. Rated Wire Size: 8 AWG.
 - e. Color: Grey.
 - f. Fuse: 13/32 inch by 1.5 inches.
 - g. Spacing: 0.95 inch, maximum.
 - h. Manufacturer and Product: Entrelec; Type MB10/24.SF.

F. Grounding of Enclosures:

1. Furnish isolated copper grounding bus for signal and shield ground connections.
2. Ground bus grounded at a common signal ground point in accordance with National Electrical Code requirements.
3. Single Point Ground for Each Analog Loop:
 - a. Locate at dc power supply for loop.
 - b. Use to ground wire shields for loop.
 - c. Group and connect shields in following locations:
 - 1) Locate signal ground at dc power supply for loop.
 - 2) Use to ground wire shields for loops.
4. Ground terminal block rails to ground bus.

G. Analog Signal Isolators: Furnish signal isolation for analog signals that are sent from one enclosure to another. Do not wire in series instruments on different panels, cabinets, or enclosures.

H. Power Distribution within Panels:

1. Feeder Circuits:
 - a. One or more 120V ac, 60-Hz feeder circuits as shown on Drawings.
 - b. Make provisions for feeder circuit conduit entry.
 - c. Furnish terminal board for termination of wires.
2. Power Panel: Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.
 - a. Locate to provide clear view of and access to breakers when door is open.
 - b. Breaker sizes: Coordinate such that fault in branch circuit will blow only branch breaker but not trip the main breaker.
 - 1) Branch Circuit Breaker: 15 amps at 250V ac.
 - c. Breaker Manufacturers and Products: Square D, Type QO.
3. Circuit Wiring: P&IDs and Control Diagrams on Drawings show function only. Use following rules for actual circuit wiring:
 - a. Devices on Single Circuit: 20, maximum.
 - b. Multiple Units Performing Parallel Operations: To prevent failure of any single branch circuit from shutting down entire operation, do not group all units on same branch circuit.
 - c. Branch Circuit Loading: 12 amperes continuous, maximum.
 - d. Panel Lighting and Service Outlets: Put on separate 15-amp, 120V ac branch circuit.
 - e. Provide 120V ac plugmold for panel components with line cords.

I. Signal Distribution:

1. Within Panels: 4 to 20 mA dc signals may be distributed as 1 to 5V dc.
2. Outside Panels: Isolated 4 mA to 20 mA dc only.
3. All signal wiring twisted in shielded pairs.

J. Signal Switching:

1. Use dry circuit type relays or switches.
2. No interruption of 4 mA to 20 mA loops during switching.
3. Switching Transients in Associated Signal Circuit:
 - a. 4 mA to 20 mA dc Signals: 0.2 mA, maximum.
 - b. 1 to 5V dc Signals: 0.05V, maximum.

K. Relays:

1. General:
 - a. Relay Mounting: Plug-in type socket.
 - b. Relay Enclosure: Furnish dust cover.
 - c. Socket Type: Screw terminal interface with wiring.
 - d. Socket Mounting: Rail.
 - e. Provide holddown clips.
2. Signal Switching Relay:
 - a. Type: Dry circuit.
 - b. Contact Arrangement: 2 Form C contacts.
 - c. Contact Rating: 0 to 5 amps at 28V dc or 120V ac.
 - d. Contact Material: Gold or silver.
 - e. Coil Voltage: As noted or shown.
 - f. Coil Power: 0.9 watts (dc), 1.2VA (ac).
 - g. Expected Mechanical Life: 10,000,000 operations.
 - h. Expected Electrical Life at Rated Load: 100,000 operations.
 - i. Indication Type: Neon or LED indicator lamp.
 - j. Seal Type: Hermetically sealed case.
 - k. Manufacturer and Product: Potter and Brumfield; Series KH/KHA.
3. Control Circuit Switching Relay, Nonlatching:
 - a. Type: Compact general-purpose plug-in.
 - b. Contact Arrangement: 3 Form C contacts.
 - c. Contact Rating: 10A at 28V dc or 240V ac.
 - d. Contact Material: Silver cadmium oxide alloy.
 - e. Coil Voltage: As noted or shown.
 - f. Coil Power: 1.8 watts (dc), 2.7VA (ac).
 - g. Expected Mechanical Life: 10,000,000 operations.
 - h. Expected Electrical Life at Rated Load: 100,000 operations.

