

BID DOCUMENTS AND TECHNICAL SPECIFICATIONS

BEASLEY PARK SANITARY SEWER IMPROVEMENT

PREPARED FOR THE
OKALOOSA COUNTY WATER & SEWER



ITB WS 34-19

March 2019
Project No. 100502.01



THIS PAGE WAS INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

PART 1 - BIDDING REQUIREMENTS

Okaloosa	Advertisement for Bids
Okaloosa	Notice to Respondents
Okaloosa	Bid Requirements
Okaloosa GSIR	General Services Insurance Requirements
Okaloosa GSC	General Services Bid Conditions
Okaloosa Form A	Drug-Free Workplace Certification
Okaloosa Form B	Conflict of Interest Disclosure Form
Okaloosa Form C	Federal E-Verify Compliance Certification
Okaloosa Form D	Indemnification and Hold Harmless
Okaloosa Form E	Lobbying
Okaloosa Form F	Cone of Silence
Okaloosa Form G	Company Data
Okaloosa Form H	System for Award Management
Okaloosa Form I	Addendum Acknowledgement
Okaloosa Form J	Bid Form
Okaloosa Form K	Anti-Collusion Form
Okaloosa Form L	Government Debarment & Suspension
EJCDC C-430	Bid Bond
EJCDC C-451	Qualifications Statement
EJCDC C-510	Notice of Award

PART 2 - CONTRACT FORMS

EJCDC C-520	Agreement
EJCDC C-550	Notice to Proceed
EJCDC C-610	Performance Bond
EJCDC C-615	Payment Bond

PART 3 - CONDITIONS OF THE CONTRACT

EJCDC C-625	Certificate of Substantial Completion
EJCDC C-700	Standard General Conditions
EJCDC C-941	Change Order

PART 4 - SPECIFICATIONS

DIVISION 1 – General Requirements

01001	General Requirements
01100	Summary of Work
01111	Permits & Rights-of-Way
01500	Pre-Construction Video
01720	Project Record Documents

DIVISION 2 – Site Construction

02101	Civil Sitework
-------	----------------

02140	Dewatering
02200	Earthwork
02260	Erosion and Sediment Control
02481	Grassing, Sod and Sprigs

DIVISION 3 – Concrete

03300	Cast-in-Place Concrete
-------	------------------------

DIVISION 4 – Not Used

DIVISION 5 – Not Used

DIVISION 6 – Not Used

DIVISION 7 – Not Used

DIVISION 8 – Not Used

DIVISION 9 – Not Used

DIVISION 10 – Not Used

DIVISION 11 – Equipment

11310	Submersible Grinder Pumps
11145	FRP Structures

DIVISION 12 – Not Used

DIVISION 13 – Not Used

DIVISION 14 – Not Used

DIVISION 15 – Mechanical

15002	Gravity Sewer Manholes & Accessories
15110	Piping and Accessories
15200	Valves and Accessories

DIVISION 16 – Electrical

16010	Basic Electrical Requirements
16055	Overcurrent Protective Device Coordination
16060	Grounding and Bonding
16075	Electrical Identification
16120	Conductors and Cables
16130	Raceways and Boxes
16135	Underground Ducts
16140	Wiring Devices
16289	Transient Voltage Suppression
16410	Enclosed Switches and Circuit Breakers
16442	Panelboards
16461	Low Voltage Transformers
16491	Fuses
16910	Control Panel Construction



INVITATION TO BID (ITB) & RESPONDENT'S ACKNOWLEDGEMENT

ITB TITLE:
Beasley Park Sanitary Sewer Improvement Project

ITB NUMBER:
ITB WS 34-19

ISSUE DATE:

March 25, 2019 8:00 A.M. CT

LAST DAY FOR QUESTIONS:

April 12, 2019 3:00 P.M. CT

ITB OPENING DATE & TIME:

April 24, 2019 3:00 P.M. CT

NOTE: BIDS RECEIVED AFTER THE BID OPENING DATE & TIME WILL NOT BE CONSIDERED.

Okaloosa County, Florida solicits your company to submit a bid on the above referenced goods or services. All terms, specifications and conditions set forth in this ITB are incorporated into your response. A bid will not be accepted unless all conditions have been met. All bids must have an authorized signature in the space provided below. All bids must be sealed and received by the Okaloosa County Clerk of Court by the "ITB Opening Date & Time" referenced above. Okaloosa County is not responsible for lost or late delivery of bids by the U.S. Postal Service or other delivery services used by the respondent. Neither faxed nor electronically submitted bids will be accepted. Bids may not be withdrawn for a period of ninety (90) days after the bid opening unless otherwise specified

RESPONDENT ACKNOWLEDGEMENT FORM BELOW MUST BE COMPLETED, SIGNED, AND RETURNED AS PART OF YOUR BID. BIDS WILL NOT BE ACCEPTED WITHOUT THIS FORM, SIGNED BY AN AUTHORIZED AGENT OF THE RESPONDENT.

COMPANY NAME _____

MAILING ADDRESS _____

CITY, STATE, ZIP _____

FEDERAL EMPLOYER'S IDENTIFICATION NUMBER (FEIN): _____

TELEPHONE NUMBER: _____ EXT: _____ FAX: _____

EMAIL: _____

I CERTIFY THAT THIS BID IS MADE WITHOUT PRIOR UNDERSTANDING, AGREEMENT, OR CONNECTION WITH ANY OTHER RESPONDENT SUBMITTING A BID FOR THE SAME MATERIALS, SUPPLIES, EQUIPMENT OR SERVICES, AND IS IN ALL RESPECTS FAIR AND WITHOUT COLLUSION OR FRAUD. I AGREE TO ABIDE BY ALL TERMS AND CONDITIONS OF THIS BID AND CERTIFY THAT I AM AUTHORIZED TO SIGN THIS BID FOR THE RESPONDENT.

AUTHORIZED SIGNATURE: _____ TYPED OR PRINTED NAME _____

TITLE: _____ DATE _____

THIS PAGE WAS INTENTIONALLY LEFT BLANK

NOTICE TO RESPONDENTS
ITB WS 34-19

Notice is hereby given that the Board of County Commissioners of Okaloosa County, FL, will accept sealed bids until **3:00 p.m. (CST) April 24, 2019**, for **Beasley Park Sanitary Sewer Improvement Project**.

Interested respondents desiring consideration shall provide an original and two (2) copies (total three (3)) of their Invitation to Bids (ITB) response with the respondent's areas of expertise identified. Submissions shall be portrait orientation, unbound, and 8 ½" x 11" where practical. **All originals must have original signatures in blue ink.**

Bid Documents can be viewed at <https://www.bidnetdirect.com/florida> or at <http://www.co.okaloosa.fl.us/purchasing/home> then accessing the link "View Current Solicitations"

At **3:00 p.m. (CST), April 24, 2019**, all bids will be opened and read aloud. All bids must be in sealed envelopes reflecting on the outside thereof the Respondent's name and "**Beasley Park Sanitary Sewer Improvement Project**". The Board of County Commissioners will consider all bids properly submitted at its scheduled bid opening in the Okaloosa County Courthouse located at 101 E. James Lee Boulevard #282, Crestview, FL 32536. Bids may be submitted in the prior to bid opening or delivered to the Clerk of Circuit Court, 101 E. James Lee Boulevard, #282, Crestview, FL 32536.

NOTE: MUST RING DOORBELL TO GAIN ENTRANCE INTO ROOM 282. THE CLERK WILL COME ACCEPT YOUR PACKAGE OR SHOW YOU TO THE CONFERENCE ROOM FOR THE SCHEDULED BID OPENING

NOTE: THE NEW CRESTVIEW COURTHOUSE HAS SECURITY AT ENTRY POINT-PLEASE ALLOW FOR TIME TO GET THROUGH SECURITY WHEN ARRIVING FOR THE BID OPENING.

NOTE: Crestview, FL is not a next day guaranteed delivery location by most delivery services. Respondents using mail or delivery services assume all risks of late or non-delivery.

The County reserves the right to award the bid to the lowest responsive respondent and to waive any irregularity or technicality in bids received. Okaloosa County shall be the sole judge of the bid and the resulting negotiated agreement that is in its best interest and its decision shall be final.

Any Respondent failing to mark outside of the envelope as set forth herein may not be entitled to have their bid considered.

All bids should be addressed as follows:

**Beasley Park Sanitary Sewer
Improvement Project**

Clerk of Circuit Court
Attn: BCC Records
101 E. James Lee Boulevard., #282
Crestview FL 32536

Jeff Hyde
Purchasing Manager

Date

OKALOOSA COUNTY
BOARD OF COUNTY COMMISSIONERS

Kelly Windes, Chairman

THIS PAGE WAS INTENTIONALLY LEFT BLANK

BID REQUIREMENTS

BID #: ITB WS 34-19

BID ITEM: Beasley Park Sanitary Sewer Improvement Project

SCOPE

This bid includes the material, equipment, and labor services for a new Sanitary Sewer Lift Station, Force Main, Gravity Service and other associated items specified herein. All materials shall be manufactured within the continental United States. No substitutions will be accepted unless approved by the Purchasing and the Water & Sewer Department. **Note: Evaluation of bid will be based on “TOTAL BASE BID AMOUNT”. All bids shall include itemized unit cost for each identified item.**

Price shall be guaranteed for 90 days after the bids are read and received. Price shall include delivery of all equipment and appurtenances.

Contractor is required to coordinate submittal, fabrication and shipping once a construction contract has been executed between the County and a Contractor. For any construction water utilized via a hydrant meter, the contractor shall setup an account with OCWS' Customer Service office and provide contract information. The account shall be setup in the contractor's name with a deposit and service fee paid by the contractor. The deposit will be refunded when the account terminates if the meter has not been damaged or lost. OCWS will be responsible for setting the hydrant, along with the monthly reading. If the hydrant meter needs to be relocated, contractor to coordinate this with OCWS Maintenance. Water usage will not be charged to the contractor, provided that the above conditions are met.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

GENERAL SERVICES INSURANCE REQUIREMENTS

REVISED: 08/1/2018

CONTRACTORS INSURANCE

1. The Contractor shall not commence any work in connection with this Agreement until he has obtained all required insurance and such insurance has been approved by the Okaloosa County Risk Manager or designee.
2. All insurance policies shall be with insurers authorized to do business in the State of Florida.
3. All insurance shall include the interest of all entities named and their respective officials, employees & volunteers of each and all other interests as may be reasonably required by Okaloosa County. The coverage afforded the Additional Insured under this policy shall be primary insurance. If the Additional Insured have other insurance that is applicable to the loss, such other insurance shall be on an excess or contingent basis. The amount of the company's liability under this policy shall not be reduced by the existence of such other insurance.
4. The County shall be shown as an Additional Insured on ALL policies with a Waiver of Subrogation on the Certificate of Insurance.
5. The County shall retain the right to reject all insurance policies that do not meet the requirement of this Agreement. Further, the County reserves the right to change these insurance requirements with 60-day notice to the Contractor.
6. The County reserves the right at any time to require the Contractor to provide copies (redacted if necessary) of any insurance policies to document the insurance coverage specified in this Agreement.
7. The designation of Contractor shall include any associated or subsidiary company which is involved and is a part of the contract and such, if any associated or subsidiary company involved in the project must be named in the Workers' Compensation coverage.
8. Any exclusions or provisions in the insurance maintained by the Contractor that excludes coverage for work contemplated in this agreement shall be deemed unacceptable and shall be considered breach of contract.

WORKERS' COMPENSATION INSURANCE

1. The Contractor shall secure and maintain during the life of this Agreement Workers' Compensation insurance for all of his employees employed for the project or any site connected with the work, including supervision, administration or management, of this project and in case any work is sublet, with the approval of the County, the Contractor shall require the Subcontractor similarly to provide Workers' Compensation insurance for all employees employed at the site of the project, and such evidence of insurance shall be furnished to the County not less than ten (10) days prior to the commencement of any and all sub-contractual Agreements which have been approved by the County.
2. Contractor must be in compliance with all applicable State and Federal workers' compensation laws, including the U.S. Longshore Harbor Workers' Act or Jones Act, if applicable.

3. No class of employee, including the Contractor himself, shall be excluded from the Workers' Compensation insurance coverage. The Workers' Compensation insurance shall also include Employer's Liability coverage.

BUSINESS AUTOMOBILE LIABILITY

Coverage must be afforded for all Owned, Hired, Scheduled, and Non-Owned vehicles for Bodily Injury and Property Damage in an amount not less than \$1,000,000 combined single limit each accident. If the contractor does not own vehicles, the contractor shall maintain coverage for Hired & Non-Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Policy. Contractor must maintain this insurance coverage throughout the life of this Agreement. In addition, the County shall be shown as Additional Insured.

COMMERCIAL GENERAL LIABILITY INSURANCE

1. The Contractor shall carry other Commercial General Liability insurance against all other Bodily Injury, Property Damage and Personal and Advertising Injury exposures.
2. All liability insurance (other than Professional Liability) shall be written on an occurrence basis and shall not be written on a claims-made basis. If the insurance is issued with an aggregate limit of liability, the aggregate limit of liability shall apply only to the locations included in this Agreement. If, as the result of any claims or other reasons, the available limits of insurance reduce to less than those stated in the Limits of Liability, the Contractor shall notify the County representative in writing. The Contractor shall purchase additional liability insurance to maintain the requirements established in this Agreement. Umbrella or Excess Liability insurance can be purchased to meet the Limits of Liability specified in this Agreement.
3. Commercial General Liability coverage shall include the following:
 - 1.) Premises & Operations Liability
 - 2.) Bodily Injury and Property Damage Liability
 - 3.) Independent Contractors Liability
 - 4.) Contractual Liability
 - 5.) Products and Completed Operations Liability
4. Contractor shall agree to keep in continuous force Commercial General Liability coverage for the length of the contract.

ENVIRONMENTAL IMPAIRMENT LIABILITY INSURANCE

Environmental Impairment Liability Insurance in the amount of \$2 million per claim to include Third Party liability, remediation and cleanup costs as well hazardous waste transportation coverage. Okaloosa County Board of County Commissioners is to be listed as Additional Insured.

LIMITS OF LIABILITY

The insurance required shall be written for not less than the following, or greater if required by law and shall include Employer's liability with limits as prescribed in this contract:

		<u>LIMIT</u>
1.	Worker's Compensation	
	1.) State	Statutory
	2.) Employer's Liability	\$500,000 each accident
2.	Business Automobile	\$1,000,000 each accident (A combined single limit)
3.	Commercial General Liability	\$1,000,000 each occurrence for Bodily Injury & Property Damage \$1,000,000 each occurrence Products and completed operations
4.	Personal and Advertising Injury	\$1,000,000 each occurrence
5.	Environmental Insurance	\$2,000,000 each occurrence

NOTICE OF CLAIMS OR LITIGATION

The Contractor agrees to report any incident or claim that results from performance of this Agreement. The County representative shall receive written notice in the form of a detailed written report describing the incident or claim within ten (10) days of the Contractor's knowledge. In the event such incident or claim involves injury and/or property damage to a third party, verbal notification shall be given the same day the Contractor becomes aware of the incident or claim followed by a written detailed report within ten (10) days of verbal notification.

INDEMNIFICATION & HOLD HARMLESS

Contractor shall indemnify and hold harmless the County, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or wrongful conduct of the Contractor and other persons employed or utilized by the Contractor in the performance of this contract.

Note: For Contractor's convenience, this certification form is enclosed and is made a part of the bid package.

CERTIFICATE OF INSURANCE

1. Certificates of insurance indicating the job site and evidencing all required coverage must be submitted not less than 10 days prior to the commencement of any of the work. The certificate holder(s) shall be as follows: Okaloosa County, 5479A Old Bethel Road, Crestview, Florida, 32536.
2. The contractor shall provide a Certificate of Insurance to the County with a thirty (30) day notice of cancellation; ten (10 days' notice if cancellation is for nonpayment of premium).
3. In the event that the insurer is unable to accommodate the cancellation notice requirement, it shall be the responsibility of the contractor to provide the proper notice. Such notification shall be in writing by registered mail, return receipt requested, and addressed to the Okaloosa County Purchasing Department at 5479-A Old Bethel Road, Crestview, FL 32536.
4. In the event the contract term goes beyond the expiration date of the insurance policy, the contractor shall provide the County with an updated Certificate of insurance no later than ten (10) days prior to

the expiration of the insurance currently in effect. The County reserves the right to suspend the contract until this requirement is met.

5. The certificate shall indicate if coverage is provided under a claims-made or occurrence form. If any coverage is provided on a claims-made form, the certificate will show a retroactive date, which should be the same date of the initial contract or prior.
6. All certificates shall be subject to Okaloosa County's approval of adequacy of protection and the satisfactory character of the Insurer.
7. All deductibles or SIRs, whether approved by Okaloosa County or not, shall be the Contractor's full responsibility. In particular, the Contractor shall afford full coverage as specified herein to entities listed as Additional Insured.
8. In no way will the entities listed as Additional Insured be responsible for, pay for, be damaged by, or limited to coverage required by this schedule due to the existence of a deductible or SIR.

GENERAL TERMS

Any type of insurance or increase of limits of liability not described above which, the Contractor required for its own protection or on account of statute shall be its own responsibility and at its own expense.

Any exclusions or provisions in the insurance maintained by the contractor that excludes coverage for work contemplated in this contract shall be deemed unacceptable and shall be considered breach of contract.

The carrying of the insurance described shall in no way be interpreted as relieving the Contractor of any responsibility under this contract.

Should the Contractor engage a subcontractor or sub-subcontractor, the same conditions will apply under this Agreement to each subcontractor and sub-subcontractor.

The Contractor hereby waives all rights of subrogation against Okaloosa County and its consultants and other indemnities of the Contractor under all the foregoing policies of insurance.

UMBRELLA INSURANCE

The Contractor shall have the right to meet the liability insurance requirements with the purchase of an umbrella insurance policy. In all instances, the combination of primary and umbrella liability coverage must equal or exceed the minimum liability insurance limits stated in this Agreement.

GENERAL SERVICES BID CONDITIONS

1. PRE-BID ACTIVITY -

Addendum - Except as provided in this section, respondents are prohibited from contacting or lobbying the County, County Administrator, Commissioners, County staff, and Review Committee members, or any other person authorized on behalf of the County related or involved with the solicitation. All inquiries on the scope of work, specifications, additional requirements, attachments, terms and general conditions or instructions, or any issue must be directed in writing, by US mail or email to:

Victoria Taravella
Contracts and Lease Coordinator
Okaloosa County Purchasing Department
5479A Old Bethel Road
Crestview, Florida 32536
(850) 689-5960 vtaravella@myokaloosa.com

All questions or inquiries must be received no later than the last day for questions (reference ITB & Respondent's Acknowledgement form). Any addenda or other modification to the bid documents will be issued by the County five (5) days prior to the date and time of bid closing, as written addenda, and will be posted to <http://www.bidnetdirect.com/florida> and the Okaloosa County website at <http://www.co.okaloosa.fl.us/purchasing/current-solicitations>.

Such written addenda or modification shall be part of the bid documents and shall be binding upon each respondent. Each respondent is required to acknowledge receipt of any and all addenda in writing and submit with their bid. No respondent may rely upon any verbal modification or interpretation.

- 2. PREPARATION OF BID** – The bid form is included with the bid documents. Additional copies may be obtained from the County. The respondent shall submit an original and two (2) copies {total three (3)} of the bid documents.

All blanks in the bid documents shall be completed by printing in ink or by typewriter in both words and numbers with the amounts extended, totaled and the bid signed. A bid price shall be indicated for each section, bid item, alternative, adjustment unit price item, and unit price item listed therein, or the words “No Bid”, “No Change”, or “Not Applicable” entered. No changes shall be made to the phraseology of the form or in the items mentioned therein. In case of any discrepancy between the written amount and the numerical figures, the written amount shall govern. Any bid which contains any omissions, erasures, alterations, additions, irregularities of any kind, or items not called for which shall in any manner fail to conform to the conditions of public notice inviting bids may be rejected.

A bid submitted by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature). The official address of the partnership shall be shown below the signature.

A bid submitted by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.

A bid submitted by an individual shall show the respondent's name and official address.

A bid submitted by a joint venture shall be executed by each joint venture in the manner indicated on the bid form. The official address of the joint venture must be shown below the signature.

It is preferred that all signatures be in blue ink with the names type or printed below the signature. Okaloosa County does not accept electronic signatures.

The bid shall contain an acknowledgement of receipt of all Addenda, the numbers of which shall be filled in on the form. The address and telephone # for communications regarding the bid shall be shown.

If the respondent is an out-of-state corporation, the bid shall contain evidence of respondent's authority and qualification to do business as an out-of-state corporation in the State of Florida in accordance with Article 3. A state contractor license # for the State of Florida shall also be included on the bid form. Respondent shall be licensed in accordance with the requirements of Chapter 489, Florida Statutes.

3. **INTEGRITY OF BID DOCUMENTS** - Respondents shall use the original Bid documents provided by the Purchasing Department and enter information only in the spaces where a response is requested. Respondents may use an attachment as an addendum to the Bid documents if sufficient space is not available. Any modifications or alterations to the original bid documents by the respondent, whether intentional or otherwise, will constitute grounds for rejection of a bid. Any such modification or alteration that a respondent wishes to propose must be clearly stated in the respondent's response in the form of an addendum to the original bid documents.
4. **SUBMITTAL OF BID** – A bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in an opaque sealed envelope plainly marked with the project title (and, if applicable, the designated portion of the project for which the bid is submitted), the name and address of the respondent, and shall be accompanied by the bid security and other required documents. It is the respondent's responsibility to assure that its bid is delivered at the proper time and place. Offers by telegram, facsimile, or telephone will **NOT** be accepted.

Note: Crestview is not a next day delivery site for overnight carriers.

5. **MODIFICATION & WITHDRAWAL OF BID** - A bid may be modified or withdrawn by an appropriate document duly executed in the manner that a bid must be executed and delivered to the place where bids are to be submitted prior to the date and time for the opening of bids.

If within 24 hours after bids are opened any respondent files a duly signed written notice with the County and promptly thereafter demonstrates to the reasonable satisfaction of the County that there was a material substantial mistake in the preparation of its bid, that respondent may withdraw its bid, and the bid security may be returned. Thereafter, if the work is rebid, that respondent will be disqualified from 1) further bidding on the work, and 2) doing any work on the contract, either as a subcontractor or in any other capacity.

6. **BIDS TO REMAIN SUBJECT TO ACCEPTANCE** – All bids will remain subject to acceptance or rejection for ninety (90) calendar days after the day of the bid opening, but the County may, in its sole discretion, release any bid and return the bid security prior to the end of this period.

7. **IDENTICAL TIE BIDS** – In case of identical procurement responses, the award shall be determined either by lot or on the basis of factors deemed to serve the interest of the County. In the case of the latter, there must be adequate documentation to support such a decision.
8. **CONDITIONAL & INCOMPLETE BIDS** - Okaloosa County specifically reserves the right to reject any conditional bid and bids which make it impossible to determine the true amount of the bid.
9. **BID PRICE** – The bid price shall include all equipment, labor, materials, permit(s), freight, taxes, required insurance, Public Liability, Property Damage and Workers’ Compensation, etc. to cover the finished work called for.
10. **ADDITION/DELETION OF ITEM** – The County reserves the right to add or delete any item from this bid or resulting contract when deemed to be in the County’s best interest.
11. **SPECIFICATION EXCEPTIONS** – Specifications are based on the most current literature available. Respondent shall clearly list any change in the manufacturer’s specifications which conflict with the bid specifications. Respondent must also explain any deviation from the bid specification in writing, as a foot note on the applicable bid page and enclose a copy of the manufacturer’s specifications data detailing the changed item(s) with their bid. Failure of the respondent to comply with these provisions will result in respondents being held responsible for all costs required to bring the equipment in compliance with bid specifications.
12. **APPLICABLE LAWS & REGULATIONS** – All applicable Federal and State laws, County and municipal ordinances, orders, rules and regulations of all authorities having jurisdiction over the project shall apply to the bid throughout, and they will be deemed to be included in the contract the same as though they were written in full therein.
13. **DISQUALIFICATION OF RESPONDENTS** - Any of the following reasons may be considered as sufficient for the disqualification of a respondent and the rejection of its bid:
 - a. Submission of more than one bid for the same work from an individual, firm or corporation under the same or different name.
 - b. Evidence that the respondent has a financial interest in the firm of another respondent for the same work.
 - c. Evidence of collusion among respondents. Participants in such collusion will receive no recognition as respondents for any future work of the County until such participant has been reinstated as a qualified respondent.
 - d. Uncompleted work which in the judgment of the County might hinder or prevent the prompt completion of additional work if awarded.
 - e. Failure to pay or satisfactorily settle all bills due for labor and material on former contracts in force at the time of advertisement of bids.
 - f. Default under previous contract.
 - g. Listing of the respondent by the Local, State or Federal Government on its barred/suspended vendor list.

14. AWARD OF BID

- a. **Okaloosa County Review** - Okaloosa County designated Staff will review all bids and will participate in the Recommendation to Award.
- b. The County will award the bid to the lowest respondent, and the County reserves the right to award the bid to the respondent submitting a responsive bid with a resulting negotiated agreement which is most advantageous and in the best interest of the County, and to reject any and all bids or to waive any irregularity or technicality in bids received. Okaloosa County shall be the sole judge of the bid and the resulting negotiated agreement that is in its best interest and its decision shall be final.
- c. Okaloosa County reserves the right to waive any informalities or reject any and all bids, in whole or part, to utilize any applicable state contracts in lieu of or in addition to this bid and to accept the bid that in its judgment will best serve the interest of the County.
- d. Okaloosa County specifically reserves the right to reject any conditional bids and will normally reject those which made it impossible to determine the true amount of the bid. Each item must be bid separately and no attempt is to be made to tie any item or items to any other item or items.

15. WARRANTY – (The warranty will be in the name of Okaloosa County) Warranty work specified herein is for defects in materials and in labor and workmanship. State the manufacturer’s warranty with your bid. A minimum of 1 year on parts and labor is required from the date of acceptance, or the manufacturer’s warranty, whichever is longer.

16. PAYMENTS – The respondent shall be paid upon submission of invoices and approval of acceptance by Okaloosa County Board of County Commissioners, Finance Office, 302 N. Wilson St., #203, Crestview FL 32536, for the prices stipulated herein for articles delivered and accepted. Invoices must show Contract #.

17. DISCRIMINATION - An entity or affiliate who has been placed on the discriminatory vendor list may not submit a bid on a contract to provide 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 award or perform work as a contractor, supplier, subcontractor, or consultant under contract with any public entity, and may not transact business with any public entity.

18. PUBLIC ENTITY CRIME INFORMATION - Pursuant to Florida Statute 287.133, a respondent 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 s. [287.017](#) for CATEGORY TWO for a period of 36 months following the date of being placed on the convicted vendor list.

19. CONFLICT OF INTEREST - The award hereunder is subject to the provisions of Chapter 112, Florida Statutes. All respondents must disclose with their bids the name of any officer, director, or agent who is also a public officer or an employee of the Okaloosa Board of County Commissioners, or any of its agencies. Furthermore, all respondents must disclose the name of any County officer or employee who owns, directly or indirectly, an interest of five percent (5%) or more in the firm or any of its branches.

Note: For respondent's convenience, this certification form is enclosed and is made a part of the bid package.

20. REORGANIZATION OR BANKRUPTCY PROCEEDINGS – Bids will not be considered from respondents who are currently involved in official financial reorganization or bankruptcy proceedings.

21. INVESTIGATION OF RESPONDENT – The County may make such investigations, as it deems necessary to determine the stability of the respondent to perform the work and that there is no conflict of interest as it relates to the project. The respondent shall furnish to the Owner any additional information and financial data for this purpose as the County may request.

22. CONE OF SILENCE - The Okaloosa County Board of County Commissioners has established a solicitation silence policy (**Cone of Silence**) that prohibits oral and written communication regarding all formal solicitations for goods and services (formal proposals, Request for Proposals, Requests for Qualifications) issued by the Board through the County Purchasing Department. The period commences from the date of advertisement until award of contract.

Note: For respondent's convenience, this certification form is enclosed and is made a part of the bid package.

23. REVIEW OF PROCUREMENT DOCUMENTS - Per Florida Statute 119.071 (2) 2 sealed bids, proposals, or replies received by the County pursuant to a competitive solicitation are exempt from public disclosure until such time as the County provides notice of an intended decision or until 30 days after opening the bids, proposals, or final replies, whichever is earlier.

24. COMPLIANCE WITH FLORIDA STATUTE 119.0701 - The Respondent shall comply with all the provisions of section 119.0701, Florida Statutes relating to the public records which requires, among other things, that the Respondent: (a) Keep and maintain public records; (b) Provide the public with access to public records on the same terms and conditions that the public agency would provide the records; (c) ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law; and (d) Meet all requirements for retaining public records and transfer, at no cost, to the public agency all public records in possession of the respondent upon termination of the contract.

25. PROTECTION OF RESIDENT WORKERS – The Okaloosa County Board of County Commissioners actively supports the Immigration and Nationality Act (INA) which includes provisions addressing employment eligibility, employment verifications, and nondiscrimination. Under the INA, employers may hire only persons who may legally work in the United States (i.e., citizens and nationals of the U.S.) and aliens authorized to work in the U.S. The employer must verify the identity and employment eligibility of anyone to be hired, which includes completing the Employment Eligibility Verifications. The respondent shall establish appropriate procedures and controls so no services or products under the Contract Documents will be performed or manufactured by any worker who is not legally eligible to perform such services or employment. Okaloosa County reserves the right to request documentation showing compliance with the requirements.

Respondents doing construction business with Okaloosa County are required to use the Federal Government Department of Homeland Security's website and use the E-Verify Employment Eligibility Verifications System to confirm eligibility of all employees to work in the United States.

26. SUSPENSION OR TERMINATION FOR CONVENIENCE - The County may, at any time, without cause, order Respondent in writing to suspend, delay or interrupt the work in whole or in part

for such period of time as the County may determine, or to terminate all or a portion of the Contract for the County's convenience. Upon such termination, the Contract Price earned to the date of termination shall be paid to Respondent, but Respondent waives any claim for damages, including loss of profits arising out of or related to the early termination. Those Contract provisions which by their nature survive final acceptance shall remain in full force and effect. If the County orders a suspension, the Contract price and Contract time may be adjusted for increases in the cost and time caused by suspension, delay or interruption. No adjustment shall be made to the extent that performance is, was or would have been so suspended, delayed or interrupted by reason for which Respondent is responsible; or that an equitable adjustment is made or denied under another provision of this Contract.

- 27. FAILURE OF PERFORMANCE/DELIVERY** - In case of default by the respondent, the County after due notice (oral or written) may procure the necessary supplies or services from other sources and hold the respondent responsible for difference in cost incurred. Continuous instances of default shall result in cancellation of the award and removal of the respondent from the bid list for duration of one (1) year, at the option of the County.
- 28. AUDIT** - If requested, respondent shall permit the County or an authorized, independent audit agency to inspect all data and records of respondent relating to its performance and its subcontracts under this bid from the date of the award through and until the expiration of contract.
- 29. EQUAL EMPLOYMENT OPPORTUNITY; NON DISCRIMINATION** – Respondent will not discriminate against any employee or an applicant for employment because of race, color, religion, gender, sexual orientation, national origin, age, familial status or handicap.
- 30. NON-COLLUSION** – Respondent certifies that it has entered into no agreement to commit a fraudulent, deceitful, unlawful or wrongful act, or any act which may result in an unfair advantage over other respondents. See Florida Statute 838.22.
- 31. UNAUTHORIZED ALIENS/PATRIOT'S ACT** – The knowing employment by respondent or its subcontractors of any alien not authorized to work by the immigration laws is prohibited and shall be a default of the contract. In the event that the respondent is notified or becomes aware of such default, the respondent shall take steps as are necessary to terminate said employment with 24 hours of notification or actual knowledge that an alien is being employed. Respondent's failure to take such steps as are necessary to terminate the employment of any said alien within 24 hours of notification or actual knowledge that an alien is being employed shall be grounds for immediate termination of the contract. Respondent shall take all commercially reasonable precautions to ensure that it and its subcontractors do not employ persons who are not authorized to work by the immigration laws.
- 32. EQUIPMENT ACCEPTANCE** - Delivery of material to Okaloosa Board of County Commissioners does not constitute acceptance for the purpose of payment. Final acceptance and authorization of payment shall be given only after a thorough inspection indicates that the material meets contract specifications and conditions as listed. Should the delivered material differ in any respect from specifications, payment will be withheld until such time as the supplier takes necessary corrective action. The Purchasing Department shall be notified of the deviation in writing within 10 days and the provisions of the delivery paragraph shall prevail. If the proposed corrective action is not acceptable to Okaloosa County, the final acceptance of the material shall remain the property of the supplier and the county shall not be liable for payment for any portion thereof.
- 33. TERMS AND CONDITIONS** – All bidders shall review the Terms and Conditions attached hereto and if the Board accepts their bid and executes a contract, the bidder awarded the contract (Seller) shall

agree to the Terms and Conditions, completely, and agree to furnish the materials and services specified herein in accordance with the Specifications and Terms and Conditions herein.

34. DELIVERY SCHEDULE- Submittal data to be delivered for approval with the Bid. Operation & Maintenance manuals to be delivered for approval no later than 30 calendar days prior to start-up and after receipt of Approved or Approved as Noted submittal data. Delivery of on-site Equipment/Materials shall be no later than calendar days identified on the Bid, after receipt of Purchase Order and shall be coordinated with the on-site installation Contractor.

35. The following documents are to be submitted with the proposal packet:

- A. Drug-Free Workplace Certification Form
- B. Conflict of Interest
- C. Federal E-Verify
- D. Indemnification and Hold Harmless
- E. Certification Regarding Lobbying Proposal Sheet
- F. Cone of Silence
- G. Company Data
- H. System of Awards Management
- I. Addendum Acknowledgement
- J. Bid Form
- K. Anti-Collusion Statement
- L. Government Debarment & Suspension
- M. Bid Bond
- N. Qualifications Statement

THIS PAGE WAS INTENTIONALLY LEFT BLANK

DRUG-FREE WORKPLACE CERTIFICATION

THE BELOW SIGNED RESPONDENT CERTIFIES that it has implemented a drug-free workplace program. In order to have a drug-free workplace program, a business shall:

1. Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.
2. Inform employees about the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.
3. Give each employee engaged in providing the commodities or contractual services that are under quote a copy of the statement specified in subsection 1.
4. In the statement specified in subsection 1, notify the employees that, as a condition of working on the commodities or contractual services that are under quote, the employee will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, any violation of Chapter 893, Florida Statutes, or of any controlled substance law of the United States or any state, for a violation occurring in the workplace no later than five (5) days after such conviction.
5. Impose a sanction on, or require the satisfactory participation in, drug abuse assistance or rehabilitation program if such is available in employee's community, by any employee who is convicted.
6. Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

As the person authorized to sign this statement, I certify that this firm complies fully with the above requirements.

DATE: _____

SIGNATURE: _____

COMPANY: _____

NAME: _____

(Typed or Printed)

ADDRESS: _____

TITLE: _____

E-MAIL: _____

PHONE NO.: _____

THIS PAGE WAS INTENTIONALLY LEFT BLANK

CONFLICT OF INTEREST DISCLOSURE FORM

For purposes of determining any possible conflict of interest, all respondents, must disclose if any Okaloosa Board of County Commissioner, employee(s), elected officials(s), or if any of its agencies is also an owner, corporate officer, agency, employee, etc., of their business.

Indicate either “yes” (a county employee, elected official, or agency is also associated with your business), or “no”. If yes, give person(s) name(s) and position(s) with your business.