- i. Indication Type: Neon or LED indicator lamp.
- j. Push to test button.
- k. Manufacturer and Product: Potter and Brumfield; Series KUP.
- 4. Control Circuit Switching Relay, Latching:
 - a. Type: Dual coil mechanical latching relay.
 - b. Contact Arrangement: 2 Form C contacts.
 - c. Contact Rating: 10A at 28V dc or 120V ac.
 - d. Contact Material: Silver cadmium oxide alloy.
 - e. Coil Voltage: As noted or shown.
 - f. Coil Power: 2.7 watts (dc), 5.3VA (ac).
 - g. Expected Mechanical Life: 500,000 operations.
 - h. Expected Electrical Life at Rated Load: 50,000 operations.
 - i. Manufacturer and Product: Potter and Brumfield; Series KB/KBP.
- 5. Control Circuit Switching Relay, Time Delay:
 - a. Type: Adjustable time delay relay.
 - b. Contact Arrangement: 2 Form C contacts.
 - c. Contact Rating: 10A at 240V ac.
 - 1) Contact Material: Silver cadmium oxide alloy.
 - d. Coil Voltage: As noted or shown.
 - e. Operating Temperature: Minus 10 to 55 degrees C.
 - f. Repeatability: Plus or minus 2 percent.
 - g. Delay Time Range: Select range such that time delay set point fall between 20 to 80 percent of range.
 - h. Time Delay Setpoint: As noted or shown.
 - i. Mode of Operation: As noted or shown.
 - j. Adjustment Type: Integral potentiometer with knob external to dust cover.
 - k. Manufacturer and Products: Potter and Brumfield:
 - 1) Series CB for 0.1 second to 100 minute delay time ranges.
 - 2) Series CK for 0.1 to 120 second delay time ranges.

L. Power Supplies:

- 1. Furnish to power instruments requiring external dc power, including two-wire transmitters and dc relays.
- 2. Convert 120V ac, 60-Hz power to dc power of appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that instruments being supplied can operate within their required tolerances.
- 3. Provide output over voltage and over current protective devices to:
 - a. Protect instruments from damage due to power supply failure.
 - b. Protect power supply from damage due to external failure.
- 4. Enclosures: NEMA 1 in accordance with NEMA 250.

5. Mount such that dissipated heat does not adversely affect other components.
6. Fuses: For each dc supply line to each individual two-wire transmitter.
 - a. Type: Indicating.
 - b. Mount so fuses can be easily seen and replaced.

M. Internal Panel Lights for Freestanding Panels:

1. Type: Switched 100-watt incandescent back-of-panel lights.
2. Quantity: One light for every 4 feet of panel width.
3. Mounting: Inside and in the top of back-of-panel area.
4. Protective metal shield for lights.

N. Service Outlets for Freestanding Panels:

1. Type: Three-wire, 120-volt, 15-ampere, GFCI duplex receptacles.
2. Quantity:
 - a. For panels 4 feet wide and smaller: One.
 - b. For panels wider than 4 feet: One for every 4 feet of panel width, two minimum per panel.
3. Mounting: Evenly spaced along back-of-panel area.

O. Standard Pushbutton Colors and Inscriptions: Use following color code and inscriptions for pushbuttons, unless otherwise noted.

Tag Function	Inscription(s)	Color
OO	ON OFF	Red Green
OC	OPEN CLOSE	Red Green
SS	START STOP	Red Green
RESET	RESET	Black
EMERGENCY STOP	EMERGENCY STOP	Red

1. Lettering Color:
 - a. Black on white and yellow buttons.
 - b. White on black, red, and green buttons.

- P. Standard Light Colors and Inscriptions: Use following color code and inscriptions for service legends and lens colors for indicating lights, unless otherwise.

Tag Function	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Green
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Amber
FAIL	FAIL	Amber
HIGH	HIGH	Amber
AUTO	AUTO	White
MANUAL	MANUAL	Blue
LOCAL	LOCAL	Blue
REMOTE	REMOTE	White

1. Lettering Color:
 - a. Black on white and amber lenses.
 - b. White on red and green lenses.

2.07 ELECTRICAL TRANSIENT PROTECTION

A. General:

1. Function: Protect elements of PIC against damage due to electrical transients induced in interconnecting lines by lightning and nearby electrical systems.
2. Implementation: Provide, install, coordinate, and inspect grounding of surge suppressors at:
 - a. Connection of ac power to PIC equipment including panels, consoles assemblies, and field mounted analog transmitters and receivers.
 - b. At the field and panel, console, or assembly connection of signal circuits that have portions of the circuit extending outside of a protective building.
3. Construction: First-stage high energy metal oxide varistor and second-stage bipolar silicon avalanche device separated by series impedance. Includes grounding wire, stud, or terminal.
4. Response: 5 nanoseconds maximum.

5. Recovery: Automatic.
 6. Temperature Range: Minus 20 degrees C to plus 85 degrees C.
- B. Suppressors on 120V ac Power Supply Connections:
1. Occurrences: Tested and rated for a minimum of 50 occurrences of IEEE 587 Category B test waveform.
 2. First-Stage Clamping Voltage: 350 volts or less.
 3. Second-Stage Clamping Voltage: 210 volts or less.
 4. Continuous Operation: Power supplies for one four-wire transmitter or receiver: 5 amps minimum at 130V ac. All other applications: 30 amps minimum at 130V ac.
- C. Suppressors on Analog Signal Lines:
1. Test Waveform: Linear 8 microsecond rise in current from 0 amps to a peak current value followed by an exponential decay of current reaching one half the peak value in 20 microseconds.
 2. Surge Rating: Tested and rated for 50 occurrences of 2,000-amp peak test waveform.
 - a. dc Clamping Voltage: 20 to 40 percent above operating voltage for circuit.
 - b. dc Clamping Voltage Tolerance: Less than plus or minus 10 percent.
 - c. Maximum Loop Resistance: 18 ohms per conductor.
- D. Physical Characteristics:
1. Mounted in Enclosures: Encapsulated in flame retardant epoxy.
 2. For Analog Signals Lines: EDCO PC-642 or SRA-64 series.
 3. For 120V ac Lines: EDCO HSP-121.
 4. Field Mounted at Two-Wire Instruments: Encapsulated in stainless steel pipe nipples. EDCO SS64 series.
 5. Field Mounted at Four-Wire Instruments: With 120V ac outlet, ac circuit breaker, and 10-ohm resistors on signal lines, all in enclosure.
 - a. Enclosure: NEMA 4X fiberglass or Type 316 stainless steel with door.
 - 1) Maximum Size: 12 inches by 12 inches by 8 inches deep.
 - b. Manufacturer and Product: EDCO; SLAC series.
- E. Installation and Grounding of Suppressors: Grounding equipment, installation of grounding equipment, and terminations for field mounted devices are provided under Division 26, Electrical.

2.08 SPARE PARTS

A. General:

1. Provide the following spare parts for the RTU control cabinet in addition to other manufacturer recommended spare parts:
 - a. TAC pack TCU RTU.
 - b. One RIO032 module.

2.09 EXPENDABLES

<u>Item</u>	<u>Quantity</u>
Corrosion-inhibiting vapor capsules	Manufacturer's recommended 2-year supply