YES _____

NO _____

NAME(S)

POSITION(S)

FIRM NAME: _____

BY (PRINTED): _____

BY (SIGNATURE): _____

TITLE: _____

ADDRESS: _____

PHONE NO. _____

E-MAIL _____

DATE _____

THIS PAGE WAS INTENTIONALLY LEFT BLANK

FEDERAL E-VERIFY COMPLIANCE CERTIFICATION

In accordance with Okaloosa County Policy and Executive Order Number 11-116 from the office of the Governor of the State of Florida, Respondent hereby certifies that the U.S. Department of Homeland Security's E-Verify system will be used to verify the employment eligibility of all new employees hired by the respondent during the contract term, and shall expressly require any subcontractors performing work or providing services pursuant to the contract to likewise utilize the U.S. Department of Homeland Security's E-Verify system to verify the employment eligibility of all new employees hired by the subcontractor during the contract term; and shall provide documentation such verification to the COUNTY upon request.

As the person authorized to sign this statement, I certify that this company complies/will comply fully with the above requirements.

DATE: _____

SIGNATURE: _____

COMPANY: _____

NAME: _____

ADDRESS: _____

TITLE: _____

E-MAIL: _____

PHONE NO.: _____

THIS PAGE WAS INTENTIONALLY LEFT BLANK

INDEMNIFICATION AND HOLD HARMLESS

Respondent shall indemnify and hold harmless the County, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or intentional wrongful conduct of the Respondent and other persons employed or utilized by the Respondent in the performance of this Agreement.

Respondent's Company Name

Authorized Signature – Manual

Physical Address

Authorized Signature – Typed

Mailing Address

Title

Phone Number

FAX Number

Cellular Number

After-Hours Number(s)

Date

Email

THIS PAGE WAS INTENTIONALLY LEFT BLANK

LOBBYING - 31 U.S.C. 1352, 49 CFR Part 19, 49 CFR Part 20

APPENDIX A, 49 CFR PART 20--CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

(To be submitted with each bid or offer exceeding \$100,000)

The undersigned [Contractor] certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to 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 this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form--LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions [as amended by "Government wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96). Note: Language in paragraph (2) herein has been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1995 (P.L. 104-65, to be codified at 2 U.S.C. 1601, *et seq.*.)]
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

[Note: Pursuant to 31 U.S.C. § 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such expenditure or failure.]

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. A 3801, *et seq.*, apply to this certification and disclosure, if any.

_____ Signature of Contractor's Authorized Official

_____ Name and Title of Contractor's Authorized Official

_____ Date

THIS PAGE WAS INTENTIONALLY LEFT BLANK

CONE OF SILENCE

The Board of County Commissioners have established a solicitation silence policy (**Cone of Silence**) that prohibits oral and written communication regarding all formal solicitations for goods and services (ITB, RFP, ITQ, ITN, and RFQ) or other competitive solicitation between the bidder (or its agents or representatives) or other entity with the potential for a financial interest in the award (or their respective agents or representatives) regarding such competitive solicitation, and any County Commissioner or County employee, selection committee member or other persons authorized to act on behalf of the Board including the County’s Architect, Engineer or their subconsultants, or anyone designated to provide a recommendation to award a particular contract, other than the Purchasing Department Staff..

The period commences from the time of advertisement until contract award.

Any information thought to affect the committee or staff recommendation submitted after bids are due, should be directed to the Purchasing Manager or an appointed representative. It shall be the Purchasing Manager’s decision whether to consider this information in the decision process.

Any violation of this policy shall be grounds to disqualify the respondent from consideration during the selection process.

All respondents must agree to comply with this policy by signing the following statement and including it with their submittal.

I _____ **representing** _____
Signature **Company Name**

On this ___ day of _____ 2019 hereby agree to abide by the County’s “**Cone of Silence Clause**” and understand violation of this policy shall result in disqualification of my proposal/submittal.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

COMPANY DATA

Respondent's Company Name: _____

Physical Address & Phone #: _____

Contact Person (Typed-Printed): _____

Phone #: _____

Cell #: _____

Federal ID or SS #: _____

DUNNS/SAM #: _____

Respondent's License #: _____

Fax #: _____

Emergency #'s After Hours,
Weekends & Holidays: _____

THIS PAGE WAS INTENTIONALLY LEFT BLANK

System for Award Management (Oct 2016)

(a) Definitions. As used in this provision.

“Electronic Funds Transfer (EFT) indicator” means a four-character suffix to the unique entity identifier. The suffix is assigned at the discretion of the commercial, nonprofit, or Government entity to establish additional System for Award Management records for identifying alternative EFT accounts (see [subpart 32.11](#)) for the same entity.

“Registered in the System for Award Management (SAM) database” means that:

(1) The Offeror has entered all mandatory information, including the unique entity identifier and the EFT indicator, if applicable, the Commercial and Government Entity (CAGE) code, as well as data required by the Federal Funding Accountability and Transparency Act of 2006 (see [subpart 4.14](#)) into the SAM database;

(2) The offeror has completed the Core, Assertions, and Representations and Certifications, and Points of Contact sections of the registration in the SAM database;

(3) The Government has validated all mandatory data fields, to include validation of the Taxpayer Identification Number (TIN) with the Internal Revenue Service (IRS). The offeror will be required to provide consent for TIN validation to the Government as a part of the SAM registration process; and

(4) The Government has marked the record “Active”.

“Unique entity identifier” means a number or other identifier used to identify a specific commercial, nonprofit, or Government entity. See www.sam.gov for the designated entity for establishing unique entity identifiers.

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the SAM database prior to award, during performance, and through final payment of any contract, basic agreement, basic ordering agreement, or blanket purchasing agreement resulting from this solicitation.

(2) The Offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation “Unique Entity Identifier” followed by the unique entity identifier that identifies the Offeror’s name and address exactly as stated in the offer. The Offeror also shall enter its EFT indicator, if applicable. The unique entity identifier will be used by the Contracting Officer to verify that the Offeror is registered in the SAM database.

(c) If the Offeror does not have a unique entity identifier, it should contact the entity designated at www.sam.gov for establishment of the unique entity identifier directly to obtain one. The Offeror should be prepared to provide the following information:

- (1) Company legal business name.
- (2) Tradestyle, doing business, or other name by which your entity is commonly recognized.
- (3) Company Physical Street Address, City, State, and Zip Code.
- (4) Company Mailing Address, City, State and Zip Code (if separate from physical).
- (5) Company telephone number.
- (6) Date the company was started.
- (7) Number of employees at your location.
- (8) Chief executive officer/key manager.
- (9) Line of business (industry).
- (10) Company Headquarters name and address (reporting relationship within your entity).

(d) If the Offeror does not become registered in the SAM database in timely manner, the Contracting Officer may proceed to award to the next otherwise successful registered Offeror.

(e) Processing time, which normally takes 48 hours, should be taken into consideration when registering. Offerors who are not registered should consider applying for registration immediately upon receipt of this solicitation.

(f) Offerors may obtain information on registration at <https://www.acquisition.gov> .

Offerors SAM information:

Entity Name: _____

Entity Address: _____

Duns Number: _____

CAGE Code: _____

THIS PAGE WAS INTENTIONALLY LEFT BLANK

ADDENDUM ACKNOWLEDGEMENT
ITB WS 34-19

Acknowledgment is hereby made of the following addenda (identified by number) received since issuance of solicitation:

<u>ADDENDUM NO.</u>	<u>DATE</u>

NOTE: Prior to submitting the response to this solicitation, it is the responsibility of the respondent to confirm if any addenda have been issued. If such addenda have been issued, acknowledge receipt by noting number(s) and date(s) above.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

BID FORM

ARTICLE 1 – BID RECIPIENT

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

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

- A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents.
- B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder’s safety precautions and programs.
- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.

- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER’S CERTIFICATION

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. “corrupt practice” means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
 - 2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 - 3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
 - 4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS		
2	Existing Pump Station Demolition	1	LS		
3	Submersible Pump including Guide Rails, Base Elbow, Coating, Mounting, and Spare Parts	2	EA		
4	Submersible Pump (Spare)	1	EA		
5	FRP Wet Well	1	LS		
6	Site Concrete	4	CY		
7	Sitework	1	LS		
8	Restoration of Disturbed Areas	1	LS		
9	Valve Vault, Piping and Fittings	1	LS		
10	New 6" Gravity Sewer Service w/ cleanouts	230	LF		
11	New 2" DR 11 HDPE Sewer Force Main	300	LF		
12	New 2" DR 17 HDPE Fiber Conduit	350	LF		
14	New Control Panel, Disconnect and Electrical Wiring	1	LS		
15	Dewatering	1	LS		
16	New 208v 3ph Power Service Allowance	1	LS	\$5,000	\$5,000
Lump Sum Bid Price				\$ _____	
Owner Contingency Allowance				<u>\$10,000</u>	
Total Base Bid				\$ _____	
(Both Figures and words)					

(Both figures and words)

Lump Sum Items

Item 1 – Mobilization and Demobilization shall include all cost associated with the mobilization and demobilization of equipment and assets required at the construction site to perform the project as shown on the plans and meeting the requirements of the specifications.

Item 2 – Existing Pump Station Demolition may include but is not limited to excavation, demolition, liquid and solids removal/disposal, backfill and disposal as shown on the drawings.

Item 3 – Submersible Pumps shall include the supply and installation of new grinder pump, guiderail, discharge piping, floats, and start up services as shown on the drawings and meeting the requirements of the specifications. The price shall include the installation, labor, equipment, and materials as required to complete the complete construction.

Item 4 – One additional Submersible Pump meeting the requirements of the specifications. The price shall include the supply and deliver cost. This will be a spare pump to be used for future installation.

Item 5 - Wet Well shall include the fiberglass wet well, concrete anchor, access hatches with safety grate, wet well lid, and interior cable brackets as shown on the drawings and meeting the requirements of the specifications. The price shall include the installation, labor, equipment, and materials as required to complete the complete construction.

Item 6 – Sitework includes site grading, earthwork, clearing, erosion control, and dune protection as shown on the drawings and meeting the requirements of the specifications. The price shall include the installation, labor, equipment, and materials as required to complete the construction.

Item 8 – Restoration of Disturbed Areas shall include all driveways, roadways, curbs, grassing, and restoration of right-of-way required for repair of areas disturbed due to installation of the sewer system as shown on the plans and meeting the requirements of the specifications. The price shall include all labor, equipment, and materials as required to complete the construction of these items.

Item 9 – Concrete/FRP valve vault, access hatch, 316 SS Piping and Fittings shall include all piping, fittings, restrains, hardware, and pump-out as shown on the drawings and meeting the requirements of the specifications. The price shall include the installation, labor, equipment, and materials as required to complete the construction.

Item 10 – New 6" Gravity Sewer shall include the pipe, fitting and associated appurtenances necessary to complete the tie-in connections. The price shall include the installation, labor, equipment, and materials as required construction.

Item 11 – New 2" Force Main shall include the pipe, fitting and associated appurtenances necessary to complete the tie-in connections. The price shall include the installation, labor, equipment, and materials as required construction.

Item 12 – New 2" Fiber Conduit shall include the pipe, fitting and associated appurtenances necessary to complete the tie-in connections. The price shall include the installation, labor, equipment, and materials as required construction. Contact Heath Buck with Okaloosa County Water and Sewer.

Item 13 – Electrical System shall include all equipment, wiring, conduit, lighting, and hardware required on the drawings and meeting the requirements of the specifications. The price shall include the installation, labor, equipment, and materials as required to complete the construction.

Item 14 – Dewatering shall include dewatering of the area as required for the lift station installation. The price shall include the installation, labor, equipment, and materials as required for this process.

Item 15 - Power Service Allowance is for the installation and coordination of the power service by Gulf Power, Contact Tom Richardson

ARTICLE 6 – TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

- 7.01 The following documents are submitted with and made a condition of this Bid:
- A. Required Bid security;
 - B. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;
 - C. Contractor's License No.: _____ Evidence of Bidder's ability to obtain a State Contractor's License and a covenant by Bidder to obtain said license within the time for acceptance of Bids;

Major Equipment Items

- A. The project will be awarded based on the base bid equipment listed below. The bidder must base his lump sum base bid on the listed equipment/suppliers in the Base Bid column of the schedule. Deductions for equipment substitutions will not be considered in determining the basis of award. The bidder may indicate substitute equipment/supplier items by writing in the substitute equipment/supplier item and the amount of deduction for that substitute name write-in.
- B. Substitute equipment/supplier will be deemed as equal if the substitute is the same or better than the product named and described in the specifications in function, performance, reliability, quality and general configuration. Determination of the equality of a substitute shall be determined by the Engineer after the bid, based on submittal data received with the Contractor's bid documents. Should the write-in substitute be determined "not equal", then the bidder shall supply the equipment listed in the Base Bid column. The Owner may determine any substitute "not equal" as the Owner determines to suit his sole best interests at any time.
- C. Evaluation data to determine if a substitute equipment manufacturer/ supplier is an acceptable substitute must be submitted by the bidder with the bid. Information submitted after the bid will not be considered. Information submitted directly by equipment manufacturers/suppliers will not be evaluated. Minimum evaluation data shall include submittal information in conformance with Section 01001 of the contract documents. Data and drawing submittal shall be prepared specifically for this project. Incomplete submittals that do not conform with Section 01001 will not be considered. Sales catalog cuts or marked up drawings from previous projects will not be reviewed. The Bidder shall reimburse the Owner for any engineering costs associated with the review of any substitutes in accordance with the terms of the Engineer's Agreement with the Owner. The Owner is no way obligated to review substitute equipment submittals.
- D. No substitute equipment/supplier will be considered unless, in the opinion of the Owner or Engineer, it conforms to the contract drawings and specifications in all respects, except for the make and manufacture and minor details. Design and preparation of these plans and specifications are based on the equipment/supplier noted in the Base Bid column of the schedule. The bidder shall be responsible for any and all changes necessary to accommodate the substitute equipment/supplier items. The Owner

shall be reimbursed for any and all associated redesign and/or construction drawings in accordance with the terms of the Engineer's Agreement with the Owner. The bidder shall also include any and all costs associated with additional construction costs (mechanical, structural, electrical, architectural, engineering, construction observation, etc.) as the result of a substitute item. The bid shall also include any paid up licenses necessary for the use of the equipment as required.

EQUIPMENT/SUPPLIER SCHEDULE				
SPEC SECTION	DESCRIPTION	EQUIPMENT MANUFACTURERS/SUPPLIERS		AMOUNT OF DEDUCTION FOR SUBSTITUTION
		Base Bid	Substitute	
11310	Submersible Grinder Pumps	Barns, , Wilo		\$
11145	FRP Structures	L.F. Manufacturing, Edwards Fiberglass and Xerxes.		\$

ARTICLE 8 – DEFINED TERMS

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

ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

 By:
[Signature] _____

[Printed name] _____
 (If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

Telephone Number: _____
Fax Number: _____
Contact Name and e-mail address: _____

Bidder's License No.: _____
(where applicable)

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

_____ Bidder's Company Name	_____ Authorized Signature – Manual
_____ _____	_____ Authorized Signature – Typed
_____ Address	_____ Title
_____ Phone #	_____ Fax #
_____ Federal ID # or SS #	

THIS PAGE WAS INTENTIONALLY LEFT BLANK

ANTI-COLLUSION STATEMENT: The below signed bidder has not divulged to, discussed or compared his bid with other bidders and has not **colluded with any other bidder or parties to bid whatever.** **Note: No premiums, rebates, or gratuities permitted either with, prior to, or after any** delivery of materials. Any such violation will result in the cancellation and/or return of material (as applicable) and the removal from bid list(s).

Bidder's Company Name

Authorized Signature – Manual

Address

Authorized Signature – Typed

Address

Title

Phone #

Fax #

Federal ID # or SS #

Date Submitted: _____

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Government Debarment & Suspension

Instructions

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out in accordance with these instructions.
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 or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person(s) 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 the rules implementing Executive Orders 12549, at Subpart C of OMB 2 C.F.R. Part 180 and 3000.332. You may contact the department or agency to which this proposal is being submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this form 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 form 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 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 System for Award Management (SAM) database.
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.

**Certification Regarding Debarment, Suspension,
Ineligibility and Voluntary Exclusion
Lower Tier Covered Transactions**

The following statement is made in accordance with the Privacy Act of 1974 (5 U.S.C. § 552(a), as amended). This certification is required by the regulations implementing Executive Orders 12549, Debarment and Suspension, and OMB 2 C.F.R. Part 180, Participants' responsibilities. The regulations were amended and published on August 31, 2005, in 70 Fed. Reg. 51865-51880.

[READ INSTRUCTIONS ON PREVIOUS PAGE BEFORE COMPLETING CERTIFICATION]

1. The prospective lower tier participant certifies, by submission of this proposal, 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. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal

Printed Name and Title of Authorized Representative

Signature _____

_____ Date

SECTION C-430

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER (*Name and Address*):

SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*):

Bid Due Date:

BOND

Bond Number:

Date:

Penal sum

\$

(Words)

(Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER

SURETY

(Seal)

(Seal)

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

By:

Signature

By:

Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest:

Signature

Title

Attest:

Signature

Title

Note: Addresses are to be used for giving any required notice.

Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION C-451

QUALIFICATIONS STATEMENT

THE INFORMATION SUPPLIED IN THIS DOCUMENT IS CONFIDENTIAL TO THE EXTENT PERMITTED BY LAWS AND REGULATIONS

1. SUBMITTED BY:

Official Name of Firm: _____

Address: _____

2. SUBMITTED TO:

3. SUBMITTED FOR:

Owner: _____

Project Name: _____

TYPE OF WORK:

4. CONTRACTOR'S CONTACT INFORMATION

Contact Person: _____

Title: _____

Phone: _____

Email: _____

5. AFFILIATED COMPANIES:

Name: _____

Address: _____

6. TYPE OF ORGANIZATION:

SOLE PROPRIETORSHIP

Name of Owner: _____

Doing Business As: _____

Date of Organization: _____

PARTNERSHIP

Date of Organization: _____

Type of Partnership: _____

Name of General Partner(s): _____

CORPORATION

State of Organization: _____

Date of Organization: _____

Executive Officers:

- President: _____

- Vice President(s): _____

- Treasurer: _____

- Secretary: _____

LIMITED LIABILITY COMPANY

State of Organization: _____

Date of Organization: _____

Members: _____

JOINT VENTURE

Sate of Organization: _____

Date of Organization: _____

Form of Organization: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

7. LICENSING

Jurisdiction: _____

Type of License: _____

License Number: _____

Jurisdiction: _____

Type of License: _____

License Number: _____

8. CERTIFICATIONS

CERTIFIED BY:

Disadvantage Business Enterprise: _____

Minority Business Enterprise: _____

Woman Owned Enterprise: _____

Small Business Enterprise: _____

Other (_____): _____

9. BONDING INFORMATION

Bonding Company: _____

Address: _____

Bonding Agent: _____

Address: _____

Contact Name: _____

Phone: _____

Aggregate Bonding Capacity: _____

Available Bonding Capacity as of date of this submittal: _____

10. FINANCIAL INFORMATION

Financial Institution: _____

Address: _____

Account Manager: _____

Phone: _____

INCLUDE AS AN ATTACHMENT AN AUDITED BALANCE SHEET FOR EACH OF THE LAST 3 YEARS

11. CONSTRUCTION EXPERIENCE:

Current Experience:

List on **Schedule A** all uncompleted projects currently under contract (If Joint Venture list each participant's projects separately).

Previous Experience:

List on **Schedule B** all projects completed within the last 5 Years (If Joint Venture list each participant's projects separately).

Has firm listed in Section 1 ever failed to complete a construction contract awarded to it?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

Has any Corporate Officer, Partner, Joint Venture participant or Proprietor ever failed to complete a construction contract awarded to them in their name or when acting as a principal of another entity?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

Are there any judgments, claims, disputes or litigation pending or outstanding involving the firm listed in Section 1 or any of its officers (or any of its partners if a partnership or any of the individual entities if a joint venture)?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

12. SAFETY PROGRAM:

Name of Contractor's Safety Officer: _____

Include the following as attachments:

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) OSHA No. 300- Log & Summary of Occupational Injuries & Illnesses for the past 5 years.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all OSHA Citations & Notifications of Penalty (monetary or other) received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all safety citations or violations under any state all received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide the following for the firm listed in Section 5 (and for each proposed Subcontractor furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) the following (attach additional sheets as necessary):

Workers' compensation Experience Modification Rate (EMR) for the last 5 years:

YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____

Total Recordable Frequency Rate (TRFR) for the last 5 years:

YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____

13. EQUIPMENT:

MAJOR EQUIPMENT: NOT USED

I HEREBY CERTIFY THAT THE INFORMATION SUBMITTED HEREWITH, INCLUDING ANY ATTACHMENTS, IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NAME OF ORGANIZATION: _____

BY: _____

TITLE: _____

DATED: _____

NOTARY ATTEST:

SUBSCRIBED AND SWORN TO BEFORE ME

THIS _____ DAY OF _____, 20____

NOTARY PUBLIC - STATE OF _____

MY COMMISSION EXPIRES: _____

REQUIRED ATTACHMENTS

1. Schedule A (Current Experience).
2. Schedule B (Previous Experience).
3. Audited balance sheet for each of the last 3 years for firm named in Section 1.
4. Evidence of authority for individuals listed in Section 7 to bind organization to an agreement.
5. Required safety program submittals listed in Section 13.
6. Additional items as pertinent.

SCHEDULE A

CURRENT EXPERIENCE

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				

SCHEDULE B

PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

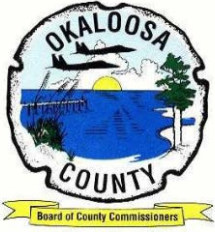
Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				

EJCDC® C-510, Qualifications Statement.

Copyright © 2013 National Society of Professional Engineers, American Council of Engineering Companies,
and American Society of Civil Engineers. All rights reserved.

SCHEDULE C - LIST OF MAJOR EQUIPMENT AVAILABLE

ITEM	PURCHASE DATE	CONDITION	ACQUIRED VALUE



Board of County Commissioners Purchasing Department

State of Florida

Date: _____

OKALOOSA COUNTY PURCHASING DEPARTMENT
NOTICE OF INTENT TO AWARD
ITB 34-19

Beasley Park Sanitary Sewer Improvement

Okaloosa County would like to thank all businesses which submitted responses to the Beasley Park Sanitary Sewer Improvement. (ITB 34-19)

After in-depth examination of all responses in accordance with the County's Purchasing Manual, the County announces its intent to award the contract/purchase order to the following:

This Notice of Intent does NOT constitute the formation of a contract/purchase order between Okaloosa County and the apparent successful bidder/respondent. The County reserves the right to enter into negotiations with the successful bidder/respondent in order to finalize contract terms and conditions. No agreement is entered into between the County and any parties until a contract is approved and fully executed.

Any person/entity desiring to file a procurement protest must meet all the standards and criteria in accordance with Section 30 of the Okaloosa County Purchasing Manual. Failure to file a protest within the time prescribed in Section 30.02 of the Okaloosa County Purchasing Manual, shall constitute a waiver of protest proceedings.

Respectfully,

Greg Kisela
Deputy County Administrator
Acting OMB Director

SECTION C-520

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between Okaloosa County Board of County Commissioners (“Owner”) and _____ (“Contractor”).

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.01 *Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:*

ARTICLE 2 – THE PROJECT

2.01 *The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Beasley Park Sanitary Sewer Improvements Project*

ARTICLE 3 – ENGINEER

3.01 *The part of the Project that pertains to the Work has been designed by Constantine Engineering, Inc.*

3.02 *The Owner has retained Constantine Engineering, Inc. (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.*

ARTICLE 4 – CONTRACT TIMES

4.01 Time of the Essence

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Contract Times: Days

A. The Work will be substantially completed within 90 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 135 days after the date when the Contract Times commence to run.

4.03 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time.

Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Substantial Completion: Contractor shall pay Owner \$250 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.

ARTICLE 5 – CONTRACT PRICE

5.01 *Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:*

- A. Total of Lump Sum Price \$.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 Progress Payments; Retainage

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor’s Applications for Payment during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract

- a. 90 percent of Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

- b. 90 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 200 percent of Engineer’s estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 Final Payment

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

7.01 *All amounts not paid when due shall bear interest at the rate of 10 percent per annum.*

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

8.01 *In order to induce Owner to enter into this Contract, Contractor makes the following representations:*

- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
- B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor’s safety precautions and programs.
- F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- J. Contractor’s entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 Contents

- A. The Contract Documents consist of the following:
 - 1. This Agreement (pages 1 to , inclusive).

2. Performance bond (pages █ to █, inclusive).
 3. Payment bond (pages █ to █, inclusive).
 4. General Conditions (pages █ to █, inclusive).
 5. Supplementary Conditions (pages █ to █, inclusive).
 6. Specifications as listed in the table of contents of the Project Manual.
 7. Drawings (not attached but incorporated by reference) consisting of █ sheets with each sheet bearing the following general title: Water Treatment Plant No. 3, Division 1 – Water Treatment Plant.
 8. Addenda (numbers █ to █, inclusive).
 9. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages █ to █, inclusive).
 10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 Terms

- A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 Assignment of Contract

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 Successors and Assigns

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 Severability

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 Contractor’s Certifications

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:
 1. “corrupt practice” means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 Other Provisions

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or “track changes” (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on (which is the Effective Date of the Contract).

OWNER:

CONTRACTOR:

Okaloosa County Board of County Commissioners

By: _____

By: _____

Title: _____

Title: _____

(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____

Attest: _____

Title: _____

Title: _____

Address for giving notices:

Address for giving notices:

License No.: _____
(where applicable)

(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

NOTICE TO PROCEED

TO:

PROJECT: Beasley Park Sanitary Sewer Improvement

DESCRIPTION: ITB 34-19, Contract C _____

You are hereby notified you are able to commence WORK in accordance with the Agreement dated _____, 2019. The work shall be completed within 90 days from the commencement date.

You are required to return an acknowledged copy of this **NOTICE TO PROCEED** to the **OWNER**: Okaloosa County Purchasing, Attention: DeRita Mason, 5479A Old Bethel Road, Crestview, FL 32536, within 15 days from the date this **NOTICE TO PROCEED** is fully executed.

Dated this _____ day of _____, 2019

OKALOOSA COUNTY BOARD OF COUNTY COMMISSIONERS
OWNER

BY: _____
Greg Kisela, Acting OMB Director

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged.

Date of Commencement of Work: _____.

Company Name

This the _____ day of _____, 2019

Signature

By: _____
Type or Print Name/Title



SECTION C-610
PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description:

BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:

Amount:

Modifications to this Bond Form: None See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal *(seal)*

Surety's Name and Corporate Seal *(seal)*

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner

and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages

16. Modifications to this Bond are as follows:

to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

EJCDC® C-610, Performance Bond

Copyright © 2013 National Society of Professional Engineers, American Council of Engineering Companies,
and American Society of Civil Engineers. All rights reserved.

SECTION C-615
PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER:

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description:

BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:

Amount:

Modifications to this Bond Form: None See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

(seal)
Contractor's Name and Corporate Seal

(seal)
Surety's Name and Corporate Seal

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond shall arise after the following:
 - 5.1 Claimants who do not have a direct contract with the Contractor,
 - 5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2 Pay or arrange for payment of any undisputed amounts.
 - 7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this

Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default:** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

SECTION C-625

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer: Constantine Engineering, Inc.	Engineer's Project No.:
Project:	Contract Name:

This [preliminary] [final] Certificate of Substantial Completion applies to:

All Work The following specified portions of the Work:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities: None
 As follows

Amendments to Contractor's responsibilities: None
 As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract.

EXECUTED BY ENGINEER:		RECEIVED:		RECEIVED:	
By:	_____	By:	_____	By:	_____
	(Authorized signature)		Owner (Authorized Signature)		Contractor (Authorized Signature)
Title:	_____	Title:	_____	Title:	_____
Date:	_____	Date:	_____	Date:	_____

**SECTION C-700
STANDARD GENERAL CONDITIONS OF THE
CONSTRUCTION CONTRACT**

TABLE OF CONTENTS

	Page
Article 1 – Definitions and Terminology.....	2
1.01 Defined Terms	2
1.02 Terminology	4
Article 2 – Preliminary Matters.....	5
2.01 Delivery of Bonds and Evidence of Insurance	5
2.02 Copies of Documents	6
2.03 Before Starting Construction	6
2.04 Preconstruction Conference; Designation of Authorized Representatives	6
2.05 Initial Acceptance of Schedules	6
2.06 Electronic Transmittals	7
Article 3 – Documents: Intent, Requirements, Reuse	7
3.01 Intent	7
3.02 Reference Standards	7
3.03 Reporting and Resolving Discrepancies	7
3.04 Requirements of the Contract Documents	8
3.05 Reuse of Documents	9
Article 4 – Commencement and Progress of the Work	9
4.01 Commencement of Contract Times; Notice to Proceed	9
4.02 Starting the Work	9
4.03 Reference Points	9
4.04 Progress Schedule	9
4.05 Delays in Contractor’s Progress	10
Article 5 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions	10
5.01 Availability of Lands	10
5.02 Use of Site and Other Areas	11
5.03 Subsurface and Physical Conditions	12
5.04 Differing Subsurface or Physical Conditions	12

5.05	Underground Facilities	13
5.06	Hazardous Environmental Conditions at Site	15
Article 6 – Bonds and Insurance		16
6.01	Performance, Payment, and Other Bonds	16
6.02	Insurance—General Provisions	17
6.03	Contractor’s Insurance	18
6.04	Owner’s Liability Insurance	20
6.05	Property Insurance	20
6.06	Waiver of Rights	22
6.07	Receipt and Application of Property Insurance Proceeds	23
Article 7 – Contractor’s Responsibilities		23
7.01	Supervision and Superintendence	23
7.02	Labor; Working Hours	23
7.03	Services, Materials, and Equipment	23
7.04	“Or Equals”	24
7.05	Substitutes	25
7.06	Concerning Subcontractors, Suppliers, and Others	26
7.07	Patent Fees and Royalties	27
7.08	Permits	28
7.09	Taxes	28
7.10	Laws and Regulations	28
7.11	Record Documents	28
7.12	Safety and Protection	29
7.13	Safety Representative	29
7.14	Hazard Communication Programs	30
7.15	Emergencies	30
7.16	Shop Drawings, Samples, and Other Submittals	30
7.17	Contractor’s General Warranty and Guarantee	32
7.18	Indemnification	32
7.19	Delegation of Professional Design Services	33
Article 8 – Other Work at the Site		34
8.01	Other Work	34
8.02	Coordination	34
8.03	Legal Relationships	34
Article 9 – Owner’s Responsibilities		35

9.01	Communications to Contractor	35
9.02	Replacement of Engineer	35
9.03	Furnish Data	35
9.04	Pay When Due	35
9.05	Lands and Easements; Reports, Tests, and Drawings	36
9.06	Insurance	36
9.07	Change Orders	36
9.08	Inspections, Tests, and Approvals	36
9.09	Limitations on Owner’s Responsibilities	36
9.10	Undisclosed Hazardous Environmental Condition	36
9.11	Evidence of Financial Arrangements	36
9.12	Safety Programs	36
Article 10 – Engineer’s Status During Construction		36
10.01	Owner’s Representative	36
10.02	Visits to Site	37
10.03	Project Representative	37
10.04	Rejecting Defective Work	37
10.05	Shop Drawings, Change Orders and Payments	37
10.06	Determinations for Unit Price Work	37
10.07	Decisions on Requirements of Contract Documents and Acceptability of Work	37
10.08	Limitations on Engineer’s Authority and Responsibilities	38
10.09	Compliance with Safety Program	38
Article 11 – Amending the Contract Documents; Changes in the Work.....		38
11.01	Amending and Supplementing Contract Documents	38
11.02	Owner-Authorized Changes in the Work	39
11.03	Unauthorized Changes in the Work	39
11.04	Change of Contract Price	39
11.05	Change of Contract Times	40
11.06	Change Proposals	40
11.07	Execution of Change Orders	41
11.08	Notification to Surety	41
Article 12 – Claims		42
12.01	Claims	42
Article 13 – Cost of the Work; Allowances; Unit Price Work.....		43
13.01	Cost of the Work	43

13.02	Allowances	45
13.03	Unit Price Work	45
Article 14 – Tests and Inspections; Correction, Removal or Acceptance of Defective Work.....46		
14.01	Access to Work	46
14.02	Tests, Inspections, and Approvals	46
14.03	Defective Work	47
14.04	Acceptance of Defective Work	47
14.05	Uncovering Work	47
14.06	Owner May Stop the Work	48
14.07	Owner May Correct Defective Work	48
Article 15 – Payments to Contractor; Set-Offs; Completion; Correction Period.....49		
15.01	Progress Payments	49
15.02	Contractor’s Warranty of Title	51
15.03	Substantial Completion	52
15.04	Partial Use or Occupancy	52
15.05	Final Inspection	53
15.06	Final Payment	53
15.07	Waiver of Claims	54
15.08	Correction Period	54
Article 16 – Suspension of Work and Termination.....55		
16.01	Owner May Suspend Work	55
16.02	Owner May Terminate for Cause	55
16.03	Owner May Terminate For Convenience	56
16.04	Contractor May Stop Work or Terminate	56
Article 17 – Final Resolution of Disputes57		
17.01	Methods and Procedures	57
Article 18 – Miscellaneous57		
18.01	Giving Notice	57
18.02	Computation of Times	57
18.03	Cumulative Remedies	57
18.04	Limitation of Damages	58
18.05	No Waiver	58
18.06	Survival of Obligations	58
18.07	Controlling Law	58
18.08	Headings	58

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. 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, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 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. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document 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, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.
 11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive

Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
27. *Notice to Proceed*—A written notice 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.

28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *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.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *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.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
37. *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, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *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.
40. *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.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *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 a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *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 but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *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; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in the following paragraphs 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 Article 10 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 15.03 or 15.04).
- 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. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- 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. *Bonds*: 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 Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 Copies of Documents

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 Before Starting Construction

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), 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;
 - 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.

2.04 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 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, 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 and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 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 2.03.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 the component parts of the Work.

2.06 Electronic Transmittals

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, 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.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 Reference Standards

- A. Standards Specifications, Codes, Laws and Regulations
 - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, 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, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract 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, reference standard, 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 part of the Contract Documents prepared by or for Engineer. 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 part of the Contract Documents prepared by or for Engineer.

3.03 Reporting and Resolving Discrepancies

- A. *Reporting Discrepancies:*
 - 1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent

figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents:* If, before or 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) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) 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 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
 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 part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); 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 Requirements of the Contract Documents

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 Reuse of Documents

- A. Contractor and its Subcontractors and Suppliers 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 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; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- 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.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 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 Contract 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 Contract. ~~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 Contract, whichever date is earlier.~~

4.02 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 such date.

4.03 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.

4.04 Progress Schedule

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 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 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. 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, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 Delays in Contractor's Progress

- A. If Owner, Engineer, 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 Times and Contract Price. 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.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. 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. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 - 1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 - 2. abnormal weather conditions;
 - 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 - 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 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.
- 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 permanent improvements are to be made 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.

5.02 Use of Site and Other Areas

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

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, 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 any such claim, and against all 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 directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent 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 and adjacent areas 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 of 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 structures or land to stresses or pressures that will endanger them.

5.03 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 adjacent to the Site;
 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on 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.