2.10 FABRICATION

A. General:

1. Panels with external dimensions and instruments arrangement as shown on Drawings.
 2. Panel Construction and Interior Wiring: In accordance with the National Electrical Code, state and local codes, NEMA, ANSI, UL, and ICECA.
 3. Fabricate panels, install instruments, wire, and plumb, at the PIC factory.
 4. Electrical Work: In accordance with Division 26, Electrical.
- B. Factory Assembly: Assemble panels at the manufacturer's factory. No fabrication other than correction of minor defects or minor transit damage shall be done on panels at Site.
- C. UL Listing Mark for Enclosures: Mark stating "Listed Enclosed Industrial Control Panel" per UL 508A.
- D. Wiring Within PIC Panels:
1. Restrain by plastic ties or ducts or metal raceways.
 2. Hinge Wiring: Secure at each end so that bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.
 3. Arrange wiring neatly, cut to proper length, and remove surplus wire.
 4. Abrasion protection for wire bundles which pass through holes or across edges of sheet metal.
 5. Connections to Screw Type Terminals:
 - a. Locking-fork-tongue or ring-tongue lugs.
 - b. Use manufacturer's recommended tool with required sized anvil to make crimp lug terminations.

- c. Wires terminated in a crimp lug, maximum of one.
 - d. Lugs installed on a screw terminal, maximum of two.
 - 6. Connections to Compression Clamp Type Terminals:
 - a. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.
 - b. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.
 - 7. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.
 - 8. Terminate 24V dc and analog signal circuits on separate terminal block from ac circuit terminal blocks.
 - 9. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
 - 10. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.
 - 11. Plastic Wire Ducts Fill: Do not exceed manufacturer's recommendation.
- E. Temperature Control:
- 1. Freestanding Panels:
 - a. Nonventilated Panels: Size to adequately dissipate heat from equipment mounted inside panel or on panel.
 - b. Ventilated Panels:
 - 1) Furnish with louvers and forced ventilation as required to prevent temperature buildup from equipment mounted inside panel or on panel.
 - 2) For panels with backs against wall, furnish louvers on top and bottom of panel sides.
 - 3) For panels without backs against wall, furnish louvers on top and bottom of panel back.
 - 4) Louver Construction: Stamped sheet metal.
 - 5) Ventilation Fans:
 - a) Furnish where required to provide adequate cooling.
 - b) Create positive internal pressure within panel.
 - c) Fan Motor Power: 120V ac, 60-Hz, thermostatically controlled.
 - 6) Air Filters: Washable aluminum, Hoffman Series A-FLT.
 - 2. Refrigerated System: Furnish where heat dissipation cannot be adequately accomplished with natural convection or forced ventilation. Smaller Panels (that are not freestanding): Size to adequately dissipate heat from equipment mounted inside panel or in panel face.

3. Space Heaters:
 - a. Thermostatically controlled to maintain internal panel temperatures above dew point.
 - b. Required for following panels: As noted.

F. Nonfreestanding Panel Construction:

1. Based on environmental design requirements required and referenced in Article Environmental Requirements, provide the following:
 - a. For panels listed as inside, air conditioned:
 - 1) Enclosure Type: NEMA 12 in accordance with NEMA 250.
 - 2) Materials: Steel.
 - b. For all other panels:
 - 1) Enclosure Type: NEMA 4X in accordance with NEMA 250.
 - 2) Materials: Type 316 stainless steel.
2. Metal Thickness: 14-gauge, minimum.
3. Doors:
 - a. Rubber-gasketed with continuous hinge.
 - b. Stainless steel lockable quick-release clamps.
4. Manufacturers:
 - a. Hoffman Engineering Co.
 - b. Rittal.

G. Factory Finishing:

1. Enclosures:
 - a. Stainless Steel and Aluminum: Not painted.
 - b. Nonmetallic Panels: Similar to steel panels.
 - c. Steel Panels:
 - 1) Sand panel and remove mill scale, rust, grease, and oil.
 - 2) Fill imperfections and sand smooth.
 - 3) Paint panel interior and exterior with one coat of epoxy coating metal primer, two finish coats of two-component type epoxy enamel.
 - 4) Sand surfaces lightly between coats.
 - 5) Dry Film Thickness: 3 mils, minimum.
 - 6) Color: As noted.
2. Manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment with light gray color.

2.11 CORROSION PROTECTION

- A. Corrosion-Inhibiting Vapor Capsule Manufacturers:
 - 1. Northern Instruments; Model Zerust VC.
 - 2. Hoffmann Engineering Co; Model A-HCI.