5.04 Differing Subsurface or Physical Conditions

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site 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 5.03 is materially inaccurate; or
 2. is of such a nature as to require a change in the Drawings or Specifications; 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;

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 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in

question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, 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 fall within any one or more of the categories described in Paragraph 5.04.A;
 - 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 Paragraph 13.03; and,
 - c. 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.
 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a 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 otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 Underground Facilities

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent 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 do not warrant or guarantee 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 information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then 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 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - 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 Paragraph 13.03;
 - c. 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; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 ~~Hazardous Environmental Conditions at Site~~

- A. ~~Reports and Drawings: The Supplementary Conditions identify:~~
 1. ~~those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and~~
 2. ~~Technical Data contained in such reports and drawings.~~
- B. ~~Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on 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 removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.~~
- D. ~~Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.~~
- E. ~~If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) 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 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question,~~

~~then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set off against payments to account for the associated costs.~~

- ~~F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.~~
- ~~G. 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, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.~~
- ~~H. 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, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.~~
- ~~I. 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 (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.~~
- ~~J. 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 failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.~~
- ~~K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.~~

ARTICLE 6 – BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

- A. Contractor shall furnish a performance bond and a payment bond, 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. 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 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond 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 the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then 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 bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 Insurance—General Provisions

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles.

Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, 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.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 Contractor's Insurance

- A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
 - 4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
 - 1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 - 2. claims for damages insured by reasonably available personal injury liability coverage.
 - 3. 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.
- C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
 - 1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment.

- b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Broad form property damage coverage.
 4. Severability of interest.
 5. Underground, explosion, and collapse coverage.
 6. Personal injury coverage.
 7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against 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. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. ~~*Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.~~
- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; 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 (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

- I. *General provisions:* The policies of insurance required by this Paragraph 6.03 shall:
 1. include at least the specific coverages provided in this Article.
 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 5. be appropriate for the Work being performed and provide protection from claims that 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.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 Owner's Liability Insurance

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, 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.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 Property Insurance

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable 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 Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
 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; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; 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. If insurance against mechanical breakdown, boiler explosion, and artificially generated

electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
 4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
 5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

- E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 Waiver of Rights

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, 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 insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the 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 Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, 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 or Contractor as trustee or fiduciary, 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 occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.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, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, 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 builder's risk insurance and any other property insurance applicable to the Work.

6.07 Receipt and Application of Property Insurance Proceeds

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 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.
- 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.

7.02 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, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 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, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work 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.

7.04 "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 Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item 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 is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that 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, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, 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;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - 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.
- B. *Contractor's Expense:* Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 3. 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:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) 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
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. 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.
- E. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 Concerning Subcontractors, Suppliers, and Others

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. 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 the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

- I. 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.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. 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.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.
- O. 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 money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 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.

7.08 Permits

- A. Unless otherwise provided in the Contract Documents, 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 the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 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.

7.10 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 or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and 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 such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 Record Documents

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

7.12 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, other work in progress, 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 Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- 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 7.12.A.2 or 7.12.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 at its expense (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 protection 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 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 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.

7.14 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.

7.15 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.

7.16 Shop Drawings, Samples, and Other Submittals

A. *Shop Drawing and Sample Submittal Requirements:*

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the 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 and equipment 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 of that submittal, and that Contractor approves the 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 set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Contractor shall submit the number of copies required in the Specifications.
- 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 7.16.D.

2. *Samples:*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall 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 7.16.D.
3. 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. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- 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 or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample 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 7.16.A.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 will document any such approved variation from the requirements of the Contract Documents in a Field Order.
 5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
 8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.
- 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.
 2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item

requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 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 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;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.
- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 Indemnification

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, 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 7.18.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 7.18.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.

7.19 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 Laws and Regulations.
- 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, 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, 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 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 Other Work

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. 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.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, 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.

8.02 Coordination

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 Legal Relationships

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account

information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. 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.

- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.
- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) 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 any such claims, and against all 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 damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 Communications to Contractor

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

9.02 Replacement of Engineer

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 Furnish Data

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

9.04 Pay When Due

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

- 9.05 Lands and Easements; Reports, Tests, and Drawings
- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
 - B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
 - C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.
- 9.06 Insurance
- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.
- 9.07 Change Orders
- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.
- 9.08 Inspections, Tests, and Approvals
- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.
- 9.09 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.
- 9.10 Undisclosed Hazardous Environmental Condition
- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.
- 9.11 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 (including obligations under proposed changes in the Work).
- 9.12 Safety Programs
- 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.
 - B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

- 10.01 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.

10.02 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 10.08. 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.

10.03 Project Representative

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. 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.

10.04 Rejecting Defective Work

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 Shop Drawings, Change Orders and Payments

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. 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, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 Determinations for Unit Price Work

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 Decisions on Requirements of Contract Documents and Acceptability of Work

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 Limitations on Engineer's Authority and Responsibilities

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, 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 15.06.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 10.08 shall also apply to the Resident Project Representative, if any.

10.09 Compliance with Safety Program

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 Amending and Supplementing Contract Documents

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
 - 2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract

Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes 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. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 Owner-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. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 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, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 Change of Contract Price

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. 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, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work

(determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, 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 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.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 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - 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 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 Change of Contract Times

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 Change Proposals

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.
 1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The

Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. 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;
 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
 4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 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.

ARTICLE 12 – CLAIMS

12.01 Claims

- A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation*:
1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.
 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the

agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 Cost of the Work

- A. *Purposes for Determination of Cost of the Work:* The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work 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 13.01.C, 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, and 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 13.01.
 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 6.05), 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 communication 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 that Contractor is required by the Contract Documents to purchase and maintain.
- C. *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 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here 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 Paragraph 13.01.B.
- D. *Contractor's Fee*: When the Work as a whole 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, Change Proposal, Claim, set-off, or other 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 11.04.C.
- E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, 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.

13.02 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*: Contractor agrees that:
 1. 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
 2. 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*: 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.

13.03 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. Payments to Contractor for Unit Price Work will be based on actual quantities.
- 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. 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 the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price 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;
2. there is no corresponding adjustment with respect to any other item of Work; and
3. Contractor believes that it 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 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 Access to Work

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction 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.

14.02 Tests, Inspections, and Approvals

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. ~~Owner~~ **Contractor** shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by ~~Owner~~ **Contractor**, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.
- 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, obtaining, and paying for all inspections and tests required:
 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 3. by manufacturers of equipment furnished under the Contract Documents;
 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. 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. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 Acceptance of Defective Work

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages 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. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 Uncovering Work

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then 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, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages 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 pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. 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, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 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, then 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.

14.07 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, 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, then 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 14.07, 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, 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 incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. 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 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 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 during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *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, a warehouse bond, 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.
- C. *Review of Applications:*
1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, 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 13.03, 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; 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 money 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 15.01.C.2.
 6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due:*

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

E. *Reductions in Payment by Owner:*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. 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;
 - l. there are other items entitling Owner to a set off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, 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, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
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 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 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 and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- 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 preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. 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 punch list.

15.04 Partial Use or Occupancy

- 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. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be 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 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work 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 15.03 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 6.05 regarding builder's risk or other property insurance.

15.05 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, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 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, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) 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, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

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 have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. 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 15.07. 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. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 Waiver of Claims

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 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 Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 1. correct the defective repairs to the Site or such other adjacent areas;
 2. correct such defective Work;
 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 to 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. 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 repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

- 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, 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 are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 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 written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 Owner May Terminate for Cause

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and 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);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, 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 complete the Work as Owner may deem expedient.

- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.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 the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds 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.
- F. 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, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 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; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 Contractor May Stop Work or Terminate

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) 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 16.03.

- 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 are not intended to preclude Contractor from submitting a Change Proposal 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 17 – FINAL RESOLUTION OF DISPUTES

17.01 Methods and Procedures

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this Article, Owner or Contractor may:
 - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agree with the other party to submit the dispute to another dispute resolution process; or
 - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 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, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 Computation of Times

- A. When any period of time is referred to in the Contract 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.

18.03 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. 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.

18.04 Limitation of Damages

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 No Waiver

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 Survival of Obligations

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 Controlling Law

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 Headings

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

**SECTION 01001
GENERAL REQUIREMENTS**

PART 1 GENERAL

1.01 GENERAL

- A. A brief description of the Work is stated in the Advertisement for Bids. 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.

PART 2 SEQUENCE OF OPERATIONS

2.01 SCHEDULING

- A. Prior to starting the Work, confer with the Engineer and Owner's representative to develop an approved Work schedule. 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.
- B. Work on existing facilities shall be performed on a schedule and in a manner that will permit the existing water system to operate continuously, unless agreed to by the Owner as described herein.

2.02 SHUTDOWN OR ALTERATION OF EXISTING OPERATIONS OR UTILITIES

- A. Continuous operation of the existing water system is of critical importance.
- B. Connections to existing services or utilities, or other 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 Owner or Engineer. The approved schedule for shutdown or restart shall be indicated on the Contractor's Progress Schedule, and advance notice shall be given in order that the Owner or Engineer may witness the shutdown, tie-in, and startup.
- C. All materials and equipment (including emergency equipment) necessary to expedite tie-ins shall be on hand prior to the shutdown of existing services or utilities.

2.03 OPERATION OF EXISTING SYSTEM PROHIBITED

- A. At no time undertake to close off any lines or open valves or take any other action which would affect the operation of the existing system, except as specifically required by the Drawings and Specifications and after approval is granted by the Owner. Request approval to change the system operation three

GENERAL REQUIREMENTS

(3) working days in advance of the time that interruption of the existing system is required.

2.04 EQUIPMENT AND SYSTEM TESTING

- A. Functional (or run) testing, in the presence of the manufacturer's representative and/or Engineer, will be required for each item of equipment following installation. Functional testing is defined, as that testing necessary to determine if installed equipment and systems will operate as intended.
- B. In addition to the functional test, specific performance testing of installed equipment and systems shall be conducted by the Contractor as required in the section specifying the equipment or system.
- C. The Contractor shall furnish all labor, materials, tools, equipment, instruments, and services necessary to perform the functional and performance testing.

2.05 SEQUENCE OF OPERATIONS

- A. The Work shall proceed in the following sequence:
 - 1. The Work sequence shall be scheduled by the Contractor.

PART 3 SITE CONDITIONS

3.01 SITE INVESTIGATION AND REPRESENTATION

- A. The Contractor acknowledges satisfaction as to the nature and location of the Work, the general and local conditions, particularly those bearing upon availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, or similar physical conditions at the site, the conformation and conditions of the ground, 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. The Contractor further acknowledges satisfaction as to character, quality, and quantity of surface and subsurface materials to be encountered from his inspection of the site and from reviewing any available records of exploratory Work furnished by the Owner or included in these Documents. Failure by the Contractor to become acquainted with the physical conditions of the site 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

GENERAL REQUIREMENTS

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 therefor is assumed by the Owner.

3.02 INFORMATION ON SITE CONDITIONS

- A. General: Any information obtained by the Engineer regarding site conditions, 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 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

- A. Utilities and structures adjacent to or expected to be encountered in the Work are the Contractor's sole responsibility to locate. A utility notification service is available and shall be used to notify those utilities that participate in the service.
- B. Where the Contractor's operations could cause damage or inconvenience to railway, telegraph, telephone, television, power, oil, gas, water, sewer, or irrigation systems, the operations shall be suspended until all arrangements necessary for the protection of these utilities and services have been made by the Contractor.
- C. Notify all utility offices which are affected by the construction operation at least forty-eight (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.
- D. 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.
- E. 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.
- F. If the Contractor while performing the Contract discovers utility facilities not identified by the public agency in the Contract Drawings or Specifications, he shall immediately notify the public agency and utility in writing.

GENERAL REQUIREMENTS

- G. The public utility, where they are the Owner, shall have the sole discretion to perform repairs or relocation Work or permit the Contractor to do such repairs or relocation Work at a reasonable price.
- H. 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.

3.04 INTERFERING STRUCTURES

- A. Take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. The completeness and accuracy of information shown cannot be guaranteed, and it is presented simply as a guide to avoid known possible difficulties.
- 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, barns, 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 operation.

3.05 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 the 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 fails to so notify the Engineer when an existing structure is encountered, and proceeds with the construction despite this interference, he shall do so at his own risk.

PART 4 SALVAGE OF MATERIALS

4.01 SALVAGE OF EQUIPMENT AND MATERIALS REMOVED

- A. If existing equipment or materials are removed and replaced, they shall be salvaged by the Contractor.

PART 5 TEMPORARY CONSTRUCTION UTILITIES AND FACILITIES

5.01 TEMPORARY WATER

- A. The Contractor shall provide all water required to accomplish the actual construction, including water required for testing, flushing and sterilization. Temporary piping for transporting the water to the Work shall be paid for by the Contractor.
- B. Water shall be supplied by the Owner at no cost to Contractor.
- C. Contractor to provide a refundable deposit to the Utility Owner for a certified, tested backflow preventer and water meter to record usage.

5.02 TEMPORARY ELECTRIC POWER

- A. The Contractor shall be responsible for obtaining a source of electric power for construction. The Contractor shall pay the cost of electric service for construction and testing until substantial completion is achieved.

5.03 SAFETY REQUIREMENT FOR TEMPORARY ELECTRIC POWER

- A. Temporary electric power installation shall meet the construction safety requirements of OSHA, State, and other governing agencies.

5.04 SANITARY FACILITIES

- A. The Contractor shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and state departments of health and as directed by the Engineer.

5.05 RECEIVING, INSPECTION, AND UNLOADING PRODUCTS

- A. Contractor shall record the receipt of products at the job site.
- B. Upon receipt of products at the job site, Contractor shall inspect for completeness and evidence of damage during shipment.
 - 1. Owner's representative may be present for inspection.
 - 2. Should there appear to be damage, notify the Owner's representative immediately and inform the Manufacturers and the Transportation Company.
 - 3. Expedite replacement of damaged, incomplete, or lost items.

GENERAL REQUIREMENTS

- C. After completion of inspection, unload products in accordance with manufacturer's instructions for unloading, or as specified. Do not unload damaged or incomplete products to be returned to manufacturer for replacement, except as necessary to expedite return shipment.

5.06 HANDLING, STORAGE, AND MAINTENANCE OF PRODUCTS

- A. Handle products in accordance with the manufacturer's written recommendations, and in a manner to prevent damage.
- B. Store products prior to installation as recommended by the manufacturer.
 - 1. Store products such as pipe and reinforcing steel off the ground in approved storage yards.
 - 2. Store items subject to damage by the elements, vandalism, or theft in secure buildings.
 - 3. Provide environmentally controlled storage facilities for items requiring environmental control for protection.
- C. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.
- D. Store products to provide access for inspection and inventory control. Contractor shall document products in storage to facilitate inspection and to estimate progress payments for products delivered but not installed in the Work.

5.07 STORAGE OF MATERIALS

- A. Materials shall be so stored 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, provide with temperature control as recommended by the manufacturer.

PART 6 SAFETY AND CONVENIENCE

6.01 CONSTRUCTION SAFETY PROGRAM

- A. The Contractor shall develop and maintain for the duration of this Contract, a safety program that will effectively incorporate and implement all required

GENERAL REQUIREMENTS

safety provisions. The Contractor shall appoint an employee who is qualified and authorized to supervise and enforce compliance with the safety program.

- B. The duty of the Engineer to conduct construction review of the Contractor's performance is not intended to include a review or approval of the adequacy of the Contractor's safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site.

6.02 SAFETY EQUIPMENT

- A. The Contractor, as part of his safety program, shall maintain at his office or other well-known place at the job site, safety equipment applicable to the Work as prescribed by the governing safety authorities, all articles necessary for giving first-aid to the injured, and shall establish the procedure for the immediate removal to a hospital or a doctor's care of any person who may be injured on the job site.
- B. The Contractor shall do all Work necessary to protect the general public from hazards, including, but not limited to, 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.
- C. The performance of all Work and all completed construction, particularly with respect to ladders, platforms, structure openings, scaffolding, shoring, lagging, machinery guards and the like, shall be in accordance with the applicable governing safety authorities.
- D. 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, obstruction, or other hazards in streets, sidewalks, floors, roofs, and walkways. All such barriers shall have adequate warning light as necessary, or required, for safety.

6.03 ACCIDENT REPORTS

- A. If death or serious injuries or serious damage are caused, the accident shall be reported immediately by telephone or messenger to the Engineer. 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.
- B. If claim is made by anyone against the Contractor or any subcontractor on account of any accidents, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

6.04 SAFE ACCESS BY FEDERAL, STATE, AND LOCAL GOVERNMENT OFFICIALS

GENERAL REQUIREMENTS

- A. Authorized representatives of the GEPD and other government officials shall at all time have safe access to the Work, and the Contractor shall provide proper facilities for such access and inspection.

6.05 PROTECTION OF PROPERTY

- A. Protect stored materials, cultivated trees and crops, and other items located adjacent to the proposed Work. Notify property owners affected by the construction at least forty-eight (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 eight (8) hours, unless the Contractor has made special arrangements with the affected persons.

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 Operation (NFPA No. 241) shall be followed.

6.07 TRAFFIC MAINTENANCE AND SAFETY

- A. 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.
- B. When flagmen and guards are required by regulation or when deemed necessary for safety, they shall be furnished with approved orange wearing apparel and other regulation traffic-control devices.

6.08 ACCESS AND NOTIFICATION 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. Conduct operations with the least interference to fire equipment access and at no time prevent such access.

GENERAL REQUIREMENTS

- B. The Contractor shall leave a night emergency telephone number or numbers with the police departments, so that contact may be made easily at all times in case of barricade or flare trouble or other emergencies.
- C. Maintain postal service facilities in accordance with the requirements of 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.

PART 7 USE OF EXPLOSIVES

- A. The Contractor shall use all precaution, control, and safety features necessary to insure the safety of life or property in the area of operation.
- B. Blasting operations shall be performed under the most skilled supervision. Where necessary, Contractor shall use suitable mats or other approved methods to smother blast.
- C. No loaded holes shall be left unattended.
- D. Extreme care shall be taken to minimize the amount and degree of ground vibration, noise, overpressure, and flying debris.
- E. All explosives shall be stored in a safe manner, in compliance with local, state and federal laws and ordinances.

PART 8 PRESERVATION, RESTORATION, AND CLEANUP

8.01 EROSION CONTROL

- A. The Contractor shall protect floodplains and wetlands by complying with the requirements in Title 33 of the Code of Federal Regulations Part 330, Appendix A and storm water permit.

8.02 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. 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.

8.03 FINISHING OF SITE, BORROW, AND STORAGE AREAS

GENERAL REQUIREMENTS

- 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.

8.04 RESEEDING AND FERTILIZING

- A. If damaged originally seeded areas inside and outside of the construction area shall be fertilized and reseeded with first-quality seed or planted with new sod as approved by the property owner. All ground preparation, reseeded, and sodding shall be done in accordance with the best accepted practices for lawn planting. The Contractor shall be responsible for obtaining a satisfactory grass turf acceptable to the property owner.

8.05 STREET CLEANUP DURING CONSTRUCTION

- A. Thoroughly clean all foreign material caused by the construction operations from all streets and roads at the conclusion of each day's operation.

PART 9 SUBMITTALS DURING CONSTRUCTION

9.01 GENERAL

- A. Requirements in this Section are in addition to any specific requirements for submittals specified in other Sections of these Contract Documents.
- B. Submittals to the Engineer shall be emailed to:

Constantine Engineering
Attn: Julia Felter
Jfelter@tcgeng.com
- C. Submitted data shall be fully sufficient in detail for determination of compliance with the Contract Documents.
- D. Review, acceptance, or approval of substitutions, schedules, shop Drawings, lists of materials, and procedures submitted or requested by the Contractor shall not

GENERAL REQUIREMENTS

add to the Contract amount, and all additional costs which may result therefrom shall be solely the obligation of the Contractor.

- F. The Owner is not precluded, by virtue of review, acceptance, or approval, from obtaining a credit for construction savings resulting from allowed concessions in the Work or materials therefore.
- G. It shall not be the responsibility of the Owner to provide engineering or other services to protect the Contractor from additional costs accruing from such approvals.
- H. No equipment or material for which listings, Drawings, or descriptive material is required shall be installed until the Engineer has on hand copies of such approved lists and the appropriately stamped final shop Drawings.
- I. The review of Drawings by the Engineer will be limited to general design requirements only, and shall in no way relieve the Contractor from responsibility for errors or omissions contained therein.
- J. Submittals will be acted upon by the Engineer as promptly as possible, and returned to the Contractor no later than the time allowed for review in SHOP DRAWING SUBMITTAL PROCEDURE. Delays caused by the need for resubmittals shall not constitute reason for an extension of Contract time.

9.02 SHOP DRAWING SUBMITTAL PROCEDURE

- A. The Contractor shall submit an electronic PDF to the Engineer for his review, of shop Drawings, electrical diagrams, and catalog cuts for fabricated items and manufactured items (including mechanical and electrical equipment) furnished under this Contract. Shop Drawings shall be submitted in sufficient time to allow the Engineer not less than twenty (20) regular working days for examining the shop Drawings.
- B. These shop Drawings shall be accurate, distinct, and complete, and shall contain all required information, including satisfactory identification of items, units, and assemblies in relation to the Contract Drawings and Specifications.
- C. Shop Drawings shall be submitted only by the Contractor, who shall indicate by a signed stamp on the shop Drawings, or other approved means, that he (the Contractor) has checked and approved the shop Drawings, and that the Work shown is in accordance with Contract requirements and has been checked for dimensions and relationship with Work of all other trades involved. The practice of submitting incomplete or unchecked shop Drawings for the Engineer to correct or finish will not be acceptable, and shop Drawings which, in the opinion of the Engineer, clearly indicate that they have not been checked by the Contractor will be considered as not complying with the intent of the Contract Documents and will be returned to the Contractor for resubmission in the proper form.

GENERAL REQUIREMENTS

- D. When the shop Drawings have been reviewed by the Engineer, a PDF will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the shop Drawing may be rejected and returned to the Contractor with such changes or corrections indicated, and the Contractor shall correct and resubmit the shop Drawings in the same manner and quantity as specified for the original submittal, unless otherwise directed by the Engineer. If changes are made by the Contractor (in addition to those requested by the Engineer) on the resubmitted shop Drawings, such changes shall be clearly explained in a transmittal letter accompanying the resubmitted shop Drawings.
- E. The review of such shop Drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for correctness of dimension, fabrication details, and space requirements, or for deviations from the Contract Drawings or Specifications, unless the Contractor has called attention to such deviations in writing by the letter accompanying the shop Drawings and the Engineer approves the change or deviation in writing at the time of submission; nor shall review by the Engineer relieve the Contractor from the responsibility for errors in the shop Drawings.
- F. The Contractor agrees that shop Drawing submittals processed by the Engineer do not become Contract Documents and are not Change Orders; that the purpose of the shop Drawing review is to establish a reporting procedure and is intended for the Contractor's convenience in organizing his Work and to permit the Engineer to monitor the Contractor's progress and understanding of the design.

9.03 SHOP DRAWING REQUIREMENTS

- A. Shop Drawings referred to herein shall include shop Drawings and other submittals for both shop and field-fabricated items. The Contractor shall submit, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, process systems, and equipment:
 - 1. Shop Drawings or equipment Drawings, including dimensions, size and location of connections to other Work, and weight of equipment.
 - 2. Catalog information and cuts.
 - 3. Installation or placing Drawings for equipment, drives, and bases.
 - 4. Supporting calculations for equipment and associated supports specified to be designed by equipment manufacturers or suppliers.
 - 5. Wiring and control diagrams of systems and equipment.
 - 6. Complete manufacturer's specifications, including materials description and paint system.

GENERAL REQUIREMENTS

7. List of special motor features being provided (i.e., space heaters, altitude corrections, thermal protectors, etc.).
 8. Complete motor rating for all motors fifteen (15) hp and larger, including motor no-load, starting, and full-load current at rated voltage; full-load speed and full-load current at one hundred-ten (110%) percent voltage; motor efficiency and power factor at $\frac{1}{2}$, $\frac{3}{4}$, and full load at rated voltage.
 9. Performance data and pump curves.
 10. Suggested spare parts list.
 11. List of special tools required for checking, testing, parts replacement, and maintenance (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics).
 12. List of special tools furnished with the equipment.
 13. List of materials and supplies required for the equipment prior to and during startup.
 14. List of materials and supplies furnished with the equipment.
 15. Samples of finish colors for selection.
 16. Special handling instructions.
 17. Requirements for storage and protection prior to installation.
 18. Requirements for routine maintenance required prior to plant startup.
 19. List of all requested exceptions to the Contract Documents.
- B. The submittals shall include satisfactory identification of items, units, and assemblies in relation to the Specification Section number, and the system or equipment identification or tag number shown on the Drawings or as provided in the applicable Specification Section.
- C. Should the Contractor propose any item on his shop Drawings, or incorporate an item into the Work, and that item should subsequently prove to be defective or otherwise unsatisfactory, (regardless of the Engineer's preliminary review), the Contractor shall, at his own expense, replace the item with another item that will perform satisfactorily.

9.04 OPERATIONS AND MAINTENANCE (O&M) MANUALS

GENERAL REQUIREMENTS

- A. The CONTRACTOR shall furnish four (4) copies and one (1) PDF of a complete instruction manual for installation, operation, maintenance, and lubrication requirements for each component of mechanical and electrical equipment or system under this Contract. All equipment manufacturers and/or suppliers shall be made aware of these requirements and all associated costs shall be included in the costs for furnishing the equipment or system. Each instruction manual furnished shall be fixed in a hard-back binder which is clearly labeled to designate the system or equipment for which it is intended with reference to the building and equipment number and the Specification section where the item is specified.
- B. The manuals shall be furnished at least thirty (30) calendar days prior to the scheduled completion of the Work but in no case shall submission of the manuals be delayed beyond seventy-five (75%) percent completion point of the Work. Submission of the manuals shall precede any payment to the CONTRACTOR for Work completed in excess of the seventy-five (75%) percent completion level. Any deficiencies found by the ENGINEER to exist in the manuals submitted shall be corrected by the CONTRACTOR within thirty (30) calendar days following notification by the ENGINEER of the deficiencies.
- C. Each instruction manual shall include, but not be limited, to the following:
1. Diagrams and illustrations.
 2. Detailed description of the function of each principal component of the system.
 3. Performance and nameplate data.
 4. Installation instructions.
 5. Procedure for starting.
 6. Proper adjustment.
 7. Test procedures.
 8. Procedure for operating.
 9. Shutdown instructions.
 10. Emergency operating instructions and troubleshooting guide.
 11. Safety precautions.
 12. Maintenance and overhaul instructions which shall include detailed assembly Drawings with part numbers, parts list, instructions for ordering spare parts, and complete preventive maintenance instruction

GENERAL REQUIREMENTS

required to ensure satisfactory performance and longevity of the equipment.

13. Lubrication instructions, which shall list points to be greased or oiled, shall recommend type, grade, and temperature range of lubricants, and shall recommend frequency of lubrication.
 14. List of electrical relay settings and control and alarm contact settings.
 15. Electrical interconnection wiring diagram for equipment furnished, including all control and lighting systems.
 16. Start-up reports.
- D. Manuals shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.
- E. Manuals shall be assembled in one (1) or more binders, each with title page, typed table of contents, and heavy section dividers with numbered plastic index tabs. Each manual shall be divided into sections paralleling the equipment Specifications. Binders shall be three (3) ring, hard-back type. All data shall be punched for binding and composition and printing shall be arranged so that punching does not obliterate any data. The Project title, division designation, and manual title printed thereon shall be furnished by the ENGINEER.
- F. Where more than one (1) binder is required, they shall be labeled "Vol. 1", "Vol. 2", and so on. The table of contents for the entire set, identified by volume number, shall appear in each binder. Submit manual organization and format to the Engineer for approval prior to manual preparation.
- G. Each O & M Manual shall be transmitted to the ENGINEER prior to the installation of the equipment and all equipment shall be serviced in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the ENGINEER prior to final acceptance of the Project.

9.05 MAINTENANCE SUMMARY FORMS

- A. In addition to the O & M Manuals, provide Maintenance Summaries in the format of the form bound at the end of this Section and described below. The timing of submission of these forms shall be the same as prescribed above for the Operation and Maintenance Manuals.
- B. An individual Maintenance Summary for each equipment item shall be completed following the outlined provided; and four (4) copies and one (1) PDF submitted for review by the ENGINEER. The manufacturer's standard form will not be acceptable as a substitute for the Maintenance Summary.

GENERAL REQUIREMENTS

- C. The term "Maintenance Operation" as used in the Maintenance Summary bound at the end of this Section is understood to mean any routine operation required to ensure the satisfactory performance and longevity of the equipment. Examples of some typical Maintenance Operations are lubrications, belt tensioning, adjustment of pump packing glands, routine adjustments, etc.
- D. The Maintenance Summary may take as many pages as required. However, the order and format shown must be adhered to. Only 8½ inch by eleven (11) inch paper will be accepted.

9.06 RECORD DRAWINGS

- A. Comply with SECTION 01720.

9.07 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

- A. Where required in the Specifications, the Contractor shall submit manufacturer's certification of proper installation of equipment prior to startup or performance testing. Such certificate shall state that the equipment or system has been installed in accordance with the manufacturer's recommendation and has been inspected by a manufacturer's authorized representative, that it has been serviced with the proper initial lubricants, that applicable safety equipment has been properly installed, and the proper electrical and mechanical connections have been made.

9.08 MATERIAL AND EQUIPMENT COLORS

- A. The Engineer will provide a schedule of colors within thirty (30) days after approval of materials and equipment and after receiving samples of all standard colors those items requiring selections.
- B. No individual color selections will be made until after approval of all pertinent materials and equipment and after receipt of appropriate samples.

9.09 CERTIFICATES OF COMPLIANCE WITH SPECIFIED STANDARDS AND CODES

- A. A Certificate of Compliance shall be furnished for materials specified to a recognized standard or code prior to the use of any such materials in the Work. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials and shall state that the materials involved comply in all respects with the requirements of the Specifications. A Certificate of Compliance shall be furnished with each lot of material delivered to the Work and the lot so certified shall be clearly identified in the certificate.
- B. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate

GENERAL REQUIREMENTS

of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents and any such material not conforming to such requirements will be subject to rejection whether in place or not.

- C. The Engineer reserves the right to refuse permission for use of material on the basis of a Certificate of Compliance.
- D. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

9.10 STARTING OF SYSTEMS

A. Definitions:

1. System: A system means the overall process or a portion thereof, that performs a specific function. A system may consist of two (2) or more subsystems as well as two (2) or more types of equipment.
2. Subsystem: A subsystem is a portion of a larger systems consisting of two (2) or more types of equipment.
3. Functional Testing: Tests necessary to demonstrate that installed equipment and systems function as specified and operate in the manner intended. Functional testing is a prerequisite to performance testing for equipment and systems specified to have a performance test.
4. Performance Testing: Tests necessary to demonstrate, after successful functional testing, that equipment and systems meet specified performance requirements.
5. Startup:
 - a. Startup of any portion of the entire facility is considered complete when, in the opinion of the Engineer, the facility or designated portion has properly operated for seven (7) continuous days without significant interruption. The startup period is in addition to the specified functional and performance testing and training.
 - b. Significant interruption during startup shall include any of the following events:
 1. Failure of a system (process, control, building service, etc.) that is not permanently corrected within four (4) hours after such failure occurs.

GENERAL REQUIREMENTS

2. Failure of a process equipment unit (mechanical, electrical, instrument, etc.) that is not permanently corrected within six (6) hours after such failure occurs.
 3. Failure of an analytical, HVAC, building service, or hoisting equipment unit that is not permanently corrected within eight (8) hours after such failure occurs.
- c. "Permanently corrected" shall consist of all the following:
1. Work repaired and replaced to conform with specified requirements.
 2. Parts and components replaced as recommended by original manufacturer and conforming with reviewed submittals.
 3. Piping and valves properly installed and connected.
 4. Wiring properly terminated and enclosed in raceways.
 5. Accessories, including spare parts and lubricants, furnished as specified.
- d. Occurrence of a significant interruption shall require startup then in progress to be stopped and restarted after permanent corrections are made.
6. Operation: The operation period begins when the facility has been substantially completed as defined in the GENERAL CONDITIONS.
- B. Testing and Startup Responsibilities
1. Contractor's Responsibilities: The Contractor shall:
 - a. Furnish labor and materials, tools, instruments, and service for checking, testing, and startup specified for each equipment item. This includes such services as required by the manufacturer's representatives, subcontractors, electricians, instrumentation technicians, and pipe fitters.
 - b. Prepare testing schedule and incorporate testing and startup activities in the progress schedule for the Work.
 - c. Designate one (1) person (other than field superintendent) to be responsible for coordinating and expediting testing and start-up responsibilities, and to be present during all pre-startup meetings

GENERAL REQUIREMENTS

and available to Owner's personnel during the testing and startup.

- d. Obtain and furnish qualified manufacturer's representative to assist testing of each equipment type and system.
 - e. Develop a standard testing log to be used as a record of testing each item and subsystem. This log shall:
 1. Be subject to approval of Engineer.
 2. Include subsystem and equipment name.
 3. Have provisions for recording dates of completion for checking, inspection by manufacturer, verification of instrumentation and controls, and completion of subsystem tests, and;
 4. Provide space for problems remaining with equipment and for signature of Engineer and manufacturer's representative indicating acceptance.
 - f. Notify Engineer and Owner at least fourteen (14) days prior to the date when each equipment system is scheduled to be initially started; also submit testing plan starting schedule, quantity and source of utilities, chemicals, and other materials needed.
 - g. Furnish spare parts and special tools as specified for the respective equipment.
 - h. Furnish O & M information needed for O & M Manuals, as specified herein.
2. Owner's Responsibilities: The Owner will:
- a. Furnish for Contractor's use during startup:
 1. Potable and/or raw water for testing, as appropriate.
 2. Chemicals including chlorine, polyaluminum chloride, lime, sodium bisulfite and sodium hexametaphosphate, provided adequate prior notice is given by Contractor.
 3. Sample containers for Contractor's use in sample collection.
 - b. Provide sampling labor and materials and laboratory analysis.

GENERAL REQUIREMENTS

- c. Furnish Owner's representative to witness all tests.

C. Testing Preparation

1. Cleaning and Checking: Prior to initial startup of equipment:
 - a. Inspect and clean equipment, devices, and connected piping so they are free of foreign material.
 - b. Lubricate equipment in accordance with manufacturer's instructions.
 - c. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.
 - d. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
 - e. Check power supply to electric-powered equipment for correct voltage.
 - f. Obtain manufacturer's certification of proper installation, where specified.
2. Ready-To-Test Determination: Equipment shall be determined ready to test by Engineer based on the following:
 - a. Notification by Contractor of equipment and system readiness for testing.
 - b. Submittal of testing plan stating detailed procedures including quantity and source of utilities, chemicals, and other materials needed for each test.
 - c. Receipt of O & M Manuals incorporating review comments.
 - d. Receipt of manufacturer's certification of proper installation, where specified.
 - e. Cleanliness of equipment, devices, and connected work.
 - f. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
3. Pre-testing Meeting: Contractor shall arrange a meeting to review the Contractor's detailed testing plan for each equipment item and system, at least two (2) days prior to the first test run.

GENERAL REQUIREMENTS

D. Functional Testing

1. Subsystem Tests: Startup and operate the individual components and subsystems that make up each equipment system, as specified in the respective sections of the Specifications. Functional testing of a complete system shall not begin until subsystem testing is completed to the Engineer's satisfaction.
2. Equipment and System Tests: Contractor shall functionally test each separate piece of equipment, and each system requiring simultaneous operation of interdependent equipment, in accordance with the following procedures:
 - a. Separate items of equipment demonstrated to function properly during subsystem testing shall require no further functional test, if documentation of subsystem testing is accepted by Engineer.
 - b. Functional testing of each system shall begin after subsystems and equipment units have been satisfactorily tested.
 - c. Functional testing will begin at a time mutually agreed upon by the Engineer, Owner, Manufacturer's Representative(s) and Contractor.
 1. The Owner or Engineer will be present during tests.
 2. Notify Engineer, Owner, and Manufacturer's Representative at least seven (7) days prior to schedule date of functional tests.
 - d. Performance tests, where specified for individual equipment, shall not begin until functional testing of the complete systems in which they operate is completed to the satisfaction of the Engineer.
 - e. If, in the opinion of the Engineer, each system meets the requirements specified, they will be accepted as conforming for the purposes of advancing to the performance testing phase. If, in the opinion of the Engineer, the functional test results do not meet the requirements specified, the systems will be considered as nonconforming.
 1. In the case of a nonconforming system, advancement to the performance testing phase shall not commence until the Contractor has made such adjustments, changes, and additions necessary to correct the system and retest it as specified and, in the opinion of the Engineer, the system functions as specified.