2.12 SOURCE QUALITY CONTROL

- A. Scope: Inspect and test entire PIC to ensure it is ready for shipment, installation, and operation.
- B. Location: Manufacturer's factory or Engineer approved staging Site.
- C. Test: Exercise and test all functions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. For equipment not provided by PIC, but that directly interfaces with the PIC, verify the following conditions:
 - 1. Proper installation.
 - 2. Calibration and adjustment of positioners and I/P transducers.
 - 3. Correct control action.
 - 4. Switch settings and dead bands.
 - 5. Opening and closing speeds and travel stops.
 - 6. Input and output signals.

3.02 INSTALLATION

- A. Material and Equipment Installation: Retain a copy of manufacturers' instructions at Site, available for review at all times.
- B. Electrical Wiring: As specified in Division 26, Electrical.
- C. Removal or Relocation of Materials and Equipment:
 - 1. Remove from Site materials that were part of the existing facility but are no longer used, unless otherwise directed by Engineer to deliver to Owner.
 - 2. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.

3.03 FIELD FINISHING

- A. Refer to Section 09 90 04, Painting (Condensed).

3.04 FIELD QUALITY CONTROL

- A. Startup and Testing Team:

- 1. Thoroughly inspect installation, termination, and adjustment for components and systems.
- 2. Complete onsite tests.
- 3. Complete onsite training.
- 4. Provide startup assistance.

- B. Operational Readiness Inspections and Calibrations: Prior to startup, inspect and test to ensure that entire PIC is ready for operation.

- 1. Loop/Component Inspections and Calibrations:
 - a. Check PIC for proper installation, calibration, and adjustment on a loop-by-loop and component-by-component basis.
 - b. Prepare component calibration sheet for each active component (except simple hand switches, lights, gauges, and similar items).
 - 1) Project name.
 - 2) Loop number.
 - 3) Component tag number.
 - 4) Component code number.
 - 5) Manufacturer for elements.
 - 6) Model number/serial number.
 - 7) Summary of functional requirements, for example:
 - a) Indicators and recorders, scale and chart ranges.
 - b) Transmitters/converters, input and output ranges.
 - c) Computing elements' function.
 - d) Controllers, action (direct/reverse) and control modes (PID).
 - e) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).
 - 8) Calibrations, for example:
 - a) Analog Devices: Actual inputs and outputs at 0, 10, 50, and 100 percent of span, rising and falling.
 - b) Discrete Devices: Actual trip points and reset points.
 - c) Controllers: Mode settings (PID).
 - 9) Space for comments.
 - c. These inspections and calibrations do not require witnessing.
- 2. Verify flawless communication of signals and data between the remote RTU and the CTU at the Richard A. Heyman Environmental Protection Facility.

- C. Unwitnessed Factory Test (UFT):
1. Scope: Inspect and test RTU to ensure it is operational.
 2. Location: RTU supplier Factory.
 3. Integrated Test:
 - a. Interconnect and test.
 - b. Exercise and test all functions.
 - c. Provide standalone testing for each panel.
 - d. Simulate inputs and outputs for primary elements and final control elements.
- D. Performance Acceptance Tests (PAT): These are the activities that Section 01 91 14, Equipment Testing and Facility Startup, refers to as performance testing.
1. General:
 - a. Test all PIC elements to demonstrate that PIC satisfies all requirements.
 - b. Test the radio communication link between the supervisor computer system at the Key West Richard A. Heyman Environmental Protection Facility and the new RTU radio system.
 - c. Test Format: Cause and effect.
 - 1) Person conducting test initiates an input (cause).
 - 2) Specific test requirement is satisfied if correct result (effect) occurs.
 - d. Procedures, Forms, and Checklists:
 - 1) Conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
 - 2) Describe each test item to be performed.
 - 3) Have space after each test item description for sign off by appropriate party after satisfactory completion.
 - e. Required Test Documentation: Test procedures, forms, and checklists. All signed by Engineer and Contractor.
 - f. Conducting Tests:
 - 1) Provide special testing materials, equipment, and software.
 - 2) Wherever possible, perform tests using actual process variables, equipment, and data.
 - 3) If it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation.
 - 4) Define simulation techniques in test procedures.
 - g. Coordinate PIC testing with Owner and affected Subcontractors.
 - 1) Excessive Test Witnessing: Refer to Supplementary Conditions.