GENERAL REQUIREMENTS

3. Documentation: Contractor shall document subsystem and system tests in writing, in a format acceptable to the Engineer. Obtain respective manufacturer's signature and approval for subsequent performance testing or startup on the appropriate test logs.

E. Performance Testing

1. Testing Fluid: Performance testing shall use plant fluid or material that the equipment or system is designed to handle during normal service conditions, unless otherwise specified.
2. Equipment and Subsystem Tests: Contractor shall:
 - a. Clean and check equipment and devices, as specified herein prior to starting equipment and subsystem performance tests.
 - b. Performance testing will begin at a time mutually agreed upon by the Engineer, Owner, Manufacturer's Representative(s), and Contractor.
 1. The Owner or Engineer will be present during tests.
 2. Notify Engineer, Owner, and manufacturer's representative at least seven (7) days prior to schedule date of performance testing.
 - c. Operate the necessary equipment units as specified in the respective O & M Manuals for a continuous period of four (4) hours.
 - d. Follow Engineer-approved testing plan and detailed procedures specified for each equipment unit and subsystem.
 - e. Complete acceptable performance testing of all equipment and subsystems included in a system, and submit test documentation before starting the system performance test.

F. Startup

1. Performance testing of all individual equipment and subsystems shall be completed before the startup period begins, unless otherwise allowed by the Engineer.
2. Prepare startup activity schedule.
 - a. Schedule shall identify and sequence distinct activities to be conducted or tasks to be accomplished.

GENERAL REQUIREMENTS

- b. Examples of startup activities to be conducted are:
 - 1. Demonstrate manual and automatic operation of equipment.
 - 2. Simulate power failure and observe operation of components, tripping of breakers, etc.
 - c. Conduct additional non process activities such as:
 - 1. Operate all plumbing systems.
 - 2. Operate all systems.
 - 3. Open, close, lock, and unlock all doors and windows to check master keying.
 - 4. Check all electrical and lighting systems.
 - d. Indicate timing and interdependence of activities in the program, indicating each system, subsystem, and unit to be operated. Allow for rotation of standby units with operating units so that each unit is started and stopped at least twice and receives approximately the same elapsed time of operation.
- 3. After review and revisions requested by Engineer and Owner, begin the startup activities. Attend a pre-startup meeting not more than five (5) days to startup to review the program and resolve questions.
 - 4. During startup operations, keep complete records of each activity and performance of each system, subsystem, and equipment unit. Use similar forms approved for functional testing, or as otherwise submitted and approved by Engineer.
 - 5. If performance testing of certain systems cannot be completed before successful startup, continue such performance tests after entire facility is in continuous operation.
 - 6. After successful startup as defined in this Section, perform remaining Work to not interfere with facility operations.

G. Continuous Operation

- 1. Owner will accept equipment and systems as ready for continuous operation only after successful testing and startup is completed and

GENERAL REQUIREMENTS

documented, test and startup reports submitted and manufacturers' services completed for training of Owner's personnel.

2. After successful performance testing of a particular equipment type or system, Owner may elect to start up a portion of the equipment or system for continuous operation in accordance with the GENERAL CONDITIONS. Such operation will not interfere with testing of other equipment and systems that may still be underway, and shall not preclude the need to start up the portion operated in combination with the rest of the facility when all testing is completed.
3. Where completed systems require disinfection, they shall only be accepted for continuous operation after disinfection work specified is satisfactorily completed.

9.11 SUPPLIERS/ MANUFACTURERS' SPECIAL SERVICES

- A. Installation Assistance: Competent and experienced technical personnel shall represent the manufacturers of all equipment and systems as may be necessary to resolve assembly or installation problems at the Work site which are attributable to, or associated with, the equipment furnished.
- B. Functional Testing: Where functional testing services are called for in the Technical Specifications, or when technical assistance is necessary to resolve performance problems that may become apparent during the performance test, the manufacturer's representative shall provide such assistance as necessary to demonstrate the specified performance.
- C. Startup: Where startup services are called for in the Technical Specifications, or when technical assistance is necessary due to any malfunction of the equipment or system furnished, the manufacturer's representative shall provide such services as necessary to provide the Owner with an acceptable operating facility.
- D. Costs for Services:
 1. Costs for providing services during installation, testing, and for the training of Owner's personnel shall be included in the costs for providing the applicable specified equipment.
 2. Where the number of days for services is not stated in the Technical Specifications, services shall be furnished for installation, testing, and plant startup as required to provide the Owner with a satisfactory operating facility.

END SECTION

TYPICAL MAINTENANCE SUMMARY FORM

- 1. EQUIPMENT ITEM
- 2. MANUFACTURER
- 3. NAMEPLATE DATE (hp, voltage, speed, etc.)
- 4. MANUFACTURER'S LOCAL REPRESENTATIVE

Name _____ Telephone Number _____

Address _____

- 5. SPARE PARTS. Include your recommendations regarding what spare parts, if any should be kept on the job.
- 6. MAINTENANCE REQUIREMENTS

Maintenance Operation ¹	Frequency ²	Lubricant (If Applicable) ³	Comments

- 1. List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable.
- 2. List required frequency of each maintenance operation.
- 3. List lubricant manufacturers, types, and identification numbers.

**SECTION 01100
SUMMARY OF WORK**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Organization and interpretation of Contract Documents.
 - 3. Measurement and Payment

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Duplex Pump Station for the Glenda Trace sewer Improvement Project
- B. Location: Coweta County, Georgia.
- C. OWNER: Coweta County Water and Sewerage Authority
 - 1. OWNER's Representative: Rick Jones, Chief Operating Officer, 545 Corinth Road, Newnan, GA 30263
- D. The Work consists of the following:
 - 1. Furnish the following pumps and pump components and appurtenances.
 - a. 5' diameter single molded FRP wetwell in accordance with the Contract Drawings and Specification. Wetwell shall be delivered to the site fully assembled and ready for operation. The wetwell shall include hatch covers, pumps, guiderails systems, piping supports, fasteners, influent drop structure, floats, discharge piping, wall penetration sleeves and seals as noted on drawings.
 - b. A concrete or single molded FRP valve vault in accordance with the Contract Drawings and Specification. The Vault shall be delivered to the site fully assembled and ready for operation. The Vault shall include hatch covers, valves, piping supports, fasteners, gauges, floor drain, discharge piping, wall penetration sleeves and seals as noted on drawings.
 - c. Note: The stainless steel wetwell discharge piping shall be extended 36" from outer wall of wetwell and shall include 125 lb flange fitting for connection to the valve vault piping.
 - d. Cut openings and field fabricate sleeves for large diameter pipe penetration and electrical pump leads. Coordinate with OWNER on final location and elevation. Provide mechanical seal between carrier

SUMMARY OF WORK

- pipe and sleeve after installation and testing.
 - e. Provide minimum 50 ft pump electrical leads for each pump and floats. Leads shall be capable of being extended for termination into Disconnect Switch and Junction Box.
 - f. Deliver and offload at project site location in accordance with Section 13125, and shall include all necessary material and labor to secure structure as a permanent fixture. Coordinate with the OWNER a minimum 3 weeks in advance of delivery.
- 2. Contractor has overall responsibility of construction of a fully operational pump station, including shoring and excavation of the existing trash tank top, concrete opening, tank liquid and solids removal, temporary by-pass piping and temporary support.
 - 3. Contractor is responsible for providing access to work areas, storage of material and equipment, site restoration and temporary service.
 - 4. Contractor shall install electrical and controls for the new station and coordinate start-up.
 - 5. Excess material from excavations to be spread out and graded at the site. All sewage removed from the trash tank shall be disposed of in accordance with CCWSA requirement. Disposal location and disposal cost will be provided by CCWSA.
- E. Project will be constructed under a single prime contract.

1.03 WORK BY OTHERS

- A. The following work will be performed by others concurrently with the Work of this Contract:
 - 1. Construction of 4" force main from the new 4" valve vault to the existing 10" FM tie-in location.
 - 2. Construction of HDD under GA Hwy 34.

1.04 ORGANIZATION AND INTERPRETATION OF CONTRACT DOCUMENTS

- A. Specifications and Drawings included in these Contract Documents establish the performance, quality requirements, location and general arrangement of materials and equipment, and establish the minimum standards for quality of workmanship and appearance.
- B. A part of the work that is necessary or required to make each installation satisfactory and operable for its intended purpose, even though it is not

SUMMARY OF WORK

specifically included in the Specifications or on the Drawings, shall be performed as incidental work as if it were described in the Specifications and shown on the Drawings.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

**SECTION 01720
PROJECT RECORD DOCUMENTS**

PART 1 GENERAL

1.01 WORK INCLUDED

The Contractor shall obtain from the Engineer, one (1) set of blueline prints of the Contract Drawings. These prints shall be kept and maintained in good condition at the project site and a qualified representative of the Contractor shall enter upon these prints, from day-to-day, the actual "as-built" record of the construction progress. Entries and notations shall be made in a neat and legible manner and these prints shall be delivered to the Engineer upon completion of the construction. APPROVAL FOR FINAL PAYMENT WILL BE CONTINGENT UPON COMPLIANCE WITH THIS PROVISION.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

- A. Section 01001 - General Requirements.
- B. General Conditions.

1.03 MAINTENANCE OF DOCUMENTS

- A. Maintain at job site, one copy of:
 - 1. Contract Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Reviewed Shop Drawings
 - 5. Change Orders
 - 6. Other Modifications to Contract
- B. Store documents in approved location, apart from documents used for construction.
- C. Provide files and racks for storage of documents.
- D. Maintain documents in clean, dry legible condition.
- E. Do not use record documents for construction purposes.
- F. Make documents available at all times for inspection by Engineer and Owner.

PROJECT RECORD DOCUMENTS

1.04 MARKING DEVICES

- A. Provide colored pencil or felt-tip marking pen for all marking.

1.05 RECORDING

- A. Label each document "PROJECT RECORD" in 2-inch high printed letters.
- B. Keep record documents current.
- C. Do not permanently conceal any work until required information has been recorded.
- D. Contract Drawings: Legibly mark to record actual construction:
 - 1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - 2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - 3. Field changes of dimension and detail.
 - 4. Changes made by Change Order or Field Order.
 - 5. Details not on original Contract Drawings.
- E. Specifications and Addenda: Legibly mark up each Section to record:
 - 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 - 2. Changes made by Change Order or Field Order.
 - 3. Other matters not originally specified.
- F. Shop Drawings: Maintain as record documents; legibly annotate Shop Drawings to record changes made after review.

1.06 SUBMITTAL

- A. At completion of project, deliver record documents to Engineer.
- B. Accompany submittal with transmittal letter, in duplicate, containing:
 - 1. Date.

PROJECT RECORD DOCUMENTS

2. Project Title and Number.
3. Contractor's Name and Address.
4. Title and Number of each Record Document.
5. Certification that each Document as Submitted is Complete and Accurate.
6. Signature of Contractor, or his authorized Representative.

END OF SECTION

**SECTION 02101
CIVIL SITEWORK**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section covers the Work necessary to complete the sitework for the project. Civil sitework includes clearing, grading for roads and driveways, temporary fencing, and finish grading and grassing.

1.02 GENERAL

- A. RELATED WORK SPECIFIED IN OTHER SECTIONS

- 1. See Sections EARTHWORK for additional requirements.

- B. See CONDITIONS OF THE CONTRACT and Section GENERAL REQUIREMENTS, for information and requirements that apply to the Work specified herein and are mandatory for this project.

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.

2.02 SEEDING AND MULCHING

- A. Topsoil: Topsoil shall be a natural, friable soil, representative of product soils in the vicinity. It shall be well-drained, free from admixture of subsoil and foreign matter, objects larger than two (2) inches in diameter, toxic substances, and any other deleterious material that may be harmful to plant growth and be a hindrance to grading, planting, and maintenance operations. Soil excavated on site may be used provided it meets the requirements of topsoil.
- B. The type of quick growing seed used shall be appropriate to provide an early ground cover during the particular season when planting is done. The rate of spread shall be as specified in Section 3.01D.
- C. For areas requiring sod it shall be Tifton Bermuda free of weeds and other undisuable grasses. Minimum 1/2 yard cuts.
- D. Fertilizer: Commercial plant food containing eight (8%) percent nitrogen, eight (8%) percent available phosphate, and eight (8%) percent potassium, uniform in

composition, dry, free-blowing, and delivered in containers bearing manufacturer's guaranteed analysis.

2.03 FENCING (IF SHOWN ON DRAWINGS)

- A. Materials shall be new and products of recognized, reputable manufacturers. Used, rolled, or regalvanized materials are not acceptable.
- B. Hot-dip galvanized after fabrication where shown on the plans. Posts and other appurtenances shall have a minimum zinc coating of 1.2 ounces per square foot of surface.
- C. Fabric: Chain link fence fabric, seventy-two (72) inches high, woven of No. 9 gauge wire, in standard two (2)-inch diamond-mesh pattern, selvages twisted and barbed, galvanized after weaving with 1.2 ounce zinc coating meeting the requirements of ASTM A392, Class 1 or Polyolefin.
- D. Posts: Federal Specification RR-F-191, fence posts, gates, and accessories, except as hereinafter modified. Standard lengths for setting in ground or in concrete as required for conditions shown. Galvanized or Polyolefin.
- E. Line Posts: For fences up to eight (8)-feet zero (0)-inches high, use 2½-inch outside diameter, ASTM A120, Schedule 40 steel pipe, weight 3.65 pounds per linear foot. Galvanized or Polyolefin.
- F. End, Corner, Angle, and Pull Posts: Use 2 7/8-inch outside diameter standard weight steel pipe, weight 5.79 pounds per linear foot. Galvanized or Polyolefin.
- G. Gate Posts: For single swing gates up to six (6)-feet wide, use 2 7/8-inch outside diameter steel pipe, 5.79 pounds per foot. For single swing gates six (6)-feet wide to thirteen (13)-feet wide, use four (4)-inch outside diameter steel pipe, 9.1 pounds per foot. For other sizes, follow manufacturer's recommendations. Galvanized or Polyolefin.
- H. Post Tops: Post tops shall be pressed steel, or malleable iron, designed as a weathertight closure cap for tubular posts. Provide one (1) cap for each post, unless equal protection is afforded by combination post top cap and barbed wire supporting arm where barbed wire is required. Where top rail is used, provide tops to permit passage of top rail. Galvanized or Polyolefin.
- I. Tension Wire: Tension wire shall be zinc or aluminum-coated coil spring steel wire not less than No. 7 gauge (0.177 inch diameter). Provide tie clips of manufacturer's standard as approved for attaching the wire to the fabric, at intervals not exceeding twenty-four (24)-inches. Galvanized or Polyolefin.
- J. Stretcher Bars and Bands: Stretcher bars shall be one-piece lengths equal to full height of fabric with a minimum cross-section of 3/16 inch by ¾-inch. Provide one (1) stretcher bar for each gate and end post and two (2) for each corner and

pull post. Bar bands shall be heavy-pressed steel, spaced not over fifteen (15)-inches on center to secure stretcher bars to tubular end, corner, pull, and gate posts. Galvanized or Polyolefin. Galvanized or Polyolefin.

- K. Top Rail: Not less than eighteen (18)-foot-long tubular steel, 1 5/8-inch outside diameter, weight 2.27 pounds per linear foot. Couplings to be outside-sleeve type and at least six (6)-inches long. Top rail to extend through line post tops to form continuous brace from end-to-end of each stretch of fence. Galvanized or Polyolefin. Galvanized or Polyolefin.
- L. Braces: Brace pipe shall be the same material as the top rail and shall be installed midway between the top rail and extend from the terminal post to the first adjacent line post. Braces shall be securely fastened to the posts by heavy-pressed steel and malleable fittings, then securely trussed from line post to base of terminal post with a 3/8-inch truss rod and tightener. Galvanized or Polyolefin.
- M. Fittings: Malleable steel, cast iron, or pressed steel galvanized to meet the requirements of ASTM A153. Fittings to include extension arms for barbed wire, stretcher bars and clamps, clips, tension rods, brace rods, hardware, fabric bands and fastenings, and all accessories. Provide forty-five (45) degree bracket type supports to accommodate three (3) strands of barbed wire as shown. Galvanized or Polyolefin.
- N. Barbed Wire: Four-point pattern with three strands of No. 12-1/2 gauge wire, and one (1) inch barbs five (5)-inches apart. Zinc-coated barbed wire shall meet the requirements of ASTM A121, Class 3. Galvanized or Polyolefin.
- O. Gates:
 - 1. Gates shall swing as indicated, complete with latches, stops, keepers, and hinges.
 - 2. Gate frames shall be constructed of tubular members welded at all corners or assembled with fittings. Fabricate frames of standard weight steel pipe, 1.90-inch outside diameter, weight 2.72 pounds per linear foot. Welds shall be painted with zinc-based paint. Where corner fittings are used, gates shall have truss rods of 5/16-inch minimum nominal diameter to prevent sag or twist. Gate leaves shall have vertical intermediate bracing as required, spaced so that no members are more than eight (8)-feet apart. Gate leaves ten (10)-feet or over shall be extended one (1)-foot above the top horizontal member to which (3) three strands of barbed wire, uniformly spaced, shall be attached by use of bands, clips, or hook bolts. All frames, hardware, etc to coated galvanized or Polyolefin as used in the fence construction.

3. 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 fifteen (15) inches.
4. Gate hinges shall be of adequate strength for gate and with large bearing surfaces for clamping into 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 (1) person.
5. Gate latches, stops, and keepers shall be provided for all gates. Latches shall have a plunger-bar arranged to engage the center stop, except that for single gates of openings less than ten (10) feet wide a forked latch may be provided. Latches shall be arranged for locking with padlocks. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger-bar of the latch of double gates. No stop is required for single gates. Keepers shall consist of a mechanical device for securing the free end of the gate when in the full position.
6. For double gates, the size and configuration shall be as indicated on the Drawings. Provide gate stops for all double gates, consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Provide locking device and padlock eyes as an integral part of the latch, requiring one (1) padlock for locking both gate leaves.
7. Provide keepers for all vehicle gates, which automatically engages the gate leaf and holds it open in the OPEN position until manually released.
8. Sliding gate system shall be E-Z slide track system as manufactured by International Gate Devices, or approved equal.
9. Sliding gates shall have a (2) two piece bolt-on enclosed track of aluminum extrusion, alloy 6061-t, having a total weight of 3.98 pounds per foot and designed to withstand a reaction load of 1500 pounds.

PART 3 EXECUTION

3.01 GRADING, SEEDING AND MULCHING

- A. Pre-Finish Grading: Complete rough grading to grades indicated on the Drawings or to accomplish adequate drainage patterns required by the site layout. Rough grading shall allow for the addition of materials needed to accomplish finish grading. Fill areas required during subgrade preparation shall be compacted to eighty-five (85%) percent of the relative maximum density. Topsoil shall be spread over the prepared rough grade using a rubber-tired tractor with grader blade or equivalent.

CIVIL SITEWORK

- B. Fertilizing: Apply commercial fertilizer at the rate of nine hundred twenty (920) pounds per one-acre or at a rate determined from soil tests, distributing uniformly with a rotary mechanical spreader. Apply soil additives such as lime if the soil pH requires adjustment.
- C. Finish Grading: After placing topsoil and applied materials, rake the topsoil to a uniform grade so that all areas drain, as indicated on the grading plan or as required to complete drainage patterns. Lightly compact with a cultipacker before planting grass. Remove all trash from the area prior to planting grass.
- D. Seeding:
 - 1. Seeding and mulching operations will not be permitted when wind velocities exceed fifteen (15) miles per hour. Seed shall be sown only when the soil is moist and in proper condition to induce growth. No seeding shall be done when the ground is unduly wet or otherwise not in a tillable condition.
 - 2. Whenever a suitable amount of area has been graded, it shall be made ready and grassed as specified in this Section. Grassing shall be incorporated into the project at the earliest practical time in the life of the Contract.
- E. The several operations involved in the work shall proceed in the following sequence: preparation of the ground; seeding; spreading of mulch; cutting-in mulch; and rolling or preparation of the ground; installation of erosion control matting, placing soil; hydroseeding; placing excelsior mat.
- F. The ground over which the seed is to be sown shall be prepared by diskharrowing and thoroughly pulverizing the soil to a suitable depth. The prepared soil shall be loose and reasonably smooth. It shall be reasonably free of large clods, roots, and other material, which will interfere with the work or subsequent mowing and maintenance operations. Apply lime at two (2) tons per acre, and 8,8,8 commercial fertilizer at nine hundred twenty (920 lbs.) pounds per acre.
- G. While the soil is still loose and moist, the seed shall be scattered uniformly over the grassing area. The rate of spread for the seed mixture shall be per schedule.

August through February

Winter

Kentucky 31	30 lbs/acre
Reseeding Crimson Clover	15 lbs/acre
Bermuda Grass (Unhulled)	30 lbs/acre
Perennial Rye Grass	30 lbs/acre

March through July

Spring

CIVIL SITEWORK

Kentucky 31	30 lbs/acre
Kobe Lespedeza (Var. Tenn)	30 lbs/acre
Bermuda Grass (Cynodon Ductylon)	20 lbs/acre (Hulled)

- H. Approximately two (2) inches, loose thickness of mulch material shall be applied uniformly over the seeded area, and the mulch material cut into the soil with equipment specified, to produce a loose mulched thickness of three (3) to four (4) inches. Care shall be exercised that the materials are not cut too deeply into the soil.
- I. Immediately after completion of the seeding, the entire mulched area shall be rolled thoroughly with the equipment specified. At least two (2) trips of the entire area will be required.
- J. Maintenance:
1. Water to keep surface soil moist. Repair washed out areas by filling with topsoil, liming, fertilizing, and seeding. Replace mulch on banks when washed or blown away. Mow grass to two (2) inches after grass reaches at least three (3) inches in height, and mow frequently enough to keep grass from exceeding 3 ½ inches.
 2. If a satisfactory stand of grass has not been established in eight (8) weeks, the Contractor shall renovate and reseed the grass or unsatisfactory portions thereof immediately. A satisfactory stand of grass is defined as having no bare spots larger than three (3) square feet and not more than ten (10%) percent of total area with bare spots larger than one (1) square foot.
 3. The seeded areas shall be watered to provide optimum growth conditions for the establishment of the grass. In no case, however, shall the period of maintaining such moisture be less than two weeks after the planting. Manual watering shall continue at least every four (4) days until the end of the growing season.
- K. The Contractor shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include filing, leveling, and repairing of any washed or eroded areas. Replant any areas in which the establishment of the grass stand does not develop satisfactorily.
- L. Clean-up the job site following seeding and mulching. Remove rubbish, excess materials, temporary structures, and equipment. Leave the work in a neat and presentable condition.
- M. Bermuda Sod shall be installed in all swales, ditches, all slopes 3:1 or greater, within 10' of all building structures, and within 3' of all walkways and driveways.

3.02 FENCING

- A. Installation of fencing shall meet the requirements of ASTM F567.
- B. Erect fencing in straight lines between angle points by personnel experienced in this type of construction. Erect in accordance with the manufacturer's recommendations as approved and with these Specifications. Post holes shall be a minimum of two (2) feet eight (8) inches below finished grade. Space posts not more than ten (10) feet on centers and in true lines. Set posts plumb and to a depth of two (2) feet six (6) inches. The top rail of the fence shall be at the top of the fabric. Fill remainder of hole with concrete to extend around the posts to a point two (2) inches above finished grade.

The top surface shall have a crowned watershed finish. After concrete has set, install accessories. Fasten chain link fabric to end posts with stretcher bars and clamps and to line posts and top rail with wire or bands at approximately fourteen (14) inch centers and twenty-four (24) inch centers, respectively.

Install three (3) strands of barbed wire on the brackets, tighten, and secure at each bracket. Brace gate posts diagonally to adjacent line posts to ensure stability. Hang gates and adjust all hardware so that gates operate satisfactorily from open or closed position.

END OF SECTION

**SECTION 02140
DEWATERING**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor and equipment required to dewater all excavations. Dewatering of all excavations shall be the responsibility of the Contractor, and no additional compensation will be allowed for same.

1.02 RELATED WORK

- A. Earthwork is included in Section 02200.
- B. Slope protection and erosion control is included in Section 02270.

1.03 SUBMITTALS

- A. None.

PART 2 PRODUCTS

- A. None in this Section.

PART 3 EXECUTION

3.01 GENERAL

- A. Dewatering of many of the construction excavations shall be required as necessary to provide a dry work environment as indicated by the geotechnical report, drawings and these specifications. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation and the use of all practical means available to prevent surface runoff from entering any excavation.
- B. The dewatering system shall be capable of relieving all hydrostatic pressure against the height of the excavation walls and of lowering the hydrostatic level below the bottom of the base slab a minimum of four (4) feet in the work areas both prior to excavation, and during excavation and construction.
- C. Provide fully redundant system to keep excavation free of water in event of pump failure.

DEWATERING

- D. Operate the dewatering system continuously twenty-four (24) hours per day, seven (7) days per week until all structures have been satisfactorily constructed, including placement of fill materials, and no longer require dewatering.
- E. Water pumped or drained from excavations must be treated by an appropriately sized sediment and erosion control device prior to leaving the site.

END OF SECTION

**SECTION 02200
EARTHWORK**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Clear, excavate, dewater, sheet, backfill, and do related Work necessary to complete Work shown or specified.
- B. Codes, Specifications, and standards referred to by number or title shall form a part of this Specification to the extent required by the references thereto. Latest revisions as of the date of bid opening shall apply, unless otherwise specified.

1.02 DEFINITIONS

A. Excavation

- 1. Removal of earth and rock to form cavities for the construction of foundations and structures and to form trenches for the installation of piping.
- 2. Cavity formed by the removal of earth and rock.

B. Earth

Unconsolidated material in the crust of the earth derived by weathering and erosion. Includes:

- 1. Materials of both inorganic and organic origin.
- 2. Boulders less than 1/3 cubic yard in volume, gravel, sand, silt, and clay.
- 3. Materials which can be excavated with backhoe, trenching machine, dragline, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.

C. Rock

A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes any combination of the following:

- 1. Limestone, sandstone, dolomite, granite, marble, and lava.
- 2. Boulders 1/3 cubic yard or more in volume.

EARTHWORK

3. Materials which cannot be excavated by equipment, which is used to remove earth overburden without the use of explosives, rock rippers, rock hammers, or jack hammers.
 4. Materials which cannot be excavated with a trackhoe, trenching machine, dragline, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.
- D. Undercutting
1. Excavation of rock and unsuitable earth below the bottom of a foundation, structure, or pipe to be constructed or installed.
- E. Subgrade
1. Undisturbed bottom of excavation.
- F. Pipe Bedding
1. Material required from invert of pipe to bottom of trench.
- G. Pipe Zone Backfill
1. Material required from invert of pipe to top of pipe.
- H. Pipe Cover
1. Material required from top of pipe to top of trench.
- I. Topsoil
1. Earth containing sufficient organic materials to support the growth of grass, free from rocks, roots and debris.

1.03 QUALITY ASSURANCE

- A. Contractor to hire an independent testing laboratory to perform specified services and necessary field density tests to ensure that proper compaction is obtained.

1.04 JOB CONDITIONS

- A. Maintain bench marks, monuments, and other reference points. Replace any disturbed or destroyed bench marks, monuments, or other reference points.
- B. Selected information from subsurface investigations performed by other consultants are included in the Specifications. Should the Contractor encounter subsurface or latent conditions at the site materially differing from those shown he shall immediately give notice to the Engineer of such conditions before they are disturbed. The Engineer will thereupon investigate the conditions; and if he finds that they materially differ from those shown on the Drawings or indicated in the Specifications, he will make such changes in the Drawings, the Specifications, or the Drawings and Specifications as he may find necessary. Any increase or decrease of cost resulting from such changes will be adjusted in the manner provided in the GENERAL CONDITIONS.

1.05 BURNING OF MATERIALS

- A. No burning on the site is allowed.

1.06 DISPOSAL OF CLEARING DEBRIS

- A. The Contractor shall dispose of construction debris resulting from clearing, grubbing, excavation, rock removal, demolition, dewatering and pavement replacement removal, in a landfill approved by the Engineers.
- B. Materials used for silt barriers shall be removed and disposed of upon acceptance of restoration of grounds.

1.07 EXCAVATED MATERIALS IN PAVED ROADS

- A. Unsuitable materials excavated in areas of pavement shall be removed by the Contractor from the job site during the excavation process.
- B. Materials excavated shall be disposed of in a landfill approved by the Engineers.

1.08 EROSION CONTROL AND PREVENTION OF STREAM POLLUTION

- A. The Contractor shall control soil erosion and prevent pollution of streams, storm drains, and watercourses by means of installing silt fences, silt barriers and sediment pools or other means which can be required by the Engineers, state, local or federal agencies involved. The Contractor shall comply with the Owner's Stormwater Permit and Title 33 of the CFR Part 330, Appendix A regarding erosion control and the protection of floodplains and wetlands.
- B. The Contractor shall comply with all applicable local, State, and Federal codes and Agencies in controlling erosion and preventing stream pollution.

PART 2 PRODUCTS

2.01 PIPE BEDDING, BACKFILL AND FOUNDATION BACKFILL

- A. Pipe trench backfill for ductile iron pipe shall adhere to Type 2 laying condition, as per AWWA C150, with four (4) inches loose bedding material.
- B. Pipe Bedding
 - 1. Native soil excavated from the trench, free of rocks, foreign materials, and frozen earth.
- C. Pipe Zone Backfill
 - 1. Native soil material free from rocks, foreign material, and frozen earth, lightly consolidated to top of pipe.
 - 2. Topsoil is not acceptable as pipe zone backfill.
 - 3. Imported material will only be required where native material is inadequate.
- D. Pipe Cover
 - 1. Native soil material free from rocks, foreign material, and frozen earth, compacted as necessary to prevent settlement and erosion.

2.02 STRUCTURE FOUNDATION

- A. Structure Bedding
 - 1. Crushed limestone or crushed dolomite meeting or exceeding minimum standards for gradation of the AHD #57.
 - 2. Crushed limestone or crushed dolomite shall meet or exceed the minimum standards for deleterious substances as follows:

EARTHWORK

Maximum Allowable Percentage by Weight

a.	Coal and lignite	0.25%
b.	Clay lumps	0.25%
c.	Material passing #200 sieve	1.00%
d.	Thin or elongated pieces	1.00%
e.	Other deleterious material	2.00%
f.	Maximum total of a,b,c, and e	6.00%

3. Crushed limestone or crushed dolomite shall be free of foreign material when placed in pipe trench.

B. Structure Foundation Backfill

1. Crushed limestone or crushed dolomite meeting or exceeding minimum standards for gradation of the AHD #1 for conditions of excessive undercutting rock or soil.
2. Spoil rock or blasted rock from quarry in sized (4) four inches to four (4) feet for conditions of sinkholes or voids filled with soupy saturated materials.
3. Type of materials and mixtures of various sized materials shall be as directed by the Engineers.

2.03 EARTH BACKFILL

- A. Backfill shall be earth of such gradation and moisture content that the soil will compact to the specified density and remain stable.
- B. Suitable backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols

Typical Names

GW.....Well-graded gravel and gravel-sand mixtures, little or no fines

GP.....Poorly graded gravel and gravel-sand mixtures, little or no fines

<u>Group Symbols</u>	<u>Typical Names</u>
GM.....	Silty gravel, gravel-sand-clay mixtures
GC.....	Clayey gravel, gravel-sand-clay mixtures
SW.....	Well-graded sand and gravelly sands, little or no fines
SP.....	Poorly graded sands and gravelly sands, little or no fines
SM.....	Silty sands, sand-silt mixtures
SC.....	Clayey sands, sand-clay mixtures
ML.....	Inorganic silts, very fine sands, rock floor, silty or layey fine sands.
CL.....	Inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, Lean clays

- C. Materials which are unsuitable for backfill include rocks greater than two (2) inches in their largest dimension, and pavement spoil, rubbish, construction debris, wood, metal, plastics, and the following soils, classified by the Unified Soil Classified System, ASTM D-2487:

<u>Group Symbols</u>	<u>Typical Names</u>
OL.....	Organic silts and organic silty clays of low plasticity
MH.....	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH.....	Inorganic clays of high plasticity, fat clays
OH.....	Organic clays of medium to high plasticity
PT.....	Peat, muck, and other highly organic soils

PART 3 EXECUTION

3.01 EXISTING STRUCTURES, PIPING, AND WIRING

- A. All poles, fences, sewer, gas, water, or other pipes, cables, wires, conduits, and manholes, buildings, and structures shall be supported and protected from injury by the Contractor.

EARTHWORK

- B. The Contractor shall proceed with caution during excavation so the exact location of underground utilities and structures, both known and unknown, may be determined. The Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.
- C. Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of underground structures, the Contractor shall make exploration and excavations for such purpose.
- D. Wherever sewer, gas, water, or other pipes or conduits cross the excavation, the Contractor shall support said pipes and conduits without damage to them and without interrupting this Contract. The manner of supporting such pipes and conduits shall be subject to the approval of the Engineer.
- E. When utility lines that have to be removed or relocated are encountered within the areas of operations, the Contractor shall notify the Utility Company in ample time for the necessary measure to be taken to prevent interruption of the service.
- F. The Contractor shall conduct the Work in such a way that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the Work, unless he shall have first obtained the property owner's written consent thereto and shall have shown said written consent to the Engineer.
- G. All excavated material shall be piled in a manner that will avoid obstructing walkways and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility drainage ways shall be kept clear or other satisfactory provisions made for drainage.

3.02 CLEARING

- A. Clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site.
- B. Do not remove or damage trees that do not interfere with the finished Work. Completely remove trees required to be removed, including stumps and roots. Properly treat damaged trees which can be saved.

3.03 STRIPPING AND STOCKPILING OF TOPSOIL

- A. Strip topsoil and vegetation from the excavated areas. Stockpile clean topsoil in location designated by the Engineer.
- B. Do not intermix grass, weeds, roots, root mat, brush, and stones larger than one (1) inches with stockpiled topsoil.

3.04 DEWATERING

- A. Provide sufficient dewatering equipment and make proper arrangements for the disposal of water from dewatering operation. Dewatering shall not damage property, create nuisances, or interfere with other Work. Do not use sanitary sewers for the disposal of water from dewatering operations.

3.05 EXCAVATING

- A. Make excavations to elevations and dimensions necessary to permit erection of forms and inspection of foundation and to install piping. Completely remove unsuitable material.
- B. Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees in excavation Work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.
- C. Contractor shall be responsible for the determination of the angle of repose of the soil in which the excavating is to be done. Excavate all slopes to at least the angle of response except for areas where solid rock allows for line drilling or pre-splitting.
- D. It is the Contractor's responsibility to control the Work such that sides, slopes, and faces of all excavations shall meet accepted OSHA requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes, which may be adversely affected by weather or moisture content.
- E. The Contractor should flatten the excavation sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.
- F. The Contractor should shore or otherwise support sides of excavations in hard or compact soil in compliance with all OSHA, State, and local safety codes.
- G. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from excavation.
- H. The Contractor shall provide protection against slides and cave-ins, as required by OSHA, State and local codes.
- I. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized adjacent to excavations.