2. Test Requirements:
 - a. Once facility has been started up and is operating, perform a witnessed PAT on complete PIC to demonstrate that it is operating as required. Demonstrate each required function on a paragraph-by-paragraph and loop-by-loop basis.
 - b. Perform local and manual tests for each loop before proceeding to remote and automatic modes.
 - c. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.
 - d. Make updated versions of documentation required for PAT available to Engineer at Site, both before and during tests.
 - e. Make one copy of O&M manuals available to Engineer at the Site both before and during testing.
 - f. Refer to referenced examples of PAT procedures and forms in Article Supplements.

3.05 MANUFACTURER'S SERVICES

- A. Specialty Equipment: For following equipment, provide the services of a qualified manufacturer's representative during installation, startup, and demonstration testing and Owner training. Provide original equipment manufacturer's services for: DFS RTUs.

3.06 CLEANING/ADJUSTING

- A. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.
- B. Cleaning:
 1. Prior to closing system using tubing, clear tubing of interior moisture and debris.
 2. Upon completion of Work, remove materials, scraps, and debris from interior and exterior of equipment.

3.07 PROTECTION

- A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.

- B. Periodically replace capsules in accordance with capsule manufacturer's recommendations. Replace capsules just prior to Final Payment and Acceptance.

3.08 SUPPLEMENTS

- A. Supplements listed below, following "End of Section," are part of this Specification.
 - 1. RTU Input/Output List.
 - 2. Performance Acceptance Test Sheet: Describes the PAT for a given loop. The format is mostly free form.
 - a. Lists the requirements of the loop.
 - b. Briefly describes the test.
 - c. Cites expected results.
 - d. Provides space for check off by witness.

END OF SECTION

**CITY OF KEY WEST
RTU INPUT OUTPUT LIST**

DWG	RTU	Tag	IO Function	Description	DI	DO	AI	AO
Lift Station A								
N/A	RTU-A		Level	Wetwell Level			1	
N/A	RTU-A		Flow	Lift Station Flow			1	
N/A	RTU-A		Salinity	Station Salinity			1	
N/A	RTU-A		On	Pump X, X=1,2 On Status	2			
N/A	RTU-A		Fail	Pump X, X=1,2 Fail Alarm	2			
N/A	RTU-A		Low Level	Low Level Float	1			
N/A	RTU-A		High Level	High Level Float	1			
N/A	RTU-A		Alarm	Bubbler Compressor Alarm	1			
N/A	RTU-A		On	Generator On Status	1			
N/A	RTU-A		Fail	Generator Fail Alarm	1			
N/A	RTU-A		Alarm	Panel Intrusion Alarm	1			
N/A	RTU-A		In Bypass	Pump X, X=1,2 In Bypass Status	2			
N/A	RTU-A		Bypass Fail	Pump X, X=1,2 Bypass Fail Alarm	2			
N/A	RTU-A		Run Command	Pump X, X=1,2 Run Command		2		
N/A	RTU-A		On	Alarm horn ON output		1		
N/A	RTU-A		On	Alarm light On Output		1		
N/A	RTU-A		Shunt Trip	Main breaker shunt trip		1		
N/A	RTU-A		Current	Pump X, X=1,2 Current			2	
N/A	RTU-A		Speed	Pump X, X=1,2 Speed Feedback			2	
N/A	RTU-A		Speed	Pump X, X=1,2 Speed Command				2
				Lift Station A RTU Totals	14	5	7	2
Lift Station B								
N/A	RTU-B		Level	Wetwell Level			1	
N/A	RTU-B		Flow	Lift Station Flow			1	
N/A	RTU-B		Salinity	Station Salinity			1	
N/A	RTU-B		On	Pump X, X=1,2 On Status	2			
N/A	RTU-B		Fail	Pump X, X=1,2 Fail Alarm	2			
N/A	RTU-B		Low Level	Low Level Float	1			
N/A	RTU-B		High Level	High Level Float	1			
N/A	RTU-B		Alarm	Bubbler Compressor Alarm	1			
N/A	RTU-B		Normal	ATS Normal	1			
N/A	RTU-B		On	Generator On Status	1			
N/A	RTU-B		Fail	Generator Fail Alarm	1			