EARTHWORK

- J. The limits of excavation for structures shall be the external dimensions of the structure plus the space necessary for the construction and removal of the forms and construction of masonry Work.
- K. The width of trenches for pipe shall provide a clearance as required by OSHA, State and local codes.
- L. The Contractor is reminded to test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible.
- M. The Contractor is reminded to provide ladders where employees are required to be in excavations as required by OSHA, State and local codes.
- N. The Contractor is reminded to provide adequate barriers and physically protect excavations. Barricade or cover all wells, pits, shafts, and similar excavations. Backfill temporary wells, shafts, and similar excavations upon completion of exploration and similar operations.

3.06 SHEETING

- A. The Contractor has the option of sheeting excavations.
- B. Supporting system, such as piling, cribbing, shoring, and bracing, shall be designed by a qualified Contractor's representative and meet accepted OSHA requirements.
- C. Materials used for sheeting, sheet piling, cribbing, bracing, shoring, and underpinning should be in good, serviceable conditions. Timbers should be sound, free from large or loose knots, and of proper dimensions.
- D. Brace the side of the excavation as necessary to resist the extra pressure due to superimposed loads.
- E. Provide shoring, bracing, or underpinning as necessary to ensure the safety of adjoining buildings or walls. Such shoring, bracing or underpinning shall be inspected daily or more often, as conditions warrant, by a competent contractor's representative and the protection effectively maintained.
- F. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for all damage to persons or property resulting from the improper quality, strength, placing, maintaining, or removing of the same. This includes damage to trees, sidewalks, and to other property on the project site, as well as on private grounds.
- G. Drive sheeting ahead of excavation. Do not remove sheeting until the excavation backfill has reached within two (2) feet of the top of the excavation, except that the lower course of sheeting may be removed from a double sheeted excavation. When sheeting is drawn, completely fill all cavities remaining in or adjoining the

excavation. When sheeting is left in place, completely fill all cavities behind such sheeting.

3.07 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

- A. Suitable excavated material required for filling and backfilling operations may be stockpiled on the job site.
- B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as excavations are back-filled. Dispose of excess excavated material in a suitable, approved location.

3.08 SUBGRADE

- A. Compact the existing disturbed earth below subgrades which will support structures. Compact existing earth with a vibratory compactor, and maintain moisture content within + or - two (2%) percent of optimum moisture content during compaction. Compact existing earth to not less than ninety-five (95%) percent of the Modified Proctor Density, as determined by ASTM D1557.
- B. Do not construct foundations, footings, slabs, or piping on loose soil, mud, or other unsuitable soil.
- C. Fill excess cuts under foundations, footings, and slabs with structure foundation backfill.
- D. Fill excess cuts under piping with compacted pipe foundation bedding.

3.09 TEMPORARY PLUGS

- A. Prevent foreign matter from entering pipe while it is being installed.
- B. Do not place debris tools, clothing, or other material in this pipe.
- C. Close the open ends of pipe by watertight plugs when pipe laying is not in progress.
- D. Remove any earth or other material that enters pipe, lateral pipe, or appurtenances through any open end.
- E. Remove earth and other materials at no additional cost to the Owner.

3.10 BACKFILLING EXCAVATIONS UNDER PAVEMENTS, FOUNDATIONS, AND STRUCTURES

- A. Contractor shall employ an independent testing laboratory to perform field density tests to ensure proper compaction.

- B. Remove debris and other unsuitable materials from excavations before backfilling is started.
- C. Backfill excavations in areas to be paved with pipe bedding material. Place pipe bedding material in layers six (6) inches loose thickness. Compact each lift of backfill to not less than ninety-eight (98%) percent of the maximum dry density as determined in accordance with AASHTO T99, Method A (Std. Proctor). Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavation by approved rollers.
- D. Backfill excavations and fill beneath footings or structures with pipe bedding material. Backfill directly over and around structures with pipe bedding material. Place backfill in lifts no greater than six (6) inches in loose depth. Backfill and fill shall be within + or - two (2%) percent optimum moisture content. Compact backfill and fill to not less than ninety-eight (98%) percent of the Modified Proctor Density, as determined by ASTM D1557.
- E. Provide additional material, if required, to complete backfill and fill. Additional backfill and fill material shall be provided at no additional cost to the Owner.
- F. Do not use the following materials for backfill:
 - 1. Unsuitable materials
 - 2. Materials which are too wet or too dry to be compacted to the densities specified in this Article.
- G. Do not place fill over wet or muddy subgrade.
- H. Place backfill and fill in a manner which will not overload foundations or structures. Place backfill and fill evenly on all sides of foundations and structures. Do not use equipment that will overload foundations or structures during filling or backfilling.
- I. Do all cutting, filling, and grading necessary to bring the entire area around foundations and outside of structures to the following subgrade levels:
 - 1. To finished grade for areas not to be paved with drives or walks.

3.11 BACKFILLING PIPING TRENCHES

- A. Do not backfill trenches and excavations until all utilities have been inspected by the Engineer and until all underground utilities and piping systems are installed in accordance with the requirements of the Specifications and the Drawings.
- B. Place and tamp bedding and backfill in a manner which will not damage pipe coating, wrapping, or encasement.

- C. Bedding procedures shall be as specified in the Section for the applicable pipe material.
- D. Place pipe backfill material in eight (8) inch layers from the top of bedding to depths as required for particular application. Compact pipe backfill material to the density required to allow backfill material over the pipe to be compacted to the density specified in this Article.
- E. Do not use the following materials for backfill:
 - 1. Unsuitable materials
 - 2. Materials which are too wet or dry to be compacted to the densities specified in this Article.
- F. Do not place fill over wet or muddy subgrade.
- G. Backfill trenches across paved roadways with pipe bedding material, compacting each lift to ninety-eight (98%) percent of the Modified Proctor Density. Backfill trenches across gravel roadways, driveways, utility crossings, and along driveways with pipe bedding material. Compact each lift of backfill to equivalent of not less than ninety (90%) percent of the Modified Proctor Density. Place backfill in six (6) inch loose lifts. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling.
- H. Backfill trenches not requiring pipe bedding material with suitable pipe cover material as required by the Engineers. Place and compact backfill to produce an adequate foundation for seeding. The top twelve (12) inches of backfill shall not contain stones or other objects larger than one (1) inch in maximum dimension. Mound backfill above finish grade to allow for settlement. Fill and restore any settlement of the backfill. Grade area to be restored to finish grade after settlement of backfill.

3.12 CLEANUP AND MAINTENANCE

- A. Cleanup the job site as backfilling is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure, components and appurtenances. Restore items moved, damaged, or destroyed during construction.
- B. Maintain the job site until the Work has been completed and accepted. Fill excavations, which settle when settlement is visible. Restore items damaged by construction or improper restoration.
- C. Control soil erosion, stream and drain pollution resulting from silt or soil runoff or any material from construction operations. Use silt fences, silt barriers and

EARTHWORK

sedimentation pools as required. Submit plan to control soil erosion, stream and drain pollution before clearing site.

END OF SECTION

**SECTION 02260
EROSION AND SEDIMENT CONTROL**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide protection of the environment during the construction of this project to reduce soil erosion and siltation to the lowest reasonably achievable level.

1.02 GENERAL

- A. Exercise every reasonable precaution, throughout the life of the project, to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces, or other property. Erosion control practices to be used for this project are shown on the drawings and are to conform to "Florida Erosion and Sediment Control Manual"
- B. Div. 1 Contractor has overall responsibility of installation and maintenance of all erosion and sediment control and shall coordinate with Div. 2 and Div. 3 Contractors.

PART 2 PRODUCTS

2.01 GRASSING

- A. Comply with Section 02101 - Civil Sitework.

2.02 SILT FENCE

- A. All posts to be self-fastener angle steel, 5' in length.
 - 1. Wooden posts are not acceptable.
- B. Woven wire shall conform to the requirements of ASTM A 116, Class I zinc coating for wire. Each woven square shall measure 6" x 6". The top and bottom wires shall be 10 gauge. All other wires shall be 12-1/2 gauge.
 - 1. Securely attach woven wire to posts with wire ties.
- C. Provide filter fabric meeting the requirements of the Manual for Erosion and Sediment Control in Florida, Latest Edition, complying with the most current edition of the FDOT Standard Specifications Construction of Transportation Systems and appearing on the FDOT Qualified Products List.
 - 1. Limit splices in filter fabric using continuous rolls whenever possible.

EROSION AND SEDIMENT CONTROL

2. Whenever splices are necessary a minimum overlap of 18" is required and all splices must occur at a post so that the integrity of the fence is not compromised.
 3. Securely attach filter fabric to top of woven wire and at posts with wire ties.
- C. Silt fences should be continuous and transverse to the flow. The silt fence should follow the contours of the site as closely as possible. Place the fence such that the water cannot runoff around the end of the fence.

2.03 OTHER MATERIAL

- A. Provide other material such as rock, rip-rap or erosion control matting as required to stabilize the site or meet the requirements as shown on the Drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. Construct and maintain all erosion control measures until the substantial completion of the project.

3.02 TEMPORARY GRASSING

- A. Provide a temporary cover for erosion control on disturbed areas that will remain unstabilized for a period of more than 14 days in accordance with Section 02101.
- B. This practice applies to cleared areas, diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles where vegetation is needed for less than 1 year.
- C. Provide grassing on slope 5% or greater within 14 days of disturbance. Comply with Section 02930.

3.03 SILT FENCE

- A. Provide silt fence barrier where shown on the plans and on utility construction parallel to the disturbed trench where perpendicular sheet flow runoff occurs on disturbed areas with slopes greater than 4%.
- B. Place at the limits shown on the plans.
- C. Construct temporary sediment barriers of filter fabric, buried at the bottom, stretched and supported by posts and install below small disturbed areas as

EROSION AND SEDIMENT CONTROL

indicated on the drawings to retain sediment by reducing the flow velocity to allow sediment deposition.

- D. Space posts as indicated on the drawings.
- E. Remove sediment deposits prior to reaching one-half height of the fence.
- F. Monitor site frequently and place additional silt fencing should evidence indicate that erosion is about to occur at locations other than those shown on plan.

3.04 MAINTENANCE

- A. Place all erosion control devices or measures prior to any land disturbing activity within the drainage area they are located.
- B. Inspect erosion control devices and clean or otherwise remove silt buildup as necessary once a week or 24-hours following a rain event of ≥ 0.1 ".

3.05 REMOVAL

- A. Remove temporary structures after protected areas have been stabilized.

3.06 SAMPLING

- A. Sample for NTU before and after construction starts as described on the Drawings. All sample cost included in Contractors Bid.

END OF SECTION

EROSION AND SEDIMENT CONTROL

**SECTION 02930
GRASSING, SOD, AND SPRIGS**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide grassing, sod, and sprigs for the sprayfield, furnishing all labor, materials and equipment necessary for a complete and proper installation.

1.02 SUMMARY

- A. Section Includes:
 - 1. Hydroseeding.
 - 2. Sodding.
 - 3. Sprigging.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- C. Certification of Sod: From sod vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the grower name, year of production and date of packaging.
- D. Qualification Data: For qualified landscape Installer.
- E. Sod Producer: Company specializing in sod production and harvesting with a minimum 5 years' experience and certified by the State of Alabama, Florida or Georgia.
- F. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

- G. Soil Analysis: For stockpiled and imported topsoil, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant- nutrient content of the soil.
1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
 2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. Representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
 3. Report suitability of tested soil for turf growth.
 - a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable turf.
 - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
- H. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.
- C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

1.05 PROJECT CONDITIONS

- A. Planting Restrictions: Coordinate installation of seed, sod and sprigs during normal planting seasons for each type of plant material required.
 1. If site is not completed in time to permit planting and establishment of permanent grass cover during the normal planting season, contractor will be required to plant a temporary cover of winter rye.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.06 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until Final Completion of project.

1.07 WARRANTY

- A. It is the responsibility of the Contractor to make known any site conditions which may be harmful or growth inhibiting to the plant materials specified, prior to acceptance or installation of said materials.
- B. Special Warranty: Installer agrees to repair or replace turf and accessories that fail in materials, workmanship, or growth within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner during 12-month warranty period, or incidents that are beyond Contractor's control. Warranty shall cover any plant loss due to weather damage to plants installed out of normal planting season.
 2. Warranty Periods from Date of Substantial Completion :

- a. Seed, Hydroseed, and New Sod: 12 months.

PART 2 PRODUCTS

2.01 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: State-certified seed of grass species as follows:
 1. Celebration Bermuda - hulled

2.02 TURFGRASS SOD

- A. Turfgrass Sod: ASPA Certified, approve nursery grown grade; cultivated grass sod. Furnish viable sod of uniform density, color, and texture, with strong fibrous root system, free of stones, burned or bare spots, disease, nematodes, soil borne insects and containing no more than 5 weeds per 1000 sq. ft.
- B. Provide sod big rolls for sprayfields. Machine install for uniformity and minimization of joints. Maximum 5% deviation in width. Broken rolls or rolls with uneven ends will not be acceptable. Sod incapable of supporting its own weight when suspended vertically with a firm grasp will be rejected.
 1. Celebration Bermuda.

2.03 SPRIGS

- A. Sod Sprigs: Healthy living stems, rhizomes, or stolons with a minimum of two nodes and attached roots free of soil, of the following turfgrass species:
 1. Celebration Bermuda.

2.04 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
 2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum

GRASSING, SOD AND SPRIGS

of 10 percent passing through No. 40 sieve.

- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.05 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.06 FERTILIZERS

- A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.07 MULCHES

- A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- B. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- C. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable

levels to attain the required results.

4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.02 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 TURF AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 16 inches with chisel plows. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Apply superphosphate fertilizer directly to subgrade before loosening.
 2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 3. Spread planting soil to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.

- C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply superphosphate fertilizer directly to surface soil before loosening.
 3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.04 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
 2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
 3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.05 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

- B. Machine lay sod big rolls on sprayfields.
- C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across angle of slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- D. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.06 SPRIGGING

- A. Plant freshly shredded sod sprigs in furrows 1-1/2 to 2 inches deep. Place individual sprigs with roots and portions of stem in moistened soil, 12 inches apart in rows 18 inches apart, and fill furrows without covering growing tips. Lightly roll and firm soil around sprigs after planting.

3.07 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

GRASSING, SOD AND SPRIGS

- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. Mow bermudagrass to a height of 1-1/2 inches.
- D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.08 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.
- C. Wastewater application at the design rate can begin only when a uniform vegetative cover has been established.

3.09 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect

GRASSING, SOD AND SPRIGS

newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

- C. Remove no degradable erosion-control measures after grass establishment period.

END OF SECTION

GRASSING, SOD AND SPRIGS

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
- B. Cast-in-Place Concrete includes the Following:
 - 1. Foundations and Footings
 - 2. Slabs-on-Grade
 - 3. Foundation Walls
 - 4. Framed Floors and Columns
 - 5. Equipment Pads and Bases
 - 6. Fill for Masonry
 - 7. Concrete on Metal Deck

1.03 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Engineer.
- C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special

CAST-IN-PLACE CONCRETE

reinforcing required for openings through concrete structures. Reproduction of contract drawings for use, as erection drawings will not be permitted.

- D. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
 - 1. Engineer's review is for general applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.
- E. Samples of materials as requested by Engineer, including names, sources, and descriptions.
- F. Laboratory test reports for concrete materials and mix design test.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings".
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete".
 - 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".
- B. Concrete Testing Service: Engage a testing agency acceptable to Engineer to perform material evaluation tests and to design concrete mixes.
- C. Materials and installed work may require testing and re-testing at any time during progress of Work. Tests, including re-testing of rejected materials for installed Work, shall be done at Contractor's expense.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

CAST-IN-PLACE CONCRETE

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners.
- D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.
- E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel stiffened to support weight of placed concrete without deformation.
- F. Carton Forms: Biodegradable paper surface, treated for moisture-resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- G. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- H. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches (38 mm) to the plane of the exposed concrete surface.
 1. Provide ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in the concrete surface.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.
- B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI Specifications.

CAST-IN-PLACE CONCRETE

1. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed to view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
1. Use one brand of cement throughout Project unless otherwise acceptable to Engineer.
- B. Fly Ash: ASTM C 618, Type F.
- C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
1. For exposed exterior surfaces, do not use fine or course aggregates that contain substances that cause spalling.
 2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Engineer.
- D. Water: Potable
- E. Fiber Reinforcement: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, not less than $\frac{3}{4}$ inch long.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Gilco Fibers, Cormix Construction Chemicals
 - b. Durafiber, Durafiber Corp.
 - c. Fiberstrand 100, Euclid Chemical Co.
 - d. Fibermesh, Fibermesh Co., Div. Synthetic Industries, Inc.
 - e. Forta, Forta Corp.
 - f. Grace Fibers, W.R. Grace & Co.
 - g. Polystrand, Metalcrete Industries
- F. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

CAST-IN-PLACE CONCRETE

- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
1. Add air-entraining admixture to all concrete at manufacturer's prescribed rate to achieve 4-6% air content at placement. Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Air-Tite, Cormix Construction Chemicals
 - b. Air-Mix or Perma-Air, Euclid Chemical Co.
 - c. Darex AEA or Daravair, W.R. Grace & Co.
 - d. MB-VR or Micro-Air, Master Builders, Inc.
 - e. Sealtight AEA, W.R. Meadows, Inc.
 - f. Sika AER, Sika Corp.
- H. Water-Reducing Admixture: ASTM C 494, Type A.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Chemtard, ChemMasters Corp.
 - b. PSI N, Cormix Construction Chemicals
 - c. Eucon WR-75, Euclid Chemical Co.
 - d. WRDA, W.R. Grace & Co.
 - e. Pozzolith Normal or Polyheed, Master Builders, Inc.
 - f. Metco W.R., Metalcrete Industries
 - g. Prokrete-N, Prokrete Industries
 - h. Plastocrete 161, Sika Corp.
- I. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Super P, Anti-Hydro Co., Inc.
 - b. Cormix 200, Cormix Construction Chemicals
 - c. Eucon 37, Euclid Chemical Co.
 - d. WRDA 19 or Daracem, W.R. Grace & Co.
 - e. Rheobuild or Polyheed, Master Builders, Inc.
 - f. Superslump, Metalcrete Industries
 - g. PSPL, Prokrete Industries
 - h. Sikament 300, Sika Corp.
- J. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

CAST-IN-PLACE CONCRETE

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Q-Set, Conspec Marketing & Manufacturing Co.
 - b. Lubricon NCA, Cormix Construction Chemicals
 - c. Accelguard 80, Euclid Chemical Co.
 - d. Daraset, W.R. Grace & Co.
 - e. Pozzutec 20, Master Builders, Inc.
 - f. Accel-Set, Metalcrete Industries

K. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. PSI-R Plus, Cormix Construction Chemicals
 - b. Eucon Retarder 75, Euclid Chemical Co.
 - c. Daratard-17, W.R. Grace & Co.
 - d. Pozzolith R, Master Builders, Inc.
 - e. Protard, Prokrete Industries
 - f. Plastiment, Sika Corporation

2.04 RELATED MATERIALS

- A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217 inch (0.46 mm) thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick (0.76 mm) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
- C. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.
- D. Rubber Waterstops: Corps of Engineers CRD-C 513.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. The Burke Co.
 - b. Progress Unlimited.
 - c. Williams Products, Inc.

CAST-IN-PLACE CONCRETE

- E. Polyvinyl Chloride Waterstops: CRD-C 572.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. The Burke Co.
 - b. Greenstreak Plastic Products Co.
 - c. W.R. Meadows, Inc.
 - d. Progress Unlimited
 - e. Schlegel Corp.
 - f. Vinylex Corp.
- F. Sand Cushion: Clean, manufactured or natural sand.
- G. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:
1. Polyethylene sheet not less than 8 mils (0.2 mm) thick.
 2. Water-resistant barrier consisting of heavy kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side.
 - a. Product: Subject to compliance with requirements, provide Moistop by Fortifiber Corporation.
- H. Vapor Barrier: Pre-molded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic antistick sheet. Water vapor transmission rate of 1 perm when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.
1. Product: Subject to compliance with requirements, provide Sealtight Pre-molded Membrane by W.R. Meadows, Inc.
- I. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing and unaffected by freezing, moisture, and cleaning materials.
- J. Colored Wear-Resistant Finish: Packaged dry combination of materials consisting of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground nonfading mineral oxides interground with cement. Color as selected by Architect from manufacture standards, unless otherwise indicated.

CAST-IN-PLACE CONCRETE

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Conshake 600 Colortone, Conspec Marketing & Mfg. Co.
 - b. Floorcron, Cormix Construction Chemicals
 - c. Quartz Tuff, Dayton-Superior
 - d. Surfex, Euclid Chemical Co.
 - e. Colorundum, A.C. Horn, Inc.
 - f. Quartz Plate, L&M Construction Chemicals, Inc.
 - g. Colorcron, Master Builders, Inc.
 - h. Floor Quartz, Metalcrete Industries
 - i. Lithochrome Color Hardener, L.M. Scofield Co.
 - j. Harcol Redi-Mix, Sonneborn-Chemrex
 - k. Hard Top, Symons Corporation

- K. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz/sq. yd. (305 g/sq. m), complying with AASHTO M 182, Class 2.

- L. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 1. Waterproof Paper
 2. Polyethylene Film
 3. Polyethylene-Coated Burlap

- M. Liquid Membrane-Forming Curing Compound: Liquid-type membrane forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq. ft/gal (4.9 sq. m/L).
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.
 - b. Spartan-Cote, The Burke Co.
 - c. Conspec #1, Conspec Marketing & Mfg. Co.
 - d. Sealco 309, Cormix Construction Chemicals
 - e. Day-Chem Cure and Seal, Dayton Superior Corporation
 - f. Eucocure, Euclid Chemical Co.
 - g. Horn Clear Seal, A.C. Horn, Inc.
 - h. L & M Cure R, L & M Construction Chemicals, Inc.
 - i. Masterkure, Master Builders, Inc.
 - j. CS-309, W.R. Meadows, Inc.
 - k. Seal-N-Kure, Metalcrete Industries

CAST-IN-PLACE CONCRETE

- l. Kure-N-Seal, Sonneborn Chemrex
 - m. Stontop CS2, Stonhard, Inc.
- N. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.
 1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
 2. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Highseal, Conspec Marketing and Mfg. Co.
 - b. Sealco - VOC, Cormix Construction Chemicals
 - c. Safe Cure and Seal, Dayton Superior Corp.
 - d. Aqua-Cure, Euclid Chemical Co.
 - e. Dress & Seal WB, L & M Construction Chemicals, Inc.
 - f. Masterkure 100W, Master Builders, Inc.
 - g. Vocomp-20, W.R. Meadows, Inc.
 - h. Metcure, Metalcrete Industries
 - i. Stontop CS1, Stonhard, Inc.
- O. Evaporation Control: Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Aquafilm, Conspec Marketing and Mfg. Co.
 - b. Eucobar, Euclid Chemical Co.
 - c. E-Con, L & M Construction Chemicals, Inc.
 - d. Confilm, Master Builders, Inc.
 - e. Waterhold, Metalcrete Industries
- P. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch (25 mm) thick to feathered edges.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. K-15, Ardex, Inc.
 - b. Self-Leveling Wear Topping, W.R. Bonsal Co.
 - c. Conflow, Conspec Marketing and Mfg. Co.
 - d. Corlevel, Cormix Construction Chemicals

CAST-IN-PLACE CONCRETE

- e. Level Layer II, Dayton Superior Corp.
- f. Flo-Top, Euclid Chemical Co.
- g. Gyp-Crete, Gyp-Crete Corp.
- h. Levelex, L & M Construction Chemicals, Inc.
- i. Underlayment 110, Master Builders, Inc.
- j. Stoncrete UL1, Stonhard, Inc.
- k. Concrete Top, Symons Corp.
- l. Thoro Underlayment Self-Leveling, Thoro System Products

Q. Bonding Agent: Polyvinyl acetate or acrylic base.

- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Aquafilm, Conspec Marketing and Mfg. Co.
 - b. Eucobar, Euclid Chemical Co.
 - c. E-Con, L & M Construction Chemicals, Inc.
 - d. Confilm, Master Builders, Inc.
 - e. Waterhold, Metalcrete Industries

R. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch (25 mm) thick to feathered edges.

- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. K-15, Ardex, Inc.
 - b. Self-Leveling Wear Topping, W.R. Bonsal Co.
 - c. Conflow, Conspec Marketing and Mfg. Co.
 - d. Corlevel, Cormix Construction Chemicals
 - e. Level Layer II, Dayton Superior Corp.
 - f. Flo-Top, Euclid Chemical Co.
 - g. Gyp-Crete, Gyp-Crete Corp.
 - h. Levelex, L & M Construction Chemicals, Inc.
 - i. Underlayment 110, Master Builders, Inc.
 - j. Stoncrete UL1, Stonhard, Inc.
 - k. Concrete Top, Symons Corp.
 - l. Thoro Underlayment Self-Leveling, Thoro System Products

S. Bonding Agent: Polyvinyl acetate or acrylic base.

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

CAST-IN-PLACE CONCRETE

- a. Polyvinyl Acetate (Interior Only):
 - 1. Superior Concrete Bonder, Dayton Superior Corp.
 - 2. Euco Weld, Euclid Chemical Co.
 - 3. Weld-Crete, Larsen Products Corp.
 - 4. Everweld, L & M Construction Chemicals, Inc.
 - 5. Herculox, Metalcrete Industries
 - 6. Ready Bond, Symons Corp.

- b. Acrylic or Styrene Butadiene:
 - 1. Acrylic Bondcrete, The Burke Co.
 - 2. Strongbond, Conspec Marketing and Mfg. Co.
 - 3. Day-Chem Ad Bond, Dayton Superior Corp.
 - 4. SBR Latex, Euclid Chemical Co.
 - 5. Daraweld C, W.R. Grace & Co.
 - 6. Hornweld, A.C. Horn, Inc.
 - 7. Everbond, L & M Construction Chemicals, Inc.
 - 8. Acryl-Set, Master Builders Inc.
 - 9. Intralok, W.R. Meadows, Inc.
 - 10. Acrylpave, Metalcrete Industries
 - 11. Sonocrete, Sonneborn-Chemrex
 - 12. Stonlock LB2, Stonhard, Inc.
 - 13. Strong Bond, Symons Corp.

- T. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

CAST-IN-PLACE CONCRETE

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Burke Epoxy M.V., The Burke Co.
 - b. Spec-Bond 100, Conspec Marketing and Mfg. Co.
 - c. Resi-Bond (J-58), Dayton Superior
 - d. Euco Epoxy System #452 or #620, Euclid Chemical Co.
 - e. Epoxitite Bonder 2390, A.C. Horn, Inc.
 - f. Epabond, L & M Construction Chemicals, Inc.
 - g. Concsive Standard Liquid, Master Builders, Inc.
 - h. Rezi-Weld 1000, W.R. Meadows, Inc.
 - i. Metco Hi-Mod Epoxy, Metalcrete Industries
 - j. Sikadur 32 Hi-Mod, Sika Corp.
 - k. Stonset LV5, Stonhard, Inc.
 - l. R-600 Series, Symons Corp.

2.05 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
 1. Do not use the same testing agency for field quality control testing.
 2. Limit use of fly ash to not exceed 25 percent of cement content by weight.
- B. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.
- C. Design mixes to provide normal weight concrete as scheduled.
- D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 1. Ramps, Slabs, and Sloping Surfaces: Not more than 3 inches (75 mm).
 2. Reinforced Foundation Systems: Not less than 2 inches (50 mm) and not more than 4 inches (100 mm).
 3. Concrete Containing High-Range Water-Reducing Admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2-3 inch (50 - 75 mm) slump concrete.
 4. Other Concrete: Not more than 4 inches (100 mm).

CAST-IN-PLACE CONCRETE

- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work.
- F. Fiber Reinforcement: Add at manufacturer's recommended rate but not less than 1.5 lb/cu. yd. (0.9 kg/cu. m).

2.06 ADMIXTURES

- A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
- B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
- C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
- D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to achieve 4-6% air content at point of placement.
- E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.07 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
 - 1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 GENERAL

Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.02 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
 - 1. Provide Class A tolerances for concrete surfaces exposed to view.
 - 2. Provide Class C tolerances for other concrete surfaces.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.03 VAPOR RETARDER/BARRIER INSTALLATION

CAST-IN-PLACE CONCRETE

- A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.
- B. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended mastic or pressure-sensitive tape.
 - 1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.04 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as specified.
 - 1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.05 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Engineer.
- B. Provide keyways at least 1-1/2 inches (38 mm) deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

CAST-IN-PLACE CONCRETE

- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.
- F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants".
- G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-fourth of slab depth of inserts 1/4 inch (6 mm) wide by one-fourth of slab depth, unless otherwise indicated.
 - 1. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 - 2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
 - 3. If joint pattern is not shown, provide joints not exceeding 15 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
 - 4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants".

3.06 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

CAST-IN-PLACE CONCRETE

- B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
- C. Install dovetail anchor slots in concrete structures as indicated on drawings.
- D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.07 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
 - 1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.08 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete", and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

CAST-IN-PLACE CONCRETE

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 3. Maintain reinforcing in proper position on chairs during concrete placement.
- F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water

CAST-IN-PLACE CONCRETE

equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineer.

3.09 FINISHING FORMED SURFACES

- A. **Rough-Formed Finish:** Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding $\frac{1}{4}$ inch (6 mm) in height rubbed down or chipped off.
- B. **Smooth-Formed Finish:** Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. **Smooth-Rubbed Finish:** Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.
 1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. **Grout-Cleaned Finish:** Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.
 1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts

CAST-IN-PLACE CONCRETE

determined by trial patches so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.
1. After placing slabs, finish surface to tolerances of F (F)15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as

CAST-IN-PLACE CONCRETE

trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.
 - 1. After completing float finishing and before starting trowel finish uniformly spread dampened nonslip aggregate at a rate of 25 lb per 100 sq. ft. (12 kg/10sq. m) of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.
 - 2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.
- G. Colored Wear-Resistant Finish: Apply a colored wear-resistant finish to monolithic slab surface indicated.
 - 1. Apply dry shake materials for the colored wear-resistant finish at a rate of 100 lb per 100 sq. ft. (49 kg/10 sq. m), unless a greater amount is recommended by material manufacturer.
 - 2. Cast a trial slab approximately 10 ft. (3 m) square to determine actual application rate, color, and finish, as acceptable to Engineer.
 - 3. Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dry shake material over the concrete surface, and embed by power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color, and embed by power floating.

CAST-IN-PLACE CONCRETE

4. After broadcasting and floating, apply a trowel finish as specified. Cure slab surface with a curing compound recommended by the dry shake material manufacturer. Apply the curing compound immediately after the final finishing.

3.11 CONCRETE FINISH SCHEDULE

	<u>Type Finish</u>
Interior Exposed Walls	Rubbed
Exterior Exposed Walls	Rubbed
Exterior Sidewalks and Drives	Broomed
Interior Exposed Floors	Steel Troweled with Sealer
Interior Covered Floors	Steel Troweled
Interior Beams and Columns	Rubbed
Interior Exposed Ceilings	Rubbed
Clearwell Top	Light Broomed
Other Surfaces	Rubbed, unless otherwise Directed by the Engineer

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

CAST-IN-PLACE CONCRETE

- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
- D. Provide moisture curing by the following methods:
 - 1. Keep concrete surface continuously wet by covering with water.
 - 2. Use continuous water-fog spray.
 - 3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch (100 mm) lap over adjacent absorptive covers.
- E. Provide moisture-retaining cover curing as follows:
 - 1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
 - 1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

CAST-IN-PLACE CONCRETE

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.14 SHORES AND SUPPORTS

- A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.
- B. Extend shoring from ground to roof for Structures four stories or less, unless otherwise permitted.

3.15 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.16 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Engineer.

3.17 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.

CAST-IN-PLACE CONCRETE

- B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh (1.2 mm) sieve, using only enough water as required for handling and placing.
1. Cut out honeycombs, rock pockets, voids over 1/4 inch (6 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch (25 mm). Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into

CAST-IN-PLACE CONCRETE

adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least $\frac{3}{4}$ inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes 1 inch (25 mm) or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- F. Perform structural repairs with prior approval of Engineer for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.18 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.
 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - a. Slump: ASTM C 143; one test at point of discharge for each truckload of each type of concrete; additional tests when concrete consistency seems to have changed.
 - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each truck load of each type of air-entrained concrete.
 - c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

CAST-IN-PLACE CONCRETE

- d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 - e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. (4 cu. m) plus additional sets for each 50 cu. yd. (38 cu. m) more than the first 25 cu. yd. (19 cu. m) of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
- 2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. When total quantity of a given class of concrete is less than 50 cu. yd. (38 cu. m), Engineer may waive strength testing if adequate evidence of satisfactory strength is provided.
 - 4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - 5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 Mpa).
- B. Test results will be reported in writing to Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28 day tests.
 - C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
 - D. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.19 CONCRETE FOR WATER HOLDING BASINS (Not including Clearwell)

A. Leakage Testing

1. Leakage testing shall be performed on each basin as soon as practicable.
2. Fill basin to full overflow level.
3. Basin is considered acceptable if:
 - a. There are no visible leakage or visible damp areas, and
 - b. The volume of leakage is less than one-tenth (1/10) of one (1%) percent of the tank volume in any twenty-four (24) hour period.
4. Prior to testing, if the structure has dried out, the water shall be left standing to allow for absorption.
5. Deficiencies shall be corrected and testing repeated until satisfactory results are achieved.

B. Disinfection

1. The contractor shall disinfect according to the following Methods (Section 4.3) of AWWA C652.
 - a. Method No. 1

Have the tank one half to three fourths full of water, so that after addition of hypochlorite, completion of the filling operation will evenly mix the chlorine with water in the tank.

Add twelve (12) pounds of HTH or 10 gallons of sodium hypochlorite (10%) for each 20,000 gallons of water that the tank will hold. Example: for a 75,000 gallon tank, add 45 pounds of HTH or Perchloron or 37.5 gallons of sodium hypochlorite to about ten gallons of water and pour the concentrated hypochlorite solution into the tank.

Completely fill the tank.

Permit the tank to stand 24 hours if possible but for not less than 6 hours.

Pump or drain the strong chlorinated water to waste.

CAST-IN-PLACE CONCRETE

Refill the reservoir or tank after the chlorinated water is removed and collect samples for submission to the laboratory for bacteriological examination.

b. Method No. 2

Wash down all surfaces thoroughly and spray the bottom, sidewalls and top with a HYPOCHLORITE solution containing at least 200 ppm of chlorine prior to filling and collecting samples.

c. Method No. 3

This disinfection system is commonly known as the "Short Dump Method" and may be utilized by experienced personnel to minimize water loss and eliminate the discharge of highly chlorinated water to the environment. Water and chlorine shall be added to the storage facility in amounts such that the solution will initially contain 50 mg/L available chlorine and will fill approximately 5 percent of the total storage volume. This solution shall be held in the storage facility for a period of not less than 6 hours. The storage facility shall then be filled to the overflow level by flowing potable water into the highly chlorinated water. It shall be held full for a period of not less than 24 hours. All highly chlorinated water shall then be purged from the drain piping. Following this procedure, and subject to satisfactory bacteriological testing and acceptable aesthetic quality, the remaining water may be delivered to the distribution system.

END OF SECTION

CAST-IN-PLACE CONCRETE

**SECTION 11310
SUBMERSIBLE GRINDER PUMPS**

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. These specifications direct attention to certain features of the pumps, but do not purport to cover all the details of design. The equipment furnished shall be designed, constructed, and erected in conformity with accepted high quality standards. The CONTRACTOR shall furnish and install the following:
1. Two (2) new submersible grinder pumps.

1.2 SUBMITTALS

- A. The CONTRACTOR shall submit the following:
- B. Detailed shop drawings for all equipment and where applicable, color and finish of each.
- C. Submission of certified shop and erection drawings and data regarding pump and motor characteristics and performance. The data shall include performance curves based on actual shop tests of pumping units which show that the units meet the specified requirements for head, capacity, efficiency, and horsepower for the various capacities specified. Except as hereinafter specified, certified tests of mechanically duplicate units will be acceptable. Curves shall be submitted on 8½" by 11" sheets. For units of the same size and type, only curves for a single unit need be provided; however, serial numbers for the multiple units shall be listed on the curve sheet. Shop drawings for accessory equipment shall also be submitted.
1. Foundations, installation, and grouting.
 2. Services of the manufacturer's representative.
 3. Operating and maintenance instructions and parts lists.
 4. Lubricants.
 5. Special tools.
 6. Bolts, anchor bolts and nuts.
 7. Electric motors.

8. Voltage rating of motors.
9. Equipment drive guards.
10. Nameplates.
11. Capacitors for motors.

1.3 REFERENCE STANDARDS

A. The chemical and physical properties of all materials and the design, performance characteristics, and methods of construction of all items of equipment shall be in accordance with the requirements of the latest issue of the various applicable Standard Specifications. These Standard Specifications have been prepared by authorities who are recognized by the Mechanical Trades. The names of these authorities are listed below together with the abbreviation of their names as they may appear in these Specifications:

1. American National Standards Institute (ANSI)
2. American Water Works Association (AWWA)
3. American Society for Testing and Materials (ASTM)
4. National Fire Protection Association (NFPA)
5. National Association of Fan Manufacturers (NAFM)
6. American Society of Mechanical Engineers (ASME)
7. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

1.4 QUALITY ASSURANCE

- A. Referenced manufacturers are WILO, Keen, Barnes.
- B. Standards, codes, rules, and regulations as established and listed herein, as amended, latest edition, govern the work.
- C. Factory Pump Tests
 1. The CONTRACTOR shall furnish sworn certificates to the effect that the pump casings have passed the hydrostatic pressure tests.
 2. Pump tests shall be conducted on the submersible pump. During each test, the pump shall be run at all specified head conditions for a sufficient time to permit accurate determination of discharge, head, and power

SUBMERSIBLE GRINDER PUMPS

input. Certified copies of the test data shall be furnished to the Engineer for review. All tests shall be run in accordance with the Standards of the Hydraulic Institute.

- D. Motor Tests: The motor shall be given the standard commercial tests in the shop of the motor manufacturer, and certified copies of the tests results submitted to the Engineer for review prior to installation of the motor.
- E. Field Acceptance Tests
1. After installation of the pump equipment, and after inspection, operation, testing, and adjustment have been accomplished by the manufacturer's representative, the pump shall be given a running test in the presence of the Engineer and Owner during which it shall determine its ability to operate without vibration or overheating, and to deliver its rated capacity. During the tests, observations shall be made of head, capacity, and motor input. All defects or defective equipment revealed by or noted during the tests shall be corrected or replaced promptly at the expense of the CONTRACTOR and, if necessary, the tests shall be repeated until results acceptable to the Engineer are obtained. The CONTRACTOR shall furnish all labor, piping, equipment, and materials necessary for conducting the tests.
 2. All adjustments necessary to place the equipment in satisfactory working order shall be made at the time of the above tests.
 3. If sufficient process water is NOT available for the test, the CONTRACTOR shall provide water for testing, if so directed.
 4. In the event that the CONTRACTOR is unable to demonstrate to the satisfaction of the Engineer and Owner that the unit will satisfactorily perform the service required and that it will operate free from vibration and heating, the pumping units may be rejected. The CONTRACTOR shall then remove and replace the equipment at his own expense.
 5. The field verification and/or drawdown tests shall include measuring or determining the following items:
 - a. Flow rate.
 - b. Total head on the pump.
 - c. Power input.
 - d. Static head on the pump.

SUBMERSIBLE GRINDER PUMPS

6. Field Testing: All field measurements for pump rate shall be made within + 0.01 feet. Readings on all instruments shall be made at 2-minute intervals and shall be averaged to calculate the power draw of the motor, the actual flow pumped, and the static and total dynamic head on the pumps.

1.5 WARRANTY

- A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SEWAGE PUMP

- A. Influent Pumps: Furnish and install submersible non-clog influent wastewater pumps meeting the following requirements.
 1. Number of Pumps: 2
 2. Pump Size discharge: 2.0-inches (horizontal configuration)
 3. Duty Point Flow (gallons per minute): 35 GPM
 4. Shutoff Head: 110 FT
 5. Total dynamic head at rating point (T.D.H): 65 FT TDH
 6. Minimum Pump Efficiency at Primary Point: 35%
 7. Maximum Motor Horsepower (nameplate): 3 HP
 8. Characteristics of Electric Motor: 208V, 3phase, 60 Hz
 9. Maximum motor speed: 3450 RPM
 10. Maximum number of starts per hour (or unlimited on VFD): 15 min

SUBMERSIBLE GRINDER PUMPS

11. Motor Service Factor: 1.0
12. Inverter Duty Rated: No
13. Type of Installation: Wet-Pit Submersible Grinder
14. Material Pumped: Raw Wastewater

2.2 PUMP DESIGN

- A. The pumps shall be capable of handling typical plant wastewater materials without clogging. The discharge base and elbow shall be permanently installed in the wet well and connected to the discharge piping. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. The sliding guide bracket shall be a separate part of the pumping unit, capable of being attached to standard ANSI or DIN pump flanges so that the base is interchangeable with other pumps and not limited to a specific pump. Non-standard flange dimensions shall not be considered acceptable. No portion of the pump shall bear directly on the floor of the sump. The pump, with its appurtenances and electric cables, shall be capable of continuous submergence to a depth of 30 feet.

2.3 PUMP CONSTRUCTION

- A. Major pump components shall be of gray cast iron, ASTM A-48, Class 35, with smooth surfaces devoid of porosity or other irregularities. All exposed nuts and bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumped media (other than the stainless steel components) shall be protected by a factory applied spray coating of modified vinyl-zinc primer with a modified polyester resin finish on the exterior of the pump.
- B. Sealing design for the pump/motor assembly shall incorporate metal to metal contact between machined surfaces. Critical mating surfaces where a watertight seal is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without requiring a specific torque limit. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered adequate or equal. No secondary sealing compounds shall be used.
- C. The impeller shall be ASTM® A536 ductile cast iron. ASTM® A48 gray cast iron shall be unacceptable. The design shall be one-piece, 10-vane, vortex flow and dynamically balanced to ISO 1940 G6.3. The impeller shall be designed with pump out vanes on the back shroud of the pump impeller to prevent the pump

SUBMERSIBLE GRINDER PUMPS

media from entering the outboard seal cavity. The impeller shall be threaded to the pump shaft. All wetted fasteners shall be of a corrosion resistant 316L stainless steel material. The mass moment of inertia calculations shall be provided by the pump manufacturer upon request.

- D. The grinder assembly shall consist of a single rotating grinding cutter and stationary grinding ring secured to the inlet of the volute case. The rotating grinding cutter shall be threaded onto the pump shaft and secured with a washer and bolt. The stationary grinding ring shall be secured in place with a metal clamping ring. Both the stationary and rotating grinding mechanisms shall be removable without disassembling the pump. No adjustment or shimming grinder assembly shall be necessary. The grinder components shall be constructed of a martensitic AISI 440C stainless steel hardened to 56-60C Rockwell. The grinder mechanism shall be capable of producing 17,250 cuts/second.
- E. The pump volute shall be ASTM® A48 class 35 gray cast iron. Design shall be a single piece and a modified constant velocity. Constructed of smooth passage ways large enough that any macerated solid can enter the impeller. The discharge is to be of a vertical al centerline configuration. The discharge is to be 1-1/2" or 2" ANSI® standard Class 125, 4-bolt configuration.
- F. The rotating assembly (impeller, shaft, and rotor) shall be dynamically balanced such that undue vibration or other unsatisfactory characteristics will not result when the pump is in operation.
- G. The pump shaft and motor shaft shall be an integral unit. Each shaft shall be of 420 stainless steel material and adequately designed to meet the maximum torque required at any normal start-up condition or operating point in the system. Maximum deflection shall not exceed 0.002 inch at the lower seal. The pump shaft shall have a polished finish and have accurately machined shoulders to accommodate bearings, seals, and impeller. Carbon steel or chrome plated shafts shall not be considered adequate or equal.
- H. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two independent shaft seal assemblies. Seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the seal faces at a constant rate. Inboard and outboard seal construction shall be of the following material:
 - 1. Primary stationary ring shall be constructed of silicon carbide face material.
 - 2. Primary rotating ring shall be constructed of silicon carbide face material.
 - 3. Elastomers shall be constructed of Viton® materials.
 - 4. Metal components shall be constructed of stainless steel for corrosion resistance.

The inboard shall be hydro-dynamically lubricated and operated in a sealed oil reservoir. The inboard seal chamber seal shall be designed and constructed to

SUBMERSIBLE GRINDER PUMPS

prevent lubricant over-filling and provide adequate lubricant expansion to avoid over-pressuring of the seal. The pump shall be capable of operating in the clockwise or counter clockwise direction without damaging the seal faces. The pump shall be capable of operating in a dry environment without damage to the seal faces. Class 1, Division 1, explosion-proof models shall contain an additional line bearing seal constructed of bronze, CDA836 material, and is mounted in the lower seal housing. The line bearing seal will minimize shaft deflection and serve as the flame path for the motor assembly. The seals shall not depend upon direction of rotation for sealing.

- I. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.
- J. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.
- K. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.
- L. The pump shaft shall rotate on permanently lubricated, greased bearings. The upper bearing shall be a cylindrical roller bearing. The lower bearings shall consist of a minimum of two (2) flush ground, heavy duty angular contact ball bearing mounted in tandem. Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection. The bearings shall be designed to deliver a minimum L-10 bearing life of 100,000 hours when operation is within the limitations of the manufacturer's performance curve. The bearings shall be lubricated in oil and will not require maintenance as described in ANSI/HI 1.4-2010.

2.4 MOTOR

- A. The motor housing shall be gray cast iron, ASTM A48, Class 35, and motor stator and rotor shall be of an induction type, NEMA® L (Single-Phase) or NEMA® B (Three-Phase) squirrel cage design. The stator is to be press-fit in watertight, oil-filled, TENV chamber to provide the maximum heat dissipation. The armature assembly of the motor must meet or exceed the balance specification as defined in ISO 1940 G2.5.

SUBMERSIBLE GRINDER PUMPS

- B. Stator housing shall be filled with clean, high dielectric oil that lubricates bearings and seals, transferring heat from windings and rotor to the outer cast housing. The motor shall be capable of continuous submerged operation underwater to a depth of 30 feet. NOTE REQUIREMENT: Non-overloading motor on entire pump curve. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing is unacceptable. The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be designed for continuous duty, handling pumped media of 40° C (104° F) and capable of handling up to 30 evenly spaced starts per hour. The service factor (as defined by NEMA) shall be a minimum of 1.15. The motor shall have a voltage tolerance of +/- 10% from nominal. A performance chart shall be provided upon request showing curves for torque, current, power factor, input KW, output HP, and efficiency. This chart shall also include data on starting and no-load characteristics.
- C. The rotor bars and short circuit rings shall be made of cast aluminum. The motor shall be designed for continuous duty, completely submerged. The motor shall be explosion-proof and shall be FM approved for use in NEC Class I, Division I, Groups C & D hazardous locations. Where indicated for use with VFDs, the motor shall be rated for inverter-duty.
- D. Each phase of the motor shall contain a bi-metallic temperature monitor in the upper portion of the stator windings. These thermal switches shall be connected in series and set to open at 180° C +/- 5° C. They shall be connected to the control panel and used in conjunction with and supplemental to external motor overload protection. Motors of 70 HP and greater shall be supplied with bi-metallic sensors to monitor the temperature of the upper and lower bearings. These sensors shall be connected to the control panel and shall provide advanced warning of high bearing temperature.
- E. An electrical probe shall be provided in the oil chamber for detecting the presence of water in the oil chamber. A solid-state device mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber, the probe shall signal the solid state relay in the control panel. The relay shall then energize a warning light on the control panel. Dual probes, or any other monitoring devices located in the stator housing are not considered to be early warning systems, and shall not be considered equal. Two additional probes, one in the motor chamber and one in the electrical connection chamber, shall be provided. These probes shall signal two additional solid state devices mounted in the control panel. In the event water enters either of these two dry chambers, the pump shall be shut down.
- F. The power and control cables shall be sized according to NEC and CSA standards and shall be 50 feet long in order to reach the junction box without requiring splices. The outer jacket of the cable shall be oil resistant chloroprene

SUBMERSIBLE GRINDER PUMPS

rubber and shall be capable of continuous submerged operation underwater to a depth of 65 feet.

- G. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

H. Level Controls

- 1. Level transducer(s) or floats (as indicated) shall be used to control and monitor the pumps. Set levels as shown on the drawings or directed by the Engineer. Provide controls to provide the above pump functions in accordance with applicable specifications.

2.5 DISCHARGE ELBOW

- A. Cast from gray cast iron complying with ASTM A 48, Class 30.
- B. Provide vertical leg with the following diameters:
 - 1. 3-inch ANSI Class 125 lb. flange.
- C. Provide horizontal or inlet leg with a flat machined face for forming an effective seal with the lip seal on pump.
- D. Provide elbow with an integral cast iron base for anchoring and support of discharge piping and pump to wetwell floor.

2.6 GUIDE RAILS

- A. Provide for each pump two lengths of Schedule 40, Type 316L stainless steel pipe with pilots as indicated on contract drawings.
 - 1. For pumps with motors less than 30 HP: 2" diameter.
 - 2. For pumps with motors 30 HP and greater: 3" diameter.
- B. Provide Type 316 stainless steel top pilots, Halliday Metals or equal.

2.7 CONTROL PANEL

- A. Provide Control Panel in accordance with 16910.
- B. Control panel shall accept 100A, 208v feed from the panelboard MDP. Include step-down power transformer and the following branch circuit breakers:
 - 1. Pumps (20/1) Each
 - 2. Area Light (10/1)
 - 3. SCADA (10/1)
 - 4. Spare (20/1)
- C. The Control panel shall house all influent pump control equipment including pump starters.
- D. The Control panel shall contain the following components:
 - 1. Provide power disconnect on each circuit breaker with operator handle located on exterior of inner swing panel.
 - a. Include interlock permitting swing panel to be opened only when circuit breakers are in the "OFF" position.
 - 2. Provide "H-O-A" switches for each motor.
 - a. Provide UL rated, heavy duty, 600 VAC, NEMA 4X, oil-tight switches, Allen Bradley Series 800H or Square D Class 9001 SK.
 - b. "Hand" position not to override motor overload shutdown.
 - 3. Provide the following components with the panel:
 - a. Pilot run light for each motor.
 - b. Lockable enclosure.
 - c. Condensation heater.
 - d. Undervoltage, phase failure and phase reversal protection unit, TimeMark Model 265, or Engineer-approved equal.
 - e. High level alarm indication light.
 - f. Alarm horn silence.
 - g. Reset-motor over temperature.
 - h. GFI 20A duplex receptacle with stainless steel cover.
 - i. Control relays.
 - k. Remote alarm terminals.
 - l. "High temperature" indicator lamps.
 - m. "Power on" indicating lamp.

- n. "Seal failure" indicator lamps.

2.8 LEVEL CONTROL

- A. Provide four (4) micro float switches, single action design, capable of withstanding water penetration under 25 feet of water with at least a 3 to 1 safety factor.
- B. Provide for duplex operation utilizing the floats (LEAD, LAG, OFF)
- C. Design circuitry so that operation of the "LAG" pump start circuit is not contingent on proper operation of the "LEAD" pump start circuit.
- D. Floats shall be provided the following functions:
 - 1. Low-Low Level Float (all pumps OFF)
 - 2. Low Level Float (Lead pump ON)
 - 3. High Level Float (Lag pump ON)
 - 2. High-High Level Float (Alarm and back up all Pumps On)
- E. Cable holder:
 - 1. Provide stainless steel, six hook design, Halliday Metals or equal.
 - 2. Mount with stainless steel anchors.

2.9 Reduced Voltage Soft Starters-RVSS (2 required):

- A. Equip each RVSS combination motor starter with built-in electronic overload protection, phase loss/phase imbalance and phase reversal sensing.
- B. Provide adequate inputs/outputs for start/stop control and run indication.
- C. Provide paralleling run bypass contactor that energizes when the motor reaches 90% of full speed and closes/opens under one (1) times the motor current contacts.
- D. The RVSS shall be provided with a fault annunciation system to indicate the cause of an alarm or shutdown and alarm indications for internal fault and external fault functions.
- E. Provide all connections for control and status from/to the pump control panel.

PART 3 - EXECUTION

3.1 FACTORY PUMP TEST

- A. The CONTRACTOR shall furnish sworn certificates to the effect that the pump casings have passed the hydrostatic pressure tests.

SUBMERSIBLE GRINDER PUMPS

- B. Pump tests shall be conducted on pump. During each test, the pump shall be run at all specified head conditions for a sufficient time to permit accurate determination of discharge, head, and power input.
- C. Certified copies of the test data shall be furnished to the Engineer for review. All tests shall be run in accordance with the Standards of the Hydraulic Institute.

3.2 MOTOR TEST

- A. The motor shall be given the standard commercial tests in the shop of the motor manufacturer, and certified copies of the tests results submitted to the Engineer for review prior to installation of the motor.

END OF SECTION

**SECTION 11145
FRP STRUCTURES**

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide structure assembled from Fiberglass Reinforced Polyester (FRP), as indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.00 SUBMITTALS

- A. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's certifications and laboratory test reports as required.
 - 3. Shop drawings showing complete information for fabrication and erection of the work of this Section including, but not necessarily limited to:
 - a. Erection procedures, lifting lugs, sequence of erection, and required handling equipment.
 - b. Layout, dimensions, and identification of each precast unit corresponding to the sequence and procedure of installation.
 - c. Details of inserts, connections, and joints, including accessories and construction at openings in the precast units.
 - d. Location and details of anchorage devices that are to be embedded in other construction.

PART 2 PRODUCTS

2.01 DESIGN STANDARDS

- A. Design in accordance with pertinent recommendations contained in:
 - 1. ASTM D3299
 - 2. ASTM D3757
 - 3. AASHTO standard specifications, minimum load rating: HS20.
- B. Comply with requirements of governmental agencies having jurisdiction.

FRP STRUCTURES

- C. In the event of a conflict between or among standards, the more stringent provision shall govern unless directed otherwise by the Engineer.
- D. Minimum design criteria, unless otherwise indicated on the drawings or specified herein:
 - 1. Soil weight of 130 pcf.
 - 2. Soil angle of internal friction of 10°.
 - 3. Groundwater depth to the top of wetwell.

2.02 COMPONENTS

- A. General:
 - 1. Provide standard FRP shapes as required for a complete structure, as indicated on the Drawings.
 - 2. Inside diameter and vertical laying lengths as shown on the contract drawings.
- B. FRP Structures:
 - 1. The FRP structure shall be standalone Fiberglass Reinforced Polyester (FRP) structure, with a minimum dynamic load rating of 16,000 ft-lbs. The sides, top, and bottom shall be type Grade "E" glass, with smooth interior and exterior surfaces. Exterior resin shall include a minimum 1/8" layer of UV inhibitor.
 - 2. The top and bottom shall be reinforced with layup in accordance with ASTM D3299. The FRP structures must meet and or exceed ASTM-D3753 standards. The structures must be Third Party Tested and Certified to meet the ASTM-D3753 standards. The structures must have labels that have serial numbers visible and states the manufacturer, date of manufacture, depth, diameter, and that structure meets ASTM-D3753 standards. Bottom shall be truncated as shown on drawings.
 - 3. The FRP structure must have a standard 10 Year structural warranty. The fiberglass structures must have a printed 10 Year warranty label gel coated next to ASTM and serial number label. Copy of this warranty must be included with the submittal data.
 - 4. Approved Manufacturer is L.F. Manufacturing, EFI and Xerxes. An Engineer approved equal may be substituted.

FRP STRUCTURES

5. All access opening shall have 12" risers with "Drop In" Aluminum Hatch Cover or approved equal. Upon completion, the wet well and valve pit will have a 6" minimum concrete slab poured over top. On wetwells 8' in diameter or larger an additional hatch cover shall be supplied on opposite side of wet well over invert piping to allow for installation of future equipment and maintenance.
6. All pipe penetration shall include a molded wall sleeve and rubber link seals to make a watertight seal. The sleeves must be large enough for the flange of pipe being used to pass freely through (Example: 4" pipe would require a 10" sleeve to allow 9-1/2" O.D. diameter of 4" flange). The link seals are used so that the rubber acts as a vibration isolator while the pump is running.
7. (FRP Wetwell Only) All piping in wetwell, including exterior extensions sections shall be welded Flange X Flange Sch 40 316 SS-L piping (HDPE or Class 250 Ductile Iron approved equal may be substituted as an Alternate if identified in proposal section). All wetwell ductile iron piping shall be interior coated with Protecto 401, and all exterior surfaces shall be coated with two (2) layers of epoxy at 5 mils per coat.
8. Hardware used for connections must be 316 SST bolts and nuts with anti-seize.
9. Manufacture shall be regularly engaged in the production of the specified manhole and shall meet UL-1316 - Standard for Safety Glass Fiber Reinforced Plastic Underground Storage structures for Petroleum Products.
10. Buoyancy and Structural Design Calculations signed and sealed by a professional engineer registered in the state of the project site location will be provided and shall include:
 - a. Empty tank buoyancy with fully flooded condition (water table at grade elevation).
 - b. Uplift with soil shear planes considered vertical with no angle.
 - c. Structural calculations shall address configuration, thickness and the calculations (moment of inertia), hydrostatic pressure, deflection due to soil and traffic load, buckling when the FRP structure is above water level, and local buckling of the shell between ribs.
 - d. Fiberglass composites shall be a minimum of:

i. Tensile Modules	900,000 psi
ii. Flexural Modulus	900,000 psi
iii. Tensile Strength	10,000 psi
iv. Compressive Strength	20,000 psi
 - e. Loading Conditions - shall withstand a minimum 20-psig internal pressure test; withstand external surface H-20 and HS-20 axle loads; 7' of

FRP STRUCTURES

overburden external hydrostatic loads over the top of the structure with a safety factor of 5:1 against general buckling when properly installed.

11. FRP structure shall be capable handling domestic wastewater, petroleum, petroleum condensates aromatic hydrocarbons and gasoline additives at temperatures as low as -5° C (23°F) and high as 40° C (104°F).
12. The primary and secondary walls of the FRP structure shall be manufactured with 100% premium isophthalic polyester resin and glass-fiber reinforcement. No sand or silica fillers shall be added to the resin. The interstitial space between the primary and secondary walls shall be constructed with a glass reinforcement material such as Parabeam®, which provides a structural bond between the two FRP structure walls while creating a defined interstice that allows for free flow of liquid.
13. All fiberglass nozzles shall be gusseted to handle the backfill and external loads. Gussets shall not interfere with anchor strap locations or flange bolt holes.
14. FRP structures will be designed with external reinforcement ribs and structural domed ends.
15. Manhole access manways shall be sized with a 12" raised collar to accept a drop-in aluminum access hatch cover. Collar internal dimensions shall be 30"x30".
16. Each FRP structure shall be equipped with a minimum of (4) lifting lugs evenly spaced to ensure a balanced lift and designed to carry (4) times the empty weight of the FRP structure when lifted vertically.
17. Bottom stingers shall be constructed of FRP pipe matching the diameter of the flanged nozzle and cut at 45° angle 12 inches off FRP structure bottom.
18. Prior to shipment, the unit shall be thoroughly cleaned internally; all flanges or openings covered with wood or wood fiber. Packaged components susceptible to shipping damage shall be braced for shipment to prevent damage from vibration, fatigue, or shock.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed.

FRP STRUCTURES

1. Correct conditions detrimental to timely and proper completion of the Work before beginning.
- B. Provide shoring, pilings or temporary support as required for the protection of existing structures and utilities.
 1. Where sheet piling or other construction work is required, retain the services of a professional engineer licensed by the State of South Carolina and qualified to provide design services for the work.
- C. Protection of existing structures and utilities is the sole responsibility of the Contractor.

3.02 COORDINATION

- A. Coordinate work with the Owner to ensure continuous operation of existing utilities.
- B. Coordinate with other trades as required for timely completion of the work.

3.03 INSTALLATION

- A. The FRP wet well shall be installed in the location shown on the plans in accordance with the Manufacturer's recommendations, the Report of Geotechnical Investigation (if applicable) and these specifications. The limit of excavation for the FRP shall allow for placing and removing forms, installing sheeting, shoring, bracing, etc. The Contractor shall pile excavated material in a manner that will not endanger the work and will avoid obstructing sidewalks, driveways, power poles, etc.
 1. Begin excavation only after all shoring, pilings and temporary supports are complete, and all sediment and erosion control measures are in place.
 2. The wet well shall not be dropped or impacted. Wet wells shall be chocked if stored horizontally. If wet wells must be moved by rolling, the ground transverses shall be smooth and free of rocks, debris, etc. FRP wet wells may be lifted by the installation of three lifting lugs as specified by the Manufacturer on the outside surface near the top or by a sling or "choker" connection around the center. Use of chains or cables in contact with the wet well surface is prohibited. Wet wells may be lifted horizontally using one support point. Lift and placement of all FRP structures shall be in accordance with the manufacturer's recommendations and the approved shop drawings.
- B. Bottom of excavation should be compacted in accordance with the Report of Geotechnical Investigation (if available) or to a minimum 95 percent Modified

FRP STRUCTURES

Proctor Density. Pour reinforced concrete base a minimum of one foot deep and at least two feet in diameter larger than the fiberglass wetwell outside diameter.

- C. When necessary to protect existing or proposed structures or other improvements, the Contractor shall maintain vertical sides of the excavation. The limit shall not exceed three feet outside the footing on a vertical plane parallel to the footing except where specifically approved otherwise by the Engineer. The Contractor shall provide and install any sheeting, shoring, and bracing as necessary to provide a safe work area as required protecting workers, structures, equipment, power design and adequacy of all sheeting, shoring, and bracing. For excavations deeper than 20 vertical feet, which utilize sheeting, shoring or bracing, the sheeting, shoring, and bracing plan shall be designed by a Florida Professional Engineer, (signed and sealed). This plan shall be submitted to the Owner for review and approval, prior to construction. The construction of sheeting, shoring and bracing shall be in accordance with the approved plan. All major field modifications shall be approved by the Professional Engineer. The sheeting, shoring, and bracing shall be removed as the excavation is backfilled in such manner as to prevent injurious caving. Excavation shall meet OSHA Excavation Standards (29 CFR sub- part P 1926.650) at a minimum.
- D. Where enough space is available, the Contractor shall be allowed to back slope the sides of the excavation. The back slope shall be such that the excavation shall be safe from caving. The type of material being excavated shall govern the back slope used, but in any case, the back slope shall be no steeper than 1 foot horizontal to 1 foot vertical without sheeting or shoring.
- E. The Contractor shall keep excavation free from water by use of cofferdams, bailing, pumping, well pointing, or any combination as the situation may warrant. All de-watering devices shall be installed in such a manner as to provide clearance for construction, removal of forms, and inspection of the exterior of form work. It is the intent of these specifications that the foundation is placed on a firm, dry bed. The foundation bed shall be kept in a de-watered condition enough period to ensure the safety of the structure. The excavation shall be protected from excessive rainfall, drainage, and drying. The excavation shall be inspected and approved by the Owner's representative before work on the structure is started. It is the intent of these specifications that the Contractor provides a relatively smooth, firm foundation bed for footing and slabs that bear directly on the undisturbed earth without additional cost, regardless of the soil conditions encountered. The Owner's representative will be the sole judge as to whether these conditions have been met.
- F. Excavation for slabs, footings, etc., that bear on earth shall not be carried below the elevation shown on the drawings. In the event the excavation is carried on below the indicated elevation, the Contractor shall bring the slab, footing, etc., to the required grade by filling with concrete having a minimum compressive strength of at least 3,000 psi at 28 days.

FRP STRUCTURES

- G. Unless shown otherwise on the drawings, suitable backfill in accordance with the Manufacturer's Installation Guidelines shall be used for backfilling around the wet well for two feet from the outside surface and extending from bottom of the excavation to the bottom of the top slab. The material chosen shall be free of large lumps or clods (which will not readily break down under compaction), clay or rocks larger than 3/4-inch size. This material will be subject to approval by the Owner's Representative. Backfill material shall be free of vegetation or other extraneous material.
- H. The Contractor may begin backfilling of wet well as soon as the concrete has been allowed to cure and the forms removed.
- I. Backfill shall be placed in accordance with the recommendations contained within the Report of Geotechnical Investigation (if applicable). Otherwise backfill shall be placed at a minimum in layers of not more than 12 loose measure inches and mechanically tamped to at least 95 percent Modified Proctor Density. Flooding will not be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the structure.
- J. Begin excavation only after all shoring, pilings and temporary supports are complete, and all sediment and erosion control measures are in place.
- K. Lift and placement of all FRP structures shall be in accordance with the manufacturer's recommendations and the approved shop drawings.

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 15002
GRAVITY SEWER, MANHOLES AND ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section covers the work necessary to furnish and install, complete, the gravity sewer, drain lines, and manholes specified herein in order to complete the gravity sewer and drain lines including connections to existing facilities.

1.02 GENERAL

- A. Like items of material provided thereunder shall be the end products of one manufacturer.

1.03 SUBMITTALS

- A. Shop Drawings: Furnish the following:
 - 1. Precast Manhole Base Sections: Details of construction.
- B. Quality Control Submittals: Furnish the following:
 - 1. Precast Manhole Sections: Manufacturer's results of tests performed on representative sections to be furnished.
 - 2. Certified load test data for manhole steps.

PART 2 PRODUCTS

2.01 PVC PIPE

- A. Polyvinyl chloride (PVC) pipe shall comply with ASTM D3034-81 for PVC materials and ASTM F679, minimum pipe stiffness 115 psi at 5% deflection, and shall meet the extra strength minimum of Standard Diameter Ratio 35. PVC pipe shall be supplied in lengths not less than 20 feet.
- B. Joints shall be push-on type spigot and bell with integral bell homogeneous with the pipe. Gaskets shall be rubber meeting the requirements of ASTM F477 and D3212 and shall be locked in to the bell groove.
- C. The pipe classes shown below shall be defined according to the Standard Pipe Diameter Ratio (SDR) as defined by ASTM D2241. Pipe class will be shown on the plans.

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

1. Class 160 pipe: SDR 26
2. Class 200 pipe: SDR 21
3. Class 250 pipe: SDR 17
4. Gravity sewer pipe: SDR 35

D. PVC pipe shall be as manufactured by North American Pipe Corporation, or equal.

2.02 TRENCH STABILIZATION MATERIAL

A. Trench stabilization material shall be three-inch minus river-run or pit-run gravel, crushed gravel, or crushed rock; free from clay balls, roots, and organic matter; well-graded from coarse to fine, with less than 8 percent by weight passing the 1/4-inch sieve.

2.03 GRANULAR PIPE BASE AND PIPE ZONE MATERIAL

A. Granular pipe base and pipe zone shall be Natural stone; washed, free of clay. Shale, organic matter; graded in accordance with ASTM C136 to meet the requirements of AHD Std. Spec., Section 801, Size No. 6 or No. 57, stone may be used if approved by the Engineer.

2.04 GRANULAR FILL

A. Granular fill shall be natural sand or sand gravel, free from dirt, clay balls, and organic material, well graded from coarse to fine, containing sufficient finer material for proper compaction, and less than 20 percent by weight passing the No. 200 sieve.

2.05 CONCRETE

A. Concrete shall have 4,000 psi compressive strength at 28 days. Portland cement shall conform to ASTM C150, Type II.

2.06 MORTAR/GROUT

A. Mortar shall be standard premixed meeting ASTM C387, or proportion 1 part portland cement to 2 parts clean, well-graded sand which will pass a 1/8-inch screen.

B. Admixtures: May be included but do not exceed the following percentages of weight of cement:

1. Hydrated Lime: 10 percent.

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

2. Diatomaceous Earth or Other Inert Material: 5 percent.
- C. Consistency:
1. Tongue-and-Groove Type Manhole Joint: Such that mortar will readily adhere.
 2. Confined Groove (Keylock) Manhole Joint: Such that excess mortar will be forced out of groove and support is not provided for section being placed.

2.07 PRECAST MANHOLE RISER SECTIONS

- A. Minimum 48 inches in diameter, conforming to ASTM C478 and the following:
1. Minimum Wall Thickness: 5" inches.
 2. Provide eccentric cones for manholes. Cones shall have same wall thickness and reinforcement as riser section.
 3. Top and bottom of sections shall be parallel.
 4. Manhole Steps: Cast in sections by the manufacturer.
 5. Joints: Tongue-and-groove or confined groove with mastic. Confined Oring with rubber gaskets meeting ASTM C443.
 6. Manhole couplings or flexible boots or sleeves either cast in or grouted into manhole wall for watertight seal on manhole-pipe connection.
- B. Source Tests:
1. Prior to delivery of any size precast manhole section to job site, conduct yard tests at point of manufacture.
 2. Precast sections to be tested will be selected at random from stockpiled material to be supplied for the job.
 3. All test specimens shall be mat-tested and meet the permeability test requirements of ASTM C14.

2.8 PRECAST BASE SECTIONS AND BASES

- A. Acceptable as an option if approved by ENGINEER.
- B. Base Sections: Base slab integral with sidewalls.

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

- C. Base Slab: Minimum 6 inches thick with No. 4 reinforcing bars, 8-inch centers, both directions in center of slab. Tie reinforcing steel to wall steel.

2.9 MANHOLE EXTENSIONS

- A. Concrete Grade Rings for Extensions: Maximum 6 inches high with a minimum of one No. 2 reinforcing bar centered in the ring.

2.10 PREFORMED PLASTIC MANHOLE GASKETS

- A. May be provided in lieu of mortar type joints.
- B. Conform to requirements of Federal Specification SS-S-00210.
- C. Manufacturers:
 - 1. Hamilton Kent Manufacturing Co., Box 178, Kent, OH 44240, Kent-Seal No. 2.
 - 2. K. T. Snyder Co., Inc., Central National Bank Bldg., Houston TX 77002, Ram-Nek.

2.11 MANHOLE FRAMES AND COVERS

- A. Shall be 24-inch clear opening as manufactured by Neenah Foundry R-1916-F. Frames shall have 4-1" anchor bolt holes for bolting to concrete manhole. Frames shall be watertight with bolted lids. The word SEWER in raised 2" letters shall be cast in lid.

PART 3 EXECUTION

3.01 PIPE PREPARATION AND HANDLING - GENERAL

- A. Each pipe and fitting shall be carefully inspected before the exposed pipe or fitting is installed. The interior and exterior protective coating shall be inspected, and all damaged areas patched in the field with material similar to the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
- B. Use proper implements, tools, and facilities for the safe and proper protection of the pipe. Carefully handle pipe in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe.
- C. Care shall be taken not to damage linings when handling pipe.

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

3.02 CUTTING PIPE

- A. Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.
- B. Dress cut ends of pipe in accordance with the type of joint to be made. Dress cut ends of mechanical joint pipe to remove sharp edges or projections, which may damage the rubber gasket. Dress cut ends of push-on joint pipe by beveling, as recommended by the pipe manufacturer. Dress cut ends of pipe for flanged coupling adapters as recommended by the manufacturer.