**CITY OF KEY WEST
RTU INPUT OUTPUT LIST**

DWG	RTU	Tag	IO Function	Description	DI	DO	AI	AO
N/A	RTU-B		Low Level	Generator Low Fuel Alarm	1			
N/A	RTU-B		Low Alarm	Generator Low Oil Alarm	1			
N/A	RTU-B		High Temperature	Generator High Temperature Alarm	1			
N/A	RTU-B		In Bypass	Pump X, X=1,2 In Bypass Status	2			
N/A	RTU-B		Bypass Fail	Pump X, X=1,2 Bypass Fail Alarm	2			
N/A	RTU-B		Run Command	Pump X, X=1,2 Run Command		2		
N/A	RTU-B		On	Alarm horn ON output		1		
N/A	RTU-B		On	Alarm light On Output		1		
N/A	RTU-B		Disable	Generator Disable Command		1		
N/A	RTU-B		Override	Generator Override Command		1		
N/A	RTU-B		Shunt Trip	Main breaker shunt trip		1		
N/A	RTU-B		Current	Pump X, X=1,2 Current			2	
N/A	RTU-B		Speed	Pump X, X=1,2 Speed Feedback			2	
N/A	RTU-B		Speed	Pump X, X=1,2 Speed Command				2
				Lift Station RTU B Totals	17	7	7	2
Lift Station C								
N/A	RTU-C		Level	Wetwell Level			1	
N/A	RTU-C		Flow	Lift Station Flow			1	
N/A	RTU-C		Salinity	Station Salinity			1	
N/A	RTU-C		On	Pump X, X=1,2 On Status	2			
N/A	RTU-C		Fail	Pump X, X=1,2 Fail Alarm	2			
N/A	RTU-C		Low Level	Low Level Float	1			
N/A	RTU-C		High Level	High Level Float	1			
N/A	RTU-C		Alarm	Bubbler Compressor Alarm	1			
N/A	RTU-C		Normal	ATS Normal	1			
N/A	RTU-C		On	Generator On Status	1			
N/A	RTU-C		Fail	Generator Fail Alarm	1			
N/A	RTU-C		Low Level	Generator Low Fuel Alarm	1			
N/A	RTU-C		Overcrank Alarm	Generator Overcrank Alarm	1			
N/A	RTU-C		Overspeed Alarm	Generator Overspeed Alarm	1			
N/A	RTU-C		Low Alarm	Generator Low Oil Alarm	1			
N/A	RTU-C		High Temperature	Generator High Temperature Alarm	1			
N/A	RTU-C		In Bypass	Pump X, X=1,2 In Bypass Status	2			
N/A	RTU-C		Bypass Fail	Pump X, X=1,2 Bypass Fail Alarm	2			
N/A	RTU-C		Run Command	Pump X, X=1,2 Run Command		2		