3.03 TRENCH EXCAVATION AND BACKFILL

- A. General:
 - 1. Trenches for mains shall be excavated in the locations shown on the plans or as directed by the ENGINEER.
 - 2. All trees, telephone and power poles along the line of work shall be protected. Where clearing or partial clearing of the right-of-way is necessary, complete before the start of trenching. Cut trees and brush as near to the ground surface as practicable, remove all stumps, and remove for disposal. Do not remove trees over 2 inches in diameter unless they are within 4 feet of the pipe centerline, without permission from the ENGINEER. Protect from damage all privately owned shrubs or plants unless approved by the ENGINEER. If necessary for protection, remove and replace trees, shrubs, or plants by balling the root system and placing in stockpiled topsoil, watering as required. Should any tree, shrub, or plant that has been disturbed as a result of its removal, or otherwise damaged by the CONTRACTOR, die within 6 months from the time it was disturbed or damaged, it shall be replaced in kind and size by the CONTRACTOR.
 - 3. Cut all bituminous and concrete pavements, curbs and sidewalks before excavation of the trenches with an approved pavement saw, hydrohammer, or approved pavement cutter. Pavement and concrete materials removed shall be hauled from the site and not used for trench backfill. No driveway or road shall be inaccessible at the end of the day's work and all street crossings shall be backfilled and opened to traffic each day.
 - 4. All excess excavation not required or suitable for backfill or filling shall become property of the CONTRACTOR and shall be disposed of off the site.
- B. Trench Excavation:

GRAVITY SEWER MANHOLES AND ACCESSORIES

1. Trench widths shall be as required to properly install the mains, but not less than 24 inches wide. The trench depths shall be as shown on the drawings.
2. At all times provide and maintain ample means and devices to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until backfill at the pipe zone has been completed.

C. Trench Backfill:

1. Provide imported granular pipe base material under gravity sewer pipe for full width of trench. Minimum depth of base shall be 4 inches unless otherwise directed by the ENGINEER.
2. The pipe zone shall be considered to include the full width of the excavated trench from the bottom of the pipe to the top of the pipe. Particular attention must be given to this area to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone. Pipe zone material shall be the same material used for the pipe base. This material shall be placed, in a manner approved by the ENGINEER, simultaneously on both sides of pipe in lifts not to exceed 4 inches. Backfill in the pipe zone shall be compacted by approved mechanical tamping methods. The minimum required compaction shall be 95 percent relative compaction, as determined by ASTM D 1557, latest edition.
3. The CONTRACTOR may backfill the trenches before air testing, but is responsible for locating and repairing all leaks until a satisfactory test is completed.
4. When backfill is placed mechanically, push the backfill material onto the slope of the backfill previously placed and allow to slide down into the trench. Do not push backfill into the trench in such a way as to permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Under no circumstances allow sharp, heavy pieces of material to drop directly onto the pipe or the tamped material around the pipe. Do not use backfill material of consolidated masses larger than 1/2 cubic foot.
5. Backfill trenches beneath roads, paving and sidewalks by placing previously specified imported granular material in 6-inch lifts and compacting each lift with mechanical tampers or vibratory compactors to at least 95 percent of the relative maximum compaction as determined by AASHTO T99.
6. Backfill trenches in other areas by placing material in loose lifts as described herein before and leave the backfill material neatly mounded

GRAVITY SEWER MANHOLES AND ACCESSORIES

so that after normal settlement the finished surface will meet the existing grade.

7. Any excess or deficiency of backfill material which becomes apparent after settlement and within the warranty period shall be corrected by regrading, disposal of excess material, and adding additional material where required.
8. Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the 1-year warranty period in accordance with the General Conditions will be considered to be caused by improper compaction methods 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.

3.4 PIPE INSTALLATION

- A. Handling Material: Provide and use proper implements, tools, and facilities for the safe and proper prosecution of the work. Lower all pipe, fittings, and appurtenances into the trench, piece by piece, by means of a crane, slings, or other suitable means and in such a manner as to prevent damage to the pipeline materials and protective coatings and linings. Do not drop or dump pipeline materials into the trench.
- B. Cleaning Pipe and Fittings: Remove all dirt, blisters, lumps, and excess coating from the bell and spigot ends of each pipe. Wipe the outside of the spigot and the inside of the bell until joints are clean, dry, and free from oil and grease before the pipe is laid.
- C. Cutting Pipe: Cut pipe in a neat and workmanlike manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe or leaving a beveled end as recommended by the manufacturer. Dress cut ends to remove sharp edges or projections, which may damage the rubber gasket.
- D. Laying Pipe: Lay pipe with bell end facing upgrade. Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of 1 inch.
- E. Joining Push-On Joint Pipe: Lay and join pipe in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for the installation. Lubricant for the pipe shall be furnished by the pipe manufacturer. Place sufficient amount of pipe zone material to secure the pipe from movement before the next joint is installed. Provide bell holes at each joint so that the joint can be assembled properly while maintaining uniform pipe support
- F. Joining Mechanical Joint Pipe and Fittings: Install in accordance with manufacturer's recommendations. After cleaning ends and gasket, slip the gland

GRAVITY SEWER MANHOLES AND ACCESSORIES

and gasket on the plain end, lubricating if necessary to facilitate sliding the gasket into place. Guide the end of the pipe into the bell of the pipe previously laid, locating the spigot centrally in the bell. Place the gasket into position and insert the bolts in the holes. When tightening bolts, bring the gland up toward the flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tighten all nuts progressively at a time. Do not over stress bolts to compensate for poor alignment. If effective sealing is not attained at the maximum torque, disassemble the joint and reassemble after cleaning.

G. Installation of Lateral Connection Tees or Wyes: Install tee or wye fittings in accordance with the Sewer Service Connection Details shown on the Drawings. Provide all tees with caps or plugs, as specified. Provide a minimum 2-foot wide compacted gravel base under tees installed in trenches less than 12 feet deep.

H. Line and Grade:

1. Laterals: Minimum slope for laterals shall be 1/4 inch per foot.
2. Sewer Mains: Do not deviate from line or grade, as established by the ENGINEER, more than 0.05% for grade, provided that such variation does not result in a level or reverse sloping invert. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness. Establish line and grade for pipe by the use of lasers or by transferring the cut from the offset stakes to batter boards set in the trench at maximum intervals of 25 feet. Match the existing line and grade of the manhole to manhole section being replaced. Maintain a minimum of three sets of batter boards with string line ahead of the pipe laying at all times. If batter boards in the trench prove impractical because of trench conditions, submit other methods of grade and alignment control the ENGINEER for approval. Hand-grade base to proper grade ahead of pipe laying. Base shall provide a firm, unyielding support along entire pipe length.

3.5 MANHOLE BASE

- A. Use approved precast manhole base with first manhole section integral with base.
- B. If material in bottom of trench is unsuitable for supporting manhole, excavate below the base as directed by ENGINEER, and backfill to required grade with trench stabilization material, as hereinbefore specified.

3.6 PLACING PRECAST MANHOLE SECTIONS

A. Section Installation:

1. Thoroughly clean ends of sections to be joined.

GRAVITY SEWER MANHOLES AND ACCESSORIES

2. Place mastic on groove of lower section.
 3. Set next section in-place.
 4. Rub seam joints inside & out with non shrink grout (hydraulic cement).
 5. Fill all lift holes inside & out with non shrink grout (hydraulic cement).
 6. Completed Manholes: Rigid and watertight.
- B. Preformed Plastic Gaskets: If used in lieu of mortar joints, install in accordance with manufacturer's instructions and the following:
1. Carefully inspect precast manhole sections to be joined.
 2. Do not use sections with chips or cracks in the tongue.
 3. Use only pipe primer furnished by gasket manufacturer.
 4. Install gasket material in accordance with manufacturer's instructions.
 5. Completed Manholes: Rigid and watertight.
- C. Rubber Gasketed Joints: Install in accordance with manufacturer's instructions.

3.7 MANHOLE INVERT

- A. Construct as shown with smooth transitions to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow.

3.8 DROP ASSEMBLIES

- A. Construct drop assemblies as shown, at locations shown.

3.9 FLEXIBLE JOINTS

- A. Provide joints in all pipe not more than 1-1/2 feet from manhole walls. Lay pipes entering manholes on compacted granular fill extending to undisturbed earth.
- B. Where last joint of the line laid up to manhole is between 1-1/2 and 6 feet from manhole wall, provide a flexible joint in the manhole wall.
- C. Shorten pipes laid out of manhole to ensure first joint is no more than 1-1/2 feet from manhole base.

3.10 MANHOLE EXTENSIONS

- A. Install extensions as shown, to height not exceeding 12 inches.
- B. Lay grade rings in mortar with sides plumb and tops level. Seal joints with mortar as specified for manhole sections, and make watertight.

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

3.11 MANHOLE FRAMES AND COVERS

- A. Install on top of manholes to positively prevent infiltration of surface or groundwater into manholes.
- B. Frame to bolt onto top of manhole. Surface of concrete manhole top to be coated with mastic prior to seating & bolting of frame.
- C. Set tops of covers flush with surface of adjoining pavement or ground surface, unless otherwise shown or directed.
- D. At locations shown, install exterior manhole frame to structure seals in accordance with manufacturer's instructions.

3.12 LOW PRESSURE AIR TEST

- A. General: Make pressure and leakage tests on all newly laid pipe after cleaning. The CONTRACTOR shall provide all necessary equipment and material, and conduct the tests. The ENGINEER will monitor and witness the tests before the installed pipe is approved. Pressure tests must be completed before payment is made for that section of pipe.
- B. Air Test:
 - 1. The test shall be conducted between each two adjacent manholes. All sewer sections within the installed system shall be tested.
 - 2. All wyes, tees, or end of slide sewer stubs shall be plugged with flexible-joint caps, or acceptable alternate, securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible-jointed lateral connection or extension.
 - 3. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds/square inch greater than the average back pressure of any ground water that may submerge the pipe. At least 2 minutes shall be allowed for temperature stabilization before proceeding further.

If piping is not below ground water, 5 psi may be applied and maintained for minimum times shown in after the 2 minute stabilization period.
 - 4. The pipeline shall be considered to have passed the low pressure air test if the time required for the low pressure exfiltration pressure drops from 3.5 psi to 3.0 psi, (in excess of back pressure from ground water submerging the pipe) shall not be less than that shown in the following table.

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

5. Air Pressure Adjustment for Pipeline below Groundwater:

The air pressure correction, which must be added to the 3.5 psig normal test starting pressure, shall be calculated by dividing the average vertical height in feet of ground water above the invert of the sewer pipe to be tested by 2.31. The result gives the air pressure correction in pounds per square inch to be added. (For example, if the average vertical height of groundwater above the pipe invert is 2.8 feet, the additional air pressure required would equal 2.8 divided by 2.31 or 1.2 psig. This would require a minimum starting pressure of 3.5 plus 1.2 or 4.7 psig). In not case should the starting pressure exceed 9.0 psig.

6. The pipeline will be considered to have passed the low pressure air test if the time required for the internal air pressure to drop not more than .5 psi is equal to or greater than that shown in the following table:

PIPE SIZE (Inches)	MINIMUM TIME (Minutes)
4" Pipe	2.5
6" Pipe	4.0
8" Pipe	5.0
10" Pipe	6.5
12" Pipe	7.5
15" Pipe	9.5
18" Pipe	11.5

Note: For pipe size not indicated minimum time in minutes = pipe size (inches) x .625.

C. Correction of Excessive Leakage: Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

3.13 NEGATIVE AIR PRESSURE (VACUUM) TEST

A. General

1. The test method as outlined in ASTM C1244 shall be followed.
2. The contractor shall furnish all facilities, equipment and personnel as required to conduct the vacuum test.
3. The test shall be conducted after the manhole installation.
4. The contractor shall furnish evidence to the engineer that all test equipment is in proper working order.

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

5. The test shall be conducted in the presence of the Engineer.

B. Preparation

1. All pipes entering the manhole shall be temporarily plugged.
2. Care shall be taken to securely brace plugs as to prevent them from being drawn into the manhole during the test.

C. Procedure

1. The test head shall be placed at the top of the manhole.
2. A vacuum of 10 inches of mercury shall be drawn on the manhole.
3. The time shall be measured for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury.
4. The manhole shall pass if the time required for the vacuum reading to drop from 10 inches to 9 inches of mercury meets or exceeds the values listed.
5. If the manhole fails the vacuum test, the Contractor shall make all necessary repairs to the manhole and shall retest the manhole.

**MINIMUM VACUUM TEST TIMES (SECONDS) FOR MANHOLES BASED ON
DIAMETER AND DEPTH**

Manhole Depth (FT.)	MANHOLE DIAMETER (INCHES)				
	48	60	72	96	120
8	17	26	33	45	57
10	21	33	41	54	67
12	25	39	49	63	77
14	30	46	57	72	87
16	34	52	65	81	97
18	38	57	73	90	107
20	42	65	81	99	117
22	46	72	89	108	127
24	51	78	97	117	137
26	55	85	105	126	147
28	59	91	113	135	157
30	63	98	121	144	167

Test times for manholes less than 8 feet shall be the same as indicated for the 8 feet depth manholes.

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

3.14 MANHOLE COATING

- A. Coat the interior of designated manholes on the Drawings with coal tar epoxy as manufactured by Sherwin Williams, or equal.

END OF SECTION

**GRAVITY SEWER MANHOLES
AND ACCESSORIES**

**SECTION 15110
PIPING AND ACCESSORIES**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section covers the Work necessary to furnish, install, and complete, the plant piping specified herein.

1.02 GENERAL

- A. Like items of material provided hereunder shall be the end products of one (1) manufacturer.
- B. To assure uniformity and compatibility of piping components in grooved end piping systems, fittings and coupling shall be furnished by the same manufacturer.
- C. See CONDITIONS OF THE CONTRACT and Section GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are mandatory for this Project.

1.03 SUBMITTALS

- A. In addition to the requirements of Division 1, GENERAL REQUIREMENTS, the following information shall be provided:
 - 1. Shop Drawings:
 - a. For piping systems greater than three (3) inches in diameter, provide double-line Drawings of each piping system to the scale stated on the Contract Drawings, locating each support, identifying the type by catalog number or shop Drawing detail number, and showing anchor locations and identifying them by shop Drawing detail number.
 - b. Detailed information for piping thrust protection systems used at all specified locations, which enable the Engineer to determine the adequacy and acceptability of the system being submitted for review.
 - 2. Manufacturer's written certification that the factory-applied coating system(s) is identical to the requirements specified herein. Where, in the manufacturer's opinion, the coating system(s) exceeds the requirements specified herein, submit complete technical literature of the proposed system(s) to the Engineer for review.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE

A. General:

1. Comply with ANSI/AWWA C150/A21.50 or AWWA C151/A21.51, latest revision.
2. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.
3. Wall thickness in accordance with Table 50.5 of ANSI/AWWA C150/A21.50, depth of cover indicated and Type 3 bedding conditions (unless indicated otherwise on the Drawings), minimum Pressure Class as follows:
 - 4" - 12" Pressure Class 350
 - 14" - 20" Pressure Class 300
4. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness or 40-60 mils of Protecto 401 lining where indicated.

B. Joints:

1. Use mechanical or push-on joints complying with ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.
2. Use gaskets and lubricant complying with ANSI/AWWA C111/A21.11.
3. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents.
4. Exposed pipe:
 - a. Class 53 minimum.
 - b. Use flanged joints complying with ANSI/AWWA C115/A21.11, latest revision; and
 - 1) Provide solid type flanges with country where cast stamped or cast into the flange."
 - 2) Use full face, red rubber, factory cut, 1/16" thick for pipe up to 10" diameter and 1/8" thick for larger sizes.
 - 3) Bolts and nuts shall be 316 stainless steel bolts, hex head complying with ANSI A21.11/AWWA C111.

C. Fittings:

PIPING AND ACCESSORIES

1. Provide 250 psi rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10 and in accordance with ANSI/AWWA C111/A21.11.
 2. Compact fittings for piping 3" - 16" may be provided in accordance with ANSI/AWWA C153/A21.53.88.b.
 3. Fittings for use with push-on joint pipe, comply with ANSI/AWWA C111/A21.11.
 4. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.
- D. Restrained joint pipe and fittings:
1. Provide restrained joint pipe and fittings where indicated on the plans.
 2. Restrained joints shall be equal to TR-Flex or Field Lok by U.S. Pipe or Flex-Ring or Fast Grip Gasket by American Cast Iron Pipe Company.
 3. Provide wedge type retainer glands for use with mechanical joint fittings.
 - a. Provide "MEGALug" series 1100 or series 1200 as manufactured by EGGA Iron, Inc. or qual.

2.02 PVC PIPE

- A. General:
1. Marked with National Sanitation Foundation approval at 18" intervals.
 2. Gaskets to comply with ASTM F 477.
 - a. Natural rubber gaskets are not acceptable.
- B. Pipe 3" and smaller: Comply with ASTM D2241 for PVC 1120, SDR 21.
- C. 4" - 12": Comply with ANSI/AWWA C900, Table 2, Pressure Class 150 (DR18).
- D. 14" and above: Comply with ANSI/AWWA C905, Table 2, Pressure Class 165 (DR 25).
- E. Color of pipe to be green for wastewater.
- F. Joints:
1. Use integral bell or coupling type with elastomeric gaskets.
 2. Integral bells to comply with ASTM D2672.

PIPING AND ACCESSORIES

3. Couplings to comply with ANSI/AWWA C900.
4. Gaskets to comply with ASTM F477.
 - a. Natural rubber gaskets are not acceptable.
5. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents. Vegetable shortening shall not be used to lubricate joints.

G. Fittings:

1. Buried pipe:

- a. 4" and larger: Provide ductile iron fittings as specified above.
- b. 3" and smaller: Provide PVC fittings, 160 psi at 73°F pressure rating, joint design to conform to pipe joints.

2. Exposed pipe:

- a. Use schedule 80 PVC fittings with solvent weld joints.
- b. Where threaded fittings are indicated, use Schedule 80 conforming to ASTM D2464.
- c. Where flanged joints are indicated, provide Type 316 stainless steel bolts, nuts and washers.

H. Restrained joint pipe and fittings:

1. Provide restrained joint pipe where indicated on the plans.
2. Provide restraint for all ductile iron fittings as specified above.
3. Provide restraint for C900 PVC and C905 PVC by mechanical means separate from the mechanical joint sealing gland.
 - a. Provide series 1600 for C900 PVC and series 2800 for C905 PVC as manufactured by EBBA Iron, Inc. or equal.

2.03 STAINLESS STEEL PIPE AND FITTINGS, 2-1/2" DIAMETER AND SMALLER

- A. Provide Schedule 40 pipe for threaded fitting and/or Schedule 10 pipe for pressfit connections.
- B. Provide Type 304L.
- C. Provide Victaulic Pressfit connections and fittings for Schedule 10 piping.
- D. Provide NPT threaded connections and fittings for Schedule 40 piping.
- E. Provide stainless steel unions at all connections to fixtures, pumps, equipment, etc.

PIPING AND ACCESSORIES

- F. Provide joint compound for thread sealant on threaded connections.
 - 1. Provide Lok-Tite PST or approved equal.
 - 2. Submit shop drawings for approval.
- G. Provide two (2) Pressfit PFT 505 fitting tools with two (2) sets of pressing jaws for all pipe size diameters between 1/2" to 2".

2.04 PLASTIC FLEXIBLE TUBING (TYGON TUBING)

- A. Provide flexible tubing where indicated on the contract drawings.
- B. Comply with Federal Specification L-T-7908.
- C. Tubing shall be clear in color.
- D. Provide nylon reinforced tubing, for suction applications, and for pressure applications greater than the un-reinforced tubing working pressure.
- E. Provide nylon fittings with stainless steel hose clamps.

2.05 LINK SEAL SLEEVE SEAL

- A. Provide sleeve seals where indicated on the plans to seal between pipe sleeves and piping.
- B. Provide glass reinforced nylon plastic pressure plates.
- C. Provide Type 316 stainless steel bolts and nuts.
- D. Provide EPDM sealing element.
- E. Provide Silicone sealing element for air piping.
- F. Provide square two (2) piece escutcheon plate on exposed side(s) of sleeve(s).
 - 1. Fabricate from .063" clear anodized aluminum sheet.
 - 2. Mount with stainless steel sleeve and stainless steel stove bolts.
- G. Acceptable manufacturer is Link Seal, Type S or equal.

2.06 ADAPTER FLANGES

- A. Provide adapter flanges where indicated on the plans.

PIPING AND ACCESSORIES

- B. Provide high strength ductile iron flange, ASTM A536, Grade 65-45-12.
- C. Provide set screws with a Rockwell hardness of C40-45 converted from Brinnell.
- D. Gasket material:
 - 1. Air lines - Gore-Tex style R rated for 400 degrees for greater.
 - 2. All other lines - BUNA S.
- E. Minimum pressure rating - 150 psi.
- F. Provide adapter flanges with a minimum of a 2 to 1 safety factor.
- G. Provide adapter flanges with MEGA-BOND Restraint Coating System.
 - 1. Wash all adapter flanges and appurtenances in a phosphate wash prior to coating.
 - 2. Coat with a minimum of two coats of liquid Xylan fluoropolymer coating with heat cure to follow each coat.
- H. Provide Series 2100 Megaflange Restrained Flange Adapter by EBAA Iron.

2.07 SERVICE SADDLE

- A. Provide of the following materials:

Body	Type 304 Stainless Steel
Bales and Strips	Type 304 Stainless Steel
Studs	Type 304 Stainless Steel
Hardware	Type 304 Stainless Steel

- B. Provide double-strap for sizes 5" and larger.
- C. Provide Romac 305 and 306 or approved equal.
- D. Connect to pipeline using a 6" long stainless steel nipple.
 - 1. Do not use a threaded PVC connection.

2.08 YARD HYDRANT (IF NOTED ON DRAWINGS)

- A. Lever type:
 - 1. Provide Woodford Model Y1 or approved equal.
 - 2. Inlet opening, 1".

PIPING AND ACCESSORIES

3. Casing - 1-1/4" galvanized steel pipe.
4. Provide 1" brass nozzle with 1" x 3/4" nozzle adapter.
5. Provide vacuum breaker.

2.09 QUICK CONNECT COUPLINGS

- A. Furnish in aluminum with stainless steel arms.
- B. Provide Viton gaskets unless otherwise indicated or specified.
- C. Cam arm finger rings and pins are to be stainless steel.
- D. Provide recess in sizes 4" and larger to hold gasket in place.
- E. Conform to MIL-C-27487 for interchangeability.
- F. Hydrostatic performance:
 1. 3/4" through 4" - 300 psi, no leakage.
 2. 5" and larger - 200 psi, no leakage.
- G. For dust caps and plugs, provide No. 10 stainless steel jack chain with stainless steel "S" hooks connected to coupling and permanent fixture.
 1. Length to be adequate to avoid interference with the operation of the coupling.
- H. Provide end connections to match application shown on the plans.
- I. Provide a pipe nipple of necessary length where required to obtain adequate clearance for operation of cam arms.
- K. Acceptable manufacturer - OPW or approved equal.

2.10 PIPING SUPPORT SYSTEMS

- A. General:
 1. Piping shall be supported, in general, as described hereinafter and as shown by the pipe support details on the Drawings. Manufacturers' catalog figure numbers are typical of the types and quality of standard pipe supports to be employed.

PIPING AND ACCESSORIES

2. No attempt has been made to show all required pipe supports in all locations, either on the Drawings or in the details. The absence of pipe supports and details on any Drawings shall not relieve the Contractor of the responsibility for providing them throughout the facility.
3. All submerged piping supports, guides, and fasteners or those installed below wet wall tops shall be type 316 stainless steel. All other pipe supports to be type 304 stainless steel.
4. All support anchoring devices, including anchor bolts, inserts and other devices used to anchor the support onto a concrete base, roof, wall or structural steel works, shall be of the proper size, strength and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
5. Where piping connects to equipment it shall be supported by a pipe support and not by the equipment. All piping shall be supported in a manner which will prevent undue strain on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, and where otherwise shown.
6. Pipe support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of five (5).
7. The maximum distance between supports or hangers shall not exceed:

	Stainless Steel Tubing, PVC	Copper, Stainless Steel, Steel or Ductile Iron
3/8" diameter and smaller	2-1/2'	4'
1/2" diameter	2-1/2'	6'
3/4" and 1" diameter	3'	8'
1-1/4" to 2" diameter	3-1/2'	10'
2-1/2" diameter to 5" diameter	4'	12'
6" diameter and larger	5'	12'

2.11 INSULATION AND HEAT TRACING (NOT REQUIRED ON WASTEWATER PIPING)

- A. Insulation on all exterior, exposed piping shall be foamed glass with a maximum K-factor of 0.4 Btu-in/hr.-sq. ft. -F at thirty (30) degrees F, a permeability rating of 0.00 perm-inch, and a maximum absorption of 0.2 percent by volume. Insulation shall be Foamglas, as manufactured by Pittsburg Corning or equal. Insulation thickness shall be two (2)-inches for pipes three (3)-inches and smaller and 1½-inches for pipes four (4)-inches to eight (8)-inches. Pipes greater than eight (8)-inches will not require insulation.

PIPING AND ACCESSORIES

- B. Insulation on aboveground piping shall be covered with minimum 0.016-inch thick aluminum jacket. The jacket shall be held in place by a continuous friction type joint, providing a positive weatherproof seal over entire length of jacket. The circumferential joints shall be secured with preformed snap straps containing weatherproof sealant. Cover outdoor fittings with matching preformed aluminum jackets, two (2) piece elbows and flange covers, secured with stainless steel bands. Fitting covers shall be as manufactured by Childers, Papco, or equal.
- C. Heat Tracing: Furnish self-limiting one hundred-twenty (120) volt electrical heating strip for exterior exposed pipes two (2)-inches and smaller. System shall be thermostatically controlled and guaranteed by the manufacturer for a period of two (2) years. System shall be listed by Underwriter Laboratories as a self-limiting pipe tracing material for freeze protection application in ordinary locations. Heat tracing shall be manufactured by Smith-Gates Corporation, Chemlex Corporation, or equal.
- D. Heat tracing schedule:
 - 1. Provide heat tracing and insulation at the following locations (exterior above grade piping).
 - a. Influent Pump Station: 6" discharge piping, ARV inlet piping, and pressure gauge piping.
 - b. Influent Screen: 8" force main and 10" PTI piping.
 - c. Filters: 8" SEC piping, 8" FE piping, backwash piping.
 - d. Sprayfield Pump Station: 4"/3" suction piping, 6"/4" discharge piping, ARV inlet piping and pressure gauge piping.

2.12 POLYETHYLENE ENCASEMENT

- A. Provide blue, 8 mil polyethylene encasement on all ductile iron pipe and fittings within 10 feet of a gas line.

PART 3 EXECUTION

3.01 INSTALLATION OF BURIED PIPING - GENERAL

- A. Trench excavation and backfill requirements are specified in Section 02200.
- B. All buried pipe shall be prepared as hereinbefore specified and shall be laid on the prepared sub-grade and bedded to ensure uniform bearing. No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable. Take all precautions necessary to prevent uplift and floating of the pipe prior to backfilling.
- C. When the pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed, and no trench water, animals, or foreign material shall be permitted to enter the pipe.

PIPING AND ACCESSORIES

3.02 INSTALLATION OF EXPOSED PIPING - GENERAL

- A. Unless shown otherwise, piping shall be parallel to building lines. Hangers on adjacent piping shall be aligned where possible on common size ranges.
- B. All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.
- C. Unions shall be installed where required for piping or equipment installation, even though they are not shown on the Drawings.
- D. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment.
- E. Valve handwheels shall be oriented to permit easy access to the handwheels, and to avoid interference.
- F. Tubing shall be installed straight with smooth bends. Tubing lengths shall be minimized by using hard piping up to the equipment items before transitioning to tubing.

3.03 INSTALLATION OF FLEXIBLE COUPLINGS AND FLANGED ADAPTERS

- A. Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. If necessary, gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Workmen tightening bolts shall use torque limiting wrenches.

3.04 INSULATION

- A. All piping shall be insulated in accordance with manufacturer's instructions including types of insulating cements, lagging adhesives, and weather-proof mastics.
- B. All insulation shall be applied over clean, dry surfaces with all joints butted firmly together, but not until piping system has been pressure tested and any leaks corrected. Insulation shall not extend beyond flanges nor cover nameplates or code inspection stamps. Insulation shall run continuous through wall openings, ceiling openings, and pipe sleeves, unless otherwise noted.
- C. Insulate all valve bodies, flanges, and pipe couplings. Provide removable insulation sections on all devices that require access for maintenance of equipment or removal.

PIPING AND ACCESSORIES

- D. Finished appearance of all insulation shall be smooth and continuous. Provide coating of insulated cement where needed to obtain this result. Joints shall be lapped and the integrity of vapor seals maintained in strict accordance with manufacturer's instructions. Staples and screws shall not be used to secure components of systems that are vapor sealed.

3.05 INTERIM CLEANING

- A. Care shall be exercised during fabrication to prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, etc. within piping sections. All piping shall be examined to assure removal of these and other foreign objects prior to assembly. Shop cleaning may employ any conventional commercial cleaning method if it does not corrode, deform, swell, or otherwise alter the physical properties of the material being cleaned.

3.06 FINAL CLEANING

- A. Following assembly and testing and prior to final acceptance, all pipelines installed under this section shall be flushed with water and all accumulated construction debris and other foreign matter removed. Flushing velocities shall be a minimum of 2.5-feet per second. Protect connected equipment by using strainers or disconnecting the equipment. Accumulated debris shall be removed through drains two (2)-inches and larger by dropping spools and valves.

3.07 CORROSION PROTECTION

- A. Install coating as specified in Section 09900.

3.08 HYDROSTATIC TESTING

- A. General: Make pressure and leakage tests on all newly laid pipe. The Contractor shall provide all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The Engineer will monitor and witness the tests before the installed pipe is approved.
- B. Test Pressure: Test pressure to be 150 psi, or 1.5 times the maximum working pressure, whichever is greater, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge. The test duration shall be two (2) hours. The Contractor shall provide a pressure chart recorder for the duration of each test.
- C. Procedure: Before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, taps shall be made at points of highest elevation and plugged afterward. At the end of the test period, the Contractor will inject a sufficient quantity of water into the pipe section to re-establish the specified pressure. The Contractor shall provide suitable means to determine the quantity of water lost by leakage during the test. The Engineer must witness the quantity of water leakage and pressure recording and sign both before approving the test.

PIPING AND ACCESSORIES

- D. Allowable Leakage: Exposed piping shall not have any visible leakage. For buried pipelines less than 500 LF the allowable leakage shall be zero gallons. For lengths more than more than 500 LF the allowable leakage shall be less than the amount determined by the following formula:

$$L = S \times D \times \sqrt{P} / 133,200; \text{ where}$$

L = allowable leakage in gallons per hour;
S = length of pipe tested in feet;
D = nominal diameter of pipe in inches; and
P = average test pressure psi gauge.

- E. Allowable Loss of Pressure: The maximum allowable drop in pressure from the test pressure shall be no greater than five percent of the test pressure.
- F. Correction of Excessive Leakage: Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

3.09 POLYETHYLENE ENCASEMENT

- A. Provide polyethylene encasement per manufacturer's recommendations on all DI pipe and fittings within 10 feet of gas lines.

3.10 PAINTING

- A. All exposed, non-insulating piping, valves, and accessories shall be painted as specified in Section PAINTING and as directed by the Engineer. Colors shall be selected by the Owner according to submitted color charts.

END OF SECTION

**SECTION 15200
VALVES AND ACCESSORIES**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section covers the Work necessary for furnishing and installing the various valves in the plant piping systems.

1.02 GENERAL

- A. Like items of equipment specified herein shall be the end products of one (1) manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.
- B. See CONDITIONS OF THE CONTRACT and Section GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are mandatory for this Project.

1.03 SUBMITTALS DURING CONSTRUCTION

- A. Submittals during construction shall be made as required in Section GENERAL REQUIREMENTS. In addition, the following specific information shall be provided:
 - 1. Valve type number.

1.04 MANUFACTURER'S SERVICE

- A. The Contractor shall provide for and receive the services of a qualified manufacturer's representative for power-actuated valves.
- B. The representatives(s) shall be present at the job site and/or classroom designated by the Owner for the minimum man-days listed for the services identified hereunder, travel time excluded:
 - 1. ½ man-day for training the Owner's personnel in the operation and maintenance of the equipment.
- C. Startup services and training of the Owner's personnel shall be at such times as requested by the Owner.
- D. See Section GENERAL REQUIREMENTS.

PART 2 PRODUCTS

2.1 GENERAL

- A. All valves shall be complete with all necessary operators, handwheels, operating nuts, wrenches, and other accessories or appurtenances, which are required for the proper completion of the Work. Operators and other accessories shall be sized and furnished by the valve supplier and factory mounted.
- B. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service, but not of a lower quality than specified herein.
- C. Valves shall be suitable for the exposure they are subject to, buried, interior or exterior, as applicable.
- D. Unless otherwise shown, valves shall be the same size as the adjoining pipe.
- E. All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached plate in raised letters.
- F. For the purpose of designating the type and grade of valve desired, a manufacturer's name and list or figure number is given in the following Specifications. Valves of equal quality by other manufacturers will be considered in accordance with the GENERAL CONDITIONS.

2.2 VALVE TYPES

- A. Valve types are specified by number. The type of valve to be used for each service and application is indicated on the Drawings by valve number callout, although not all valves are called out by number on the Drawings. See Valve Schedule at the end of this section for actuated valves.

2.3 DESIGN FEATURES

- A. Brass and Bronze Components:
 - 1. Brass and bronze components of valves and appurtenances which have surfaces in contact with the water shall be alloys containing less than sixteen (16)% percent zinc and two (2%) percent aluminum.
 - 2. Approved alloys are of the following ASTM designations:
 - a. B61, B62, B98 (Alloy UNS No. C65100, C65500, or C66100), B139 (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127 and C995.

VALVES AND ACCESSORIES

- b. Stainless steel Alloy 18-8 may be substituted for bronze at the option of the manufacturer and with the approval of the Engineer.
3. All gland bolts on iron body valves shall be bronze and shall be fitted with brass nuts.
4. Valve ends shall be as specified, as shown on the Drawings, and to suit the adjacent piping.

2.4 VALVE OPERATORS

- A. General: All valves shall be equipped with operators. The valve operator types, as specified herein, describe only the general characteristics of the operator. The operator shall be compatible with the valve that it will be used with and shall be of the same manufacturer, or a product that is recommended by the valve manufacturer. All valve operators shall open by turning counterclockwise.
- B. Manual Operators:
 1. General: Manual handwheel operators shall be provided unless otherwise shown or specified. Ferrous handwheels shall be painted red or as selected by the Owner.
 2. Buried Operators: Buried service operators on valves larger than 2½-inches shall have a two (2)-inch AWWA operating nut. All moving parts of the valve and operators shall be enclosed in the housing to prevent contact with the soil.
- C. Electric Operators:
 1. The operators shall be power-actuating devices in accordance with AWWA C540 and as specified herein. Manufacturer shall provide certified drawings and affidavit of compliance as specified in AWWA C540.
 2. Actuators shall be furnished and sized by the valve supplier for service shown and shall be factory mounted. They shall be sized to produce 1-1/2 times the required operating torque, but the stall torque of the motor shall not exceed the torque capacity of the valve.
 3. Motors shall be sized for continuous duty. Actuators shall operate the valve from fully closed to fully open or the reverse in ten (10) to sixty (60) seconds.
 4. Actuators shall be permanently lubricated at the factory. Gear train shall be self locking.
 5. Actuator controls shall be integral, operating one hundred-twenty (120)-volt, single-phase, sixty (60)-Hz ac power. Actuators shall be furnished

VALVES AND ACCESSORIES

with integral manual override. Actuator shall be furnished with integral manual travel stops and adjustable limit switches.

6. Enclosures shall be NEMA 4 Watertight. (Hard anodized aluminum with epoxy coating preferred).
7. Actuators for quarter-turn valves shall be Raymond Control Systems MAR Series with worm gear drive, Limitorque Ly Series, Rotorque, Auma, or equal.