**CITY OF KEY WEST
RTU INPUT OUTPUT LIST**

DWG	RTU	Tag	IO Function	Description	DI	DO	AI	AO
N/A	RTU-C		On	Alarm horn ON output		1		
N/A	RTU-C		On	Alarm light On Output		1		
N/A	RTU-C		Disable	Generator Disable Command		1		
N/A	RTU-C		Override	Generator Override Command		1		
N/A	RTU-C		Shunt Trip	Main breaker shunt trip		1		
N/A	RTU-C		Current	Pump X, X=1,2 Current			2	
N/A	RTU-C		Speed	Pump X, X=1,2 Speed Feedback			2	
N/A	RTU-C		Speed	Pump X, X=1,2 Speed Command				2
				Lift Station RTU C Totals	19	7	7	2
Lift Station D								
N/A	RTU-D		Level	Wetwell Level			1	
N/A	RTU-D		Flow	Lift Station Flow			1	
N/A	RTU-D		Salinity	Station Salinity			1	
N/A	RTU-D		On	Pump X, X=1,2,3 On Status	3			
N/A	RTU-D		Fail	Pump X, X=1,2,3 Fail Alarm	3			
N/A	RTU-D		Low Level	Low Level Float	1			
N/A	RTU-D		High Level	High Level Float	1			
N/A	RTU-D		Alarm	Bubbler Compressor Alarm	1			
N/A	RTU-D		On	Generator On Status	1			
N/A	RTU-D		Overcrank Alarm	Generator Overcrank Alarm	1			
N/A	RTU-D		High Temperature	Generator High Temperature Alarm	1			
N/A	RTU-D		Overspeed Alarm	Generator Overspeed Alarm	1			
N/A	RTU-D		Low Oil	Generator Low Oil Alarm	1			
N/A	RTU-D		In Bypass	Pump X, X=1,2,3 In Bypass Status	3			
N/A	RTU-D		Bypass Fail	Pump X, X=1,2,3 Bypass Fail Alarm	3			
N/A	RTU-D		Run Command	Pump X, X=1,2,3 Run Command		3		
N/A	RTU-D		On	Alarm horn ON output		1		
N/A	RTU-D		On	Alarm light On Output		1		
N/A	RTU-D		Current	Pump X, X=1,2,3 Current			3	
N/A	RTU-D		Speed	Pump X, X=1,2,3 Speed Feedback			3	
N/A	RTU-D		Speed	Pump X, X=1,2,3 Speed Command				3
				Lift Station D RTU Totals	20	5	9	3

**CITY OF KEY WEST
RTU INPUT OUTPUT LIST**

DWG	RTU	Tag	IO Function	Description	DI	DO	AI	AO
Lift Station DA								
N/A	RTU-DA		Level	Wetwell Level			1	
N/A	RTU-DA		Flow	Lift Station Flow			1	
N/A	RTU-DA		Salinity	Station Salinity			1	
N/A	RTU-DA		On	Pump X, X=1,2 On Status	2			
N/A	RTU-DA		Fail	Pump X, X=1,2 Fail Alarm	2			
N/A	RTU-DA		Low Level	Low Level Float	1			
N/A	RTU-DA		High Level	High Level Float	1			
N/A	RTU-DA		Alarm	Bubbler Compressor Alarm	1			
N/A	RTU-DA		Normal	ATS Normal	1			
N/A	RTU-DA		On	Generator On Status	1			
N/A	RTU-DA		Fail	Generator Fail Alarm	1			
N/A	RTU-DA		Low Level	Generator Low Fuel Alarm	1			
N/A	RTU-DA		Overcrank Alarm	Generator Overcrank Alarm	1			
N/A	RTU-DA		Overspeed Alarm	Generator Overspeed Alarm	1			
N/A	RTU-DA		Low Alarm	Generator Low Oil Alarm	1			
N/A	RTU-DA		High Temperature	Generator High Temperature Alarm	1			
N/A	RTU-DA		In Bypass	Pump X, X=1,2 In Bypass Status	2			
N/A	RTU-DA		Bypass Fail	Pump X, X=1,2 Bypass Fail Alarm	2			
N/A	RTU-DA		Run Command	Pump X, X=1,2 Run Command		2		
N/A	RTU-DA		On	Alarm horn ON output		1		
N/A	RTU-DA		On	Alarm light On Output		1		
N/A	RTU-DA		Disable	Generator Disable Command		1		
N/A	RTU-DA		Override	Generator Override Command		1		
N/A	RTU-DA		Shunt Trip	Main breaker shunt trip		1		
N/A	RTU-DA		Current	Pump X, X=1,2 Current			2	
N/A	RTU-DA		Speed	Pump X, X=1,2 Speed Feedback			2	
N/A	RTU-DA		Speed	Pump X, X=1,2 Speed Command				2
				Lift Station DA Totals	19	7	7	2

PART 4

**DRAWINGS
(BOUND SEPARATELY)**