2.5 ACCESSORIES

- A. Tagging: Each valve shall be provided with a 1½-inch minimum diameter heavy brass or stainless steel tag. The tags shall be attached to the valve with key rings so that ring and tag cannot be removed. The numbers and letters shall be of block type, with ¼-inch high numbers and letters stamped thereon.
- B. Valve Boxes: Valve boxes shall be cast iron two (2) piece adjustable heavy roadway type with 5 ¼ inch diameter and appropriate length for the installation. Include cast iron lid with the work "Water" cast into the top of the lid. Extension pieces, if required, shall be the manufacturer's standard type.
- C. T-Handled Operating Wrenches: Provide one (1) galvanized and/or painted operating wrench, four (4) feet total length, Mueller No. A-24610, Clow No. F-2520, or equal.
- D. Floor Stands and Extension Stems: When required by the installations, floor stands and extension stems shall be provided for operation of valves. Floor stands shall be of the rising stem, indicating type, complete with all necessary steel extensions stems, couplings, handwheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Stem guides shall be spaced so that the stem L/R ratio does not exceed two-hundred (200). Provide all necessary anchor bolts in Type 316 stainless steel. Floor stands shall be cast iron base type, as manufactured by Clow Corporation; Mueller Company, or equal. All handwheels shall turn counterclockwise to open the valves.

2.6 BUTTERFLY VALVES

- A. Conform to AWWA Standard C-504, latest revision, unless otherwise specified.
- B. Conform to UL classification in accordance with ANSI/NSF Standard 61.
- C. Working pressure of 250 psi.
- D. Suitable for two-way flow.
 1. Capable of withstanding bi-directional hydrostatic test pressure of 250 psi without leaking.

VALVES AND ACCESSORIES

- E. Ductile iron valve body per ASTM A 536, Grade 65-45-12.
- F. Flanged body ends, ANSI B-16.1, Class 125, for all exposed locations and all valves larger than 48".
- G. Provide mechanical joint ends, AWWA C-111, for buried valves 48" and smaller.
- H. Furnish disc of ductile iron per ASTM A 536, Grade 65-45-12.
- I. Resilient seats to be synthetic rubber, BUNA-N.
 - 1. 3"-20": Mold and vulcanize to the valve body.
 - a. Provide integral shaft seal to protect the bearings and packing from line debris.
 - 2. 24" and larger: Retain within a dovetail groove in the body and lock in place by an epoxy compound wedge.
 - a. Compression between the seat and disc edge to be adjustable from both the upstream and downstream side of the valve disc.
 - b. Seat to be field replaceable without disassembly of the disc and shaft.
- J. Shafts to be one piece, turned, ground and polished.
 - 1. Construct of ASTM A 564 Type 630 stainless steel.
- K. Valve bearings:
 - 1. Teflon lined.
 - 2. Non-metallic fiberglass composite backing.
 - 3. Permanently lubricated.
- L. Attach the disc securely to the shaft:
 - 1. 3"-12": Utilize a field replaceable 17-4 PH stainless steel torque screw.
 - 2. 14"-18": Utilize a 17-4 PH stainless steel tangential pin locked in place with a setscrew.
 - 3. 20" and larger: Utilize 17-4 PH stainless steel taper pins.
- M. Shaft seals shall consist of non-adjustable self-compensation V-type packing with a minimum of four sealing rings.
- N. Provide stainless steel fasteners on valve and actuator.

VALVES AND ACCESSORIES

- O. Valve painting to conform to AWWA C-504, latest revision, unless otherwise specified.
- P. Fully line the interior of the body and each valve 3"-20" with synthetic rubber.
 - 1. Vulcanize to the body.
 - 2. Line mechanical joint valve to point of pipe insertion.
- Q. Butterfly valves to be DeZurik, Pratt, or equal.

2.7 AIR SERVICE BUTTERFLY VALVES

- A. Provide with single flange lug style body suitable for use with ANSI 125 or 150 pound flanges.
 - 1. Provide ductile iron body valves with bi-directional drip-tight shutoff up to the full valve rating of 200 psi.
 - 2. Provide shaft seals and three heavy duty aluminum bronze self-lubricated bearings.
 - 3. Provide reinforced resilient type Viton seats suitable for air service at 250°F continuous and 300°F intermittent.
 - 4. Seats shall fully line the valve body and be permanently bonded. Use of separate flange seals shall not be used.
 - 5. Provide one piece Type 316 stainless steel shaft finish ground with shaft diameter as per 75B standard from AWWA Spec C-504-87.
 - 6. Provide Type 316 stainless steel disc with splined disc to shaft connections.
- B. Provide Sartell Valves & Controls Model BOS.

2.8 CHECK VALVES

- A. Valves, 3" and larger:
 - 1. Provide valve body of a one-piece casting, globe pattern, constructed of ASTM A126 Class B cast iron with minimum strength of 30,000 psi.
 - 2. Provide flanged end connections per ANSI B16.1.

VALVES AND ACCESSORIES

3. Provide full pipeline flow area with disc at 23° open position, and allow for a minimum of 60° total disc travel.
4. Provide a circular flanged cover of adequate size to permit field inspection, maintenance, and/or replacement of all internal valve components.
5. Design working pressures to 250 psi.
6. Body seat:
 - a. Material to be Type 316 stainless steel.
 - b. Design seat to permit field replacement.
7. Disc construction:
 - a. Construct of ASTM A126 Class B cast iron with minimum strength of 30,000 psi.
 - b. Provide disc with resilient seat ring for tight shut-off.
 - 1) Disc seat ring shall be of BUNA-N.
 - 2) Attach disc seat ring to disc by means of 18-8 stainless steel follower ring and 18-8 stainless steel fasteners.
 - 3) Design disc seat ring to permit field replacement.
 - c. Attach disc to disc arm by means of a single attachment point.
 - 1) Attachment design shall permit a controlled amount of disc articulation to provide uniform compression of disc seat ring under any pressure condition, up to the maximum working pressure.
 - 2) Rotation of the disc around the attachment point shall not be permitted.
 - d. Construct disc arm of one-piece, ductile iron casting with minimum strength of 60,000 psi.
8. Shaft construction:
 - a. Construct of non-hardened, Type 316 stainless steel.
 - 1) Hardened stainless steel or chrome-plated steel shafts shall not be permitted.
 - b. Support shaft in the body by solid bronze bearings mounted in the valve body.
 - 1) Locate shaft and bearings completely out of flowpath through valve.
 - 2) Bearing material shall be UNS C93200 bronze, with minimum strength of 20,000 psi.
 - 3) Bearing/shaft design shall provide sufficient bearing area to prevent bearing wear, deformation, or excessive friction. Use of oil impregnated bearings, grease or oil lubrication, or synthetic bearing materials shall not be permitted.
 - c. Shaft design shall employ stainless steel keys for attachment of disc arm and externally mounted counterweight arm.
 - 1) Use of set screws or clamps shall not be permitted.

VALVES AND ACCESSORIES

- d. Extend shaft through one (1) side of valve body to allow attachment of external counterweight arm and cushion chamber.
- e. Seal shaft where it passes through the valve body by means of an externally adjustable packing gland and Teflon packing.
 - 1) O-ring shaft seals shall not be permitted.
- f. Shaft design shall employ a mechanical locking device for maintaining proper shaft and disc arm alignment within the valve body. The shaft bearings and/or disc arm shall not be used to maintain shaft alignment.

- g. Provide minimum shaft diameters for each size as follows:

<u>Valve Size</u>	<u>Shaft Diameter</u>
2-1/2"	3/4"
3"	3/4"
4"	7/8"
6"	1"
8"	1-1/4"
10"	1-1/4"
12"	1-1/2"
14"	2"
16"	2"
18"	2"
20"	2"
24"	2-3/4"
30"	4"
36"	5"

- 9. Cushion chamber construction:
 - a. Attach a cushion chamber to the exterior of the valve body with mechanical linkage connecting the cushion chamber piston to the valve shaft.
 - b. Construct the cushion chamber cylinder tube and piston of bronze.
 - c. Cushioning shall be accomplished by using air as the cushioning media. Use of hydraulic oil or pre-charged air cylinders shall not be permitted.
 - d. The degree of cushioning shall be easily adjustable.
- 10. Counterweight arm and counterweight construction:
 - a. Attach a single counterweight arm to the valve shaft.
 - b. The counterweight arm shall employ a stainless steel key to prevent rotation around the valve shaft.
 - 1) Use of set screws or clamps to connect the counterweight arm to the valve shaft shall not be permitted.
 - c. The counterweight arm shall be positioned on the shaft to provide the maximum amount of closing force when the valve is in the seated position, and the minimum amount of closing force when the valve is in the open position.
 - d. Sufficient counterweight(s) shall be provided to prevent or minimize slamming of the check valve immediately following shut-

VALVES AND ACCESSORIES

down of the pump.

- 1) The position of the counterweight(s) shall be adjustable on the counterweight arm.
 - 2) The counterweight(s) shall have provision to be locked in-to position on the counterweight arm.
11. Valve shall be completely serviceable in the line, and all internal parts shall be removable through the top cover.
 12. The valve shall be Figure 250-D as manufactured by G.A. Industries, Inc. or Engineer approved equal.

2.9 PLUG VALVES

- A. Provide non-lubricated, eccentric type plug valves having resilient faced plugs, complying with AWWA Standard C517 and other requirements specified herein.
- B. Furnish flanged or mechanical joint end connections as indicated on the Drawings.
 1. Unless otherwise noted on the drawings, all exposed valves shall have flanged end connections and all buried valves shall have mechanical joint end connections.
 2. Flanged ends to be faced and drilled to ANSI 125/150 lb. standard.
- C. Provide valves of bolted bonnet design:
 1. Valves 3" and larger to be designed to allow packing inspection and replacement without removing the bonnet or actuator and the packing shall be adjustable.
 2. Packing to be replaceable with the valve under pressure with valve open or closed with pressure on either side of the plug.
- D. Provide valves capable of drip-tight shutoff up to full rating with pressure in either direction. Pressure ratings shall be 175 psi for 3" through 12 and 150 psi for 14" and larger.
- E. Provide cast iron valve bodies complying with ASTM A 126, Class B and AWWA Standard C517.
- F. Provide one piece plugs cast of ASTM A536 ductile iron.
- G. Open Counterclockwise.
- H. All exposed nuts, bolts, springs, etc. shall be stainless steel on all valves.

VALVES AND ACCESSORIES

- I. Provide minimum 100% full pipe area on sizes 3"-60".
 - 1. Provide rectangular port; round ports are not acceptable.
- J. Provide corrosion resistant seats complying with AWWA Standard C507-73 and AWWA Standard C517.
- K. Provide valves with permanently lubricated, Type 316 stainless steel bearings in the upper and lower plug stem journals.
 - 1. Bearings to comply with AWWA Standard C517.
- L. Provide neoprene plug facings vulcanized to the plug. Plug facing bond strength shall meet test methods as described in ASTM D429 method B (75 psi test).
- M. Plug valves to be DeZurik, Pratt, or equal.

2.10 COMBINATION AIR RELEASE VALVES

- A. Provide single body universal type with compound lever system.
 - 1. Design valve to automatically exhaust large amounts of air and gases while the pipeline or system is being filled.
 - 2. Design valve to release accumulated pockets of air while the pipeline is in operation.
 - 3. Design valve to re-open to admit air during draining or when a negative pressure exists in the system.
- B. Body to be reinforced nylon.
- C. All non-sealing internal metal components shall be 316 stainless steel.
- D. Provide valve with minimum 2" inlet, or larger, if shown on the drawings.
- E. Provide inlet Type 316 stainless steel ball valve with T-handle operator.
- F. All inlet piping, nipples, etc., to be Schedule 40, Type 316L stainless steel.
- H. Provide ARI, Inc. Model SAAR Short Version 0-025.

2.11 STAINLESS STEEL BALL VALVES, 4" AND SMALLER

- A. Provide the following for sizes under 3":

VALVES AND ACCESSORIES

1. Full port Type 316 stainless steel ball valves where indicated on the plans or otherwise specified herein.
2. Lever handle operator. T-handle operator where space does not allow use of lever.
3. Three piece body that is in-line serviceable without removing the valve from the line.
4. Acceptable manufacturers:
 - a. Series "60" as manufactured by Whitey.
 - b. Apollo Series 86A as manufactured by Conbraco.
 - c. V3P-1000 as manufactured by Velan.

2.12 PVC AND CPVC BALL VALVES

- A. Provide true union PVC or CPVC ball valves to match pipe material where shown on the plans.
- B. Provide valves with the following features:
 1. Full port design.
 2. Reversible PTFE seats.
 3. Adjustable seat retainer.
 4. Viton double O-ring stem seals unless indicated otherwise.
 5. Provide stem extension where indicated.
 6. Provide Hayward True Union ball valves or equal.
 7. Valves for hypochlorite service:
 - a. Provide CPVC full port, full flow design.
 - b. Provide upstream vented port.
 - c. Compatible with 15% hypochlorite solution.
 - d. Provide flanged connections with Teflon gaskets.
 - e. Provide "Z-Ball" type Hayward True Union ball valves.

2.13 VALVE BOXES

- A. Provide at each buried valve.
- B. Cast iron extension type, suitable for minimum cover of 3'6" over the pipe.

VALVES AND ACCESSORIES

- C. Minimum inside diameter at the top of 5", minimum riser wall thickness 1/4" and thickness at the top of 11/16".
- D. Have the word "WATER"; "SEWER"; "SLUDGE", etc., as applicable, cast into the cover.
- E. Provide Tyler Series 6850.
- F. Where depth requires more than a two piece box use adjustable cast iron extensions.
- G. Coat box and cover with two (2) shop coats of bitumastic paint.
- H. Provide precast concrete protection ring at each valve box.

2.14 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

- A. Shall be of the size shown on the Drawings and body shall be constructed of bronze for sizes less than 2-1/2" and epoxy coated cast iron for sizes 2-1/2" and larger.
- B. Each unit shall be complete with two companion OS&Y gate (full bore ball) valves equipped with test connections. Valves shall be of similar material as that of the backflow device body, including epoxy coating.
- C. Unit shall be of the manufacture that meets the approval of the authority having jurisdiction.
- D. Acceptable manufacturers shall include Watts Regulator, Hersey, Cla-Val Co. or equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen or remove the nuts and bolts, reset or replace the gasket, retighten and/or reinstall the nuts and bolts, and retest the joints. Joints shall be watertight at test pressures before acceptance.
- B. Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other approved methods. Apply approved joint compound to threads prior to making joints. Joints shall be watertight at test pressures before acceptance.

3.02 PLACING

VALVES AND ACCESSORIES

- A. Generally, unless otherwise indicated on the Drawings, all valves installed in horizontal runs of pipe having center line elevations four (4)-feet six (6)-inches or less above the finish floor shall be installed with their operating stems vertical. Valves installed in horizontal runs of pipe having center line elevations between four (4)-feet six (6)-inches and six (6)-feet nine (9)-inches above the finish floor shall be installed with their operating stems horizontal. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems oriented to facilitate the most practicable operation.

3.03 TESTING

- A. Valves shall be tested at the same time that the adjacent pipeline is tested. Joints shall show no visible leakage under test. Repair joints that show signs of leakage prior to final acceptance. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The Contractor will be held responsible for any damage caused by the testing.
- B. If requested by the Engineer, the valve manufacturer shall furnish an Affidavit stating the materials options furnished and/or that he has complied with these and other referenced Specifications.

END OF SECTION

VALVES AND ACCESSORIES

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements.

1.2 SCOPE

- A. This scope covers the furnishing, installation, testing, adjusting and placing in operation all electrical equipment, devices, facilities, materials, and auxiliary items necessary for the complete and successful operation of all electrical equipment as herein described, shown on the plans, or deemed necessary for the completion of the electrical portion of the project. It is the intent of DIVISION 16 to outline the electrical requirements of the contract in order to provide the information necessary for the construction of a fully operational system as shown on the plans and as herein described. A comprehensive electrical scope of work is as follows:

- 1. Power/Electrical System
- 2. Lighting System
- 3. Control System
- 4. Utility Work
- 5. Connection of Electrically Powered Mechanical Equipment
- 6. Temporary Construction Power
- 7. All Incidentals Necessary for a Complete and Fully Operational Electrical System.

1.3 WORKING CLEARANCES

- A. Working clearances around equipment requiring electrical services shall be verified by Contractor to comply with Code requirements. Should there be apparent violations of clearances; the Contractor shall notify the Engineer before proceeding with connection or placing of equipment.
- B. In the case of panelboards, safety switches and other equipment requiring wire and cable terminations, the Contractor shall ascertain that lug sizes and wiring

BASIC ELECTRICAL REQUIREMENTS

gutters or space allowed for proper accommodation and termination of the wires and cables are adequate.

1.4 WORKMANSHIP

- A. Workmanship under this Division shall be accomplished by persons skilled in the performance of the required task. All work shall be done in keeping with conventions of the trade. Work of this Division shall be closely coordinated with work of other trades to avoid conflict and interference.

1.5 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Electrical equipment shall be protected by the weather, especially from water dripping or splashing upon it, at all times during shipment, storage and after installation. Should any apparatus be subjected to possible injury by water, it shall be thoroughly dried out and put through a dielectric test, at the expense of the contractor, to ascertain the suitability of this apparatus. The results of the test shall be submitted to the Engineer and if the apparatus is found to be unsuitable, the contractor shall replace it without additional cost to the Owner.

1.6 UTILITIES

- A. The electrical contractor shall install a fully operational electrical service as described in the plans.
- B. Arrange with the utility company for the services and install the services in accordance with their requirements, regulations and recommendations.

1.7 GUARANTEE

- A. Contractor shall guarantee all light bulbs. Fluorescent and HID lamps, starters, and ballasts shall be guaranteed for a period of one (1) year after the building is occupied. Incandescent bulbs shall be guaranteed for a period of 30 days after occupancy. Guarantee shall include material and labor for re-lamping.
- B. The Contractor shall guarantee all other electrical systems, materials and workmanship to be free from defects for a period of one (1) year from the date of final acceptance. He shall correct all defects arising within this period upon notification by the Owner or Engineer, without additional compensation.
- C. It is understood that the rights and benefits given the Owner by the guarantees found in the technical specifications are in addition to and not in derogation of any rights or benefits found in the special and general provisions of the contract.

BASIC ELECTRICAL REQUIREMENTS

1.8 TEMPORARY LIGHTS DURING CONSTRUCTION

- A. It shall be the responsibility of the Contractor to provide and maintain adequate temporary lighting at all times during construction, so that the various other trades can accomplish their work in a flawless manner. Particular attention will be given to lighting for masonry, drywall, painting, tile work and any other finish work.

1.9 MATERIAL STANDARDS

- A. Material shall be new and comply with standards of Underwriters' Laboratories, Inc., where standards have been established for the particular product and the various NEMA, ANSI, ASTM, IEEE, AEIC, IPCEA or other publications referenced.

1.10 TEST EQUIPMENT

- A. The contractor shall provide all test equipment and supplies deemed necessary by the Engineer at no extra cost to the Owner. These supplies shall include but not be limited to the following: volt meters, amp meters, light meters, fuel, generator load banks, watt meters, harmonic distortion test equipment, thermal image camera, high pot test equipment, power quality analyzers, and oscilloscopes.

1.11 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSIC2 - National Electrical Safety Code.
- C. NEMA - National Electrical Manufacturer's Assoc.
- D. UL - Underwriters Laboratories
- E. NFPA - National Fire Protection Assoc.
- F. IEEE - The Institute of Electrical and Electronics Engineers
- G. IESNA - The Illuminating Engineering Society of North America
- H. NETA - International Electrical Testing Association
- I. Recommended Standards for Water Works and Wastewater Facilities as published by Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers.

BASIC ELECTRICAL REQUIREMENTS

1.12 SUBMITTAL

A. Submit under provisions of the General Provisions.

1. The Contractor installing all Electrical work shall review and approve all electrical shop drawings prior to submittal to the Engineer for review. As part of the review, the installer shall certify the following:
 - a. I hereby certify that the (equipment (material) (article) shown and marked in this submittal is in compliance with the contract drawing and specifications, can be installed in the allocated space, will be stored in accordance with the manufacturers recommendation, will be installed per NEC, and is submitted for approval.

Certified by: _____ Date: _____

B. Submit shop drawings and product data grouped to include complete submittal of related systems, products, and accessories in a single submittal. No electrical work may be performed until shop drawings are approved. Submit Shop Drawings on the Following Systems as Grouped Below:

1. Power/Electrical System
 - a. Conduit and Conduit Fittings
 - b. Wire
 - c. Pull Boxes
 - d. Panelboards
 - e. Panelboard Layouts
 - f. Circuit Breakers
 - g. Disconnects
 - h. Fuses
 - i. Conduit Support Systems
 - j. Wiring Devices
2. Generator Equipment
 - a. Generator
 - b. Low Voltage Transfer Switches
3. Lighting System
 - a. All Light Fixtures
 - 1) Computer Printout of Lighting Layout
 - 2) Sample Fixture (as directed by Engineer)
 - 3) IES Photometric Files
4. Miscellaneous Electrical Equipment
 - a. Miscellaneous Electrical Parts

BASIC ELECTRICAL REQUIREMENTS

- 5. Drawings
 - a. As-Built Drawings
- C. Mark dimensions and values in units to match those specified.

1.13 REGULATORY REQUIREMENTS

- A. Conform to applicable sections of the Building Code and all local rules, regulations and ordinances.
- B. Electrical: Conform to NFPA 70 & National Electric Safety Code
- C. Obtain permits, and request inspections from authority having jurisdiction.
- D. References listed in Paragraph 1.11, this section.

1.14 FINAL INSPECTION AND TESTING

- A. After the electrical installation is complete, the Contractor shall deliver to the Engineer the following information with his request for final inspection.
 - 1. One set of contract drawings marked to show all significant changes in equipment ratings and locations, alterations in locations of conduit runs, or of any data differing from the contract drawings. This shall include revised or changed panelboard and switchgear schedules.
 - 2. Certificates of final inspection from local authority.
 - 3. A tabulation of all motors listing their respective manufacturer, horsepower, nameplate voltage and current, actual running current after installation and overload heater rating.
- B. The electrical work shall be thoroughly tested to demonstrate that the entire system is in proper working order and in accordance with the plans and specifications. Each motor with its control shall be run as nearly as possible under operating conditions for a sufficient length of time to demonstrate correct alignment, wiring capacity, speed and satisfactory operation. All main switches and circuit breakers shall be operated, but not necessarily at full load. Contractor may be required during final inspection, at the request of the Engineer to furnish test instruments for use during the testing.
- C. All wiring shall be given a megger test using a 1000 Volt megger. This test shall be performed after conductors are pulled, but before final connections are made. The Engineer shall be given two (2) days' written notice of the anticipated test date so that he may witness the test if so desired. In any event, the Contractor shall record the circuit designation and the megger reading on each phase. This written record shall be submitted to the Engineer. The cost of this test or any

BASIC ELECTRICAL REQUIREMENTS

retest caused by insufficient megger readings shall be the responsibility of the Contractor (All tests shall be done in accordance with NETA Standards).

1.15 STAFFING

- A. The electrical contractor shall provide a "Master Electrician" who has been deemed a "Master Electrician" by exam through the State of Florida, or any other Florida County Permitting Authority as the Electrical Superintendent for the project. The Electrical Superintendent shall be on the project site any time any electrical work is performed by the contractor.
- B. In addition, the contractor shall provide one Journeyman electrician for every four electrical helpers used on the project site.

1.16 PROCESS EQUIPMENT

- A. The electrical contractor is required and expected to read all other equipment specifications contained in these documents and provide all required power and control conductors required by said equipment to allow them to function as described.
- B. All equipment for which power is not specifically indicated on the plans shall be provided with power per the NEC to the nearest panelboard, MCC, or switchboard with adequate capacity to serve said equipment as calculated by the NEC.

1.17 AS-BUILT DRAWINGS

- A. The contractor shall provide detailed as-built drawings for the project indicating all power wiring. (All Drawings shall be delivered to the Owner in an AutoCAD 2016 Format.)
- B. The As-Built drawings shall include detailed drawings of all duct banks, underground conduit, above ground conduit, motor control centers, PLC control panels, control drawings. These drawings shall indicate exact location of all underground electrical wiring and fiber optic cable.
- C. The Engineer shall provide electronic copies of all drawings in the bid plans set for use by the contractor.

END OF SECTION

**SECTION 16060
GROUNDING AND BONDING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.
 - 1. Underground distribution grounding.
 - 2. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Ground rods.
 - 2. Ground rings.
 - 3. Grounding arrangements and connections for separately derived systems.
 - 4. Grounding for sensitive electronic equipment.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
 - 1. Instructions for periodic testing and inspection of grounding features at ground rings grounding connections for separately derived systems based on NFPA 70.

GROUNDING AND BONDING

- a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
- b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 1. Pipe Connectors: Clamp type, sized for pipe.

- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type, 1 inch in diameter (length as required to achieve resistance to ground as specified in 3.5, B).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: All conductors shall be stranded.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

GROUNDING AND BONDING

9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

GROUNDING AND BONDING

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building area or item indicated.
 1. Install copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 2. Bury ground ring not less than 24 inches from building foundation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Report measured ground resistances that exceed the following values:

GROUNDING AND BONDING

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 5 ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm.
 5. Substations and Pad-Mounted Equipment: 5 ohms.
 6. Manhole Grounds: 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

**SECTION 16075
ELECTRICAL IDENTIFICATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1, ANSI C2, and ANSI Z635.4.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.
- E. Install all signs and labels horizontal (level) and consistent for similar equipment and panels.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb, minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with snap-around label.
 - 1. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, snap-around, color-coding bands:
 - 1. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
 - 2. Fire Alarm System: Red.
 - 3. Fire-Suppression Supervisory and Control System: Red and yellow.
 - 4. Combined Fire Alarm and Security System: Red and blue.
 - 5. Security System: Blue and yellow.
 - 6. Mechanical and Electrical Supervisory System: Green and blue.
 - 7. Telecommunication System: Green and yellow.
 - 8. Control Wiring: Green and red.

ELECTRICAL IDENTIFICATION

- C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
1. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
1. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
 4. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway. During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches above duct. Use multiple tapes

ELECTRICAL IDENTIFICATION

where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

1. Description:
 - a. Permanent, bright-colored, continuous-printed, polyethylene tape.
 - b. Not less than 6 inches wide by 4 mils thick.
 - c. Compounded for permanent direct-burial service.
 - d. Embedded continuous metallic strip or core.
 - e. Printed legend shall indicate type of underground line.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
 2. Comply with NFPA 70 and 29 CFR 1910.145.
 3. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
 4. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
 5. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
 6. Warning label and sign shall include, but are not limited to, the following legends:
 - a. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

ELECTRICAL IDENTIFICATION

- b. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

I. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with ENGINEER/OWNER APPROVED instructions where needed for system or equipment operation. Instructions are needed for all equipment unless otherwise noted.
 - a. Signs shall be engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - b. The engraved legend shall be 1/2 " White letters on Brown face, and punched or drilled for mechanical fasteners.
 - c. The signs shall be installed with stainless hardware.
2. Emergency Operating Instructions: Install emergency operating instruction signs at equipment used for power transfer, safety shutdown, or any other locations requiring operation in an emergency.
 - a. Signs shall be engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - b. The engraved legend shall be 1/2 " White letters on Red face, and punched or drilled for mechanical fasteners.
 - c. The signs shall be installed with stainless hardware.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
 - a. Indoor and Outdoor Equipment: Use engraved, laminated acrylic or melamine labels, punched or drilled for screw mounting. Identification labels shall have white letters on a dark-gray background. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high. Mount labels with stainless hardware.
 - b. Elevated Components: Increase the size of the labels and letters to those appropriate for viewing from the floor.

ELECTRICAL IDENTIFICATION

2. Equipment to Be Labeled:
 - a. Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.
 - b. Panelboards, electrical cabinets, and enclosures.
 - c. Access doors and panels for concealed electrical items.
 - d. Electrical switchgear and switchboards.
 - e. Transformers.
 - f. Electrical substations.
 - g. Emergency system boxes and enclosures.
 - h. Motor-control centers.
 - i. Disconnect switches.
 - j. Enclosed circuit breakers.
 - k. Motor starters.
 - l. Push-button stations.
 - m. Power transfer equipment.
 - n. Contactors.
 - o. Battery inverter units.
 - p. Battery racks.
 - q. Power-generating units.
 - r. Voice and data cable terminal equipment.
 - s. Television/audio components, racks, and controls.
 - t. Fire-alarm control panel and annunciators.
 - u. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
 - v. Monitoring and control equipment.
 - w. Uninterruptible power supply equipment.
 - x. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
 - y. Control systems
 - z. Field mounted control devices
 - aa. Field mounted instruments

3.2 INSTALLATION PRACTICES

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- D. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

ELECTRICAL IDENTIFICATION

1. Color shall be factory applied or, for sizes LARGER than No. 10 AWG if authorities having jurisdiction permit, field applied.
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- E. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- F. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

END OF SECTION

**SECTION 16120
CONDUCTORS AND CABLES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wires and cables rated 600 V and less.
 - 2. Connectors and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.
- B. Restrictions
 - 1. All wire/cable runs of any type must be continuous. Splices are expressly prohibited.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. Beldon CDT Inc.
 - 4. General Cable Corporation.
 - 5. Senator Wire & Cable Company.
 - 6. Southwire Company.
- C. Copper Conductors: Comply with NEMA WC 70.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types XHHW and SO.
- E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC and Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.

- 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.4 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper, stranded.
- B. Branch Circuits: Copper, stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type XHHW-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type XHHW-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type XHHW-2, single conductors in raceway.
- F. Feeders in Cable Tray: Type XHHW-2, single conductors in raceway.
- G. Exposed Branch Circuits, Including in Crawlspace: Type XHHW-2, single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type XHHW-2, single conductors in raceway.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- J. Branch Circuits Installed below Raised Flooring: Metal-clad cable, Type MC.
- K. Branch Circuits in Cable Tray: Type TC.
- L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- M. All control cables between the PLCs / MMCs and field instruments: 2 # 18 AWG, twisted shielded pair, UL Instrument Cable, XLPE conductor insulation, PVC outer jacket.

CONDUCTORS AND CABLES

- N. Fiber Optics Cable: Fiber optics cable shall be 62.5/125 micron 12-fiber (unless note 4-fiber on Drawings), loose-tube outdoor, with dry block altos LST. Fiber optics cable shall be Siecor 012KS4-14130A20 or equal as approved by Engineer.
- O. Fiber Optics Connectors: Fiber optics connectors shall be Siecor ST UNICAM type with ceramic tip for 62.5/125-micron fiber.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- C. Fiber Terminations: All fiber optics terminations shall be the responsibility of the Electrical Contractor.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

CONDUCTORS AND CABLES

- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to local codes and the manufacturer's written instructions.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to local codes and the manufacturer's written instructions.
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to local codes and the manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. All Process Equipment.
 - b. Panels/Switchboards/Transformers/Transfer Switches
 - c. Pumps
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. All megger readings using a 1000 V dc megger shall be greater than 50 mega ohms.
 - 4. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

CONDUCTORS AND CABLES

- c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

**SECTION 16135
UNDERGROUND DUCTS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
 - 2. Handholes and boxes.
 - 3. Manholes.

1.3 DEFINITION

- A. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Duct-bank materials, including separators and miscellaneous components.
 - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Accessories for manholes, handholes, boxes, and other utility structures.
 - 4. Warning tape.
 - 5. Warning planks.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.

UNDERGROUND DUCTS

2. Reinforcement details.
 3. Frame and cover design and manhole frame support rings.
 4. Ladder/Step details.
 5. Grounding details.
 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 7. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
1. Duct entry provisions, including locations and duct sizes.
 2. Cover design.
 3. Grounding details.
 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- D. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 2. Drawings shall be signed and sealed by a qualified professional engineer.
- E. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.
- F. Qualification Data: For professional engineer and testing agency.
- G. Source quality-control test reports.
- H. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store non-metallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify the Engineer, Construction Manager, and Owner no fewer than 5 days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without the Engineer's written permission.

1.8 COORDINATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Engineer.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 10% percent of quantity of each item installed.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following or Engineer approved equal:
 - 1. ARNCO Corp.
 - 2. Beck Manufacturing.
 - 3. Cantex, Inc.
 - 4. CertainTeed Corp.; Pipe & Plastics Group.
 - 5. Condux International, Inc.
 - 6. ElecSys, Inc.
 - 7. Electri-Flex Company.
 - 8. IPEX Inc.

UNDERGROUND DUCTS

9. Lamson & Sessions; Carlon Electrical Products.
 10. Manhattan/CDT; a division of Cable Design Technologies.
 11. Spiraduct/AFC Cable Systems, Inc.
- D. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- E. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-60-PVC and Type DB-80-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- F. Duct Accessories:
1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
 2. Warning Tape: Underground-line warning tape specified in Division 16 Section "Electrical Identification."
 3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
 - a. Color: Red dye added to concrete during batching.
 - b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carder Concrete Products.
 2. Christy Concrete Products.
 3. Elmhurst-Chicago Stone Co.
 4. Oldcastle Precast Group.

UNDERGROUND DUCTS

5. Riverton Concrete Products; a division of Cretex Companies, Inc.
 6. Utility Concrete Products, LLC.
 7. Utility Vault Co.
 8. Wausau Tile, Inc.
- C. Comply with ASTM C 858 for design and manufacturing processes.
- D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
 4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "ELECTRICAL." Or "CONTROL"
 7. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension shall provide increased depth of 12 inches.
 - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

UNDERGROUND DUCTS

9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size shall match fittings to duct or conduit to be terminated.
 - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
11. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.4 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Description: Comply with SCTE 77.
 1. Color: Gray.
 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, "ELECTRICAL." Or "CONTROL."
 6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

UNDERGROUND DUCTS

7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.
 - d. NewBasis.
 - e. Quazite
- C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.

UNDERGROUND DUCTS

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
 - a. Carson Industries LLC.
 - b. Christy Concrete Products.
 - c. Nordic Fiberglass, Inc.
- E. High-Density Plastic Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be plastic.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
 - a. Carson Industries LLC.
 - b. Nordic Fiberglass, Inc.
 - c. PenCell Plastics.

2.5 PRECAST MANHOLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carder Concrete Products.
 2. Christy Concrete Products.
 3. Oldcastle Precast Group.
 4. Riverton Concrete Products; a division of Cretex Companies, Inc.
 5. Utility Vault Co.

UNDERGROUND DUCTS

- C. Coordinate first paragraph below with Drawings.
- D. Comply with ASTM C 858, and with interlocking mating sections, complete with accessories, hardware, and features.
 - 1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
 - 2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size shall match fittings to duct or conduit to be terminated.
 - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.
- E. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.
- F. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.6 CAST-IN-PLACE MANHOLES

- A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.
- B. Materials: Comply with ASTM C 858 and with Division 3 Section "Cast-in Place Concrete."
- C. Structural Design Loading: As specified in Part 3 "Underground Enclosure Application" Article.

2.7 UTILITY STRUCTURE ACCESSORIES

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

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bilco Company (The).
 - 2. Campbell Foundry Company.
 - 3. Carder Concrete Products.
 - 4. Christy Concrete Products.
 - 5. East Jordan Iron Works, Inc.
 - 6. Elmhurst-Chicago Stone Co.
 - 7. McKinley Iron Works, Inc.
 - 8. Neenah Foundry Company.
 - 9. NewBasis.
 - 10. Oldcastle Precast Group.
 - 11. Osburn Associates, Inc.
 - 12. Pennsylvania Insert Corporation.
 - 13. Riverton Concrete Products; a division of Cretex Companies, Inc.
 - 14. Strongwell Corporation; Lenoir City Division.
 - 15. Underground Devices, Inc.
 - 16. Utility Concrete Products, LLC.
 - 17. Utility Vault Co.
 - 18. Wausau Tile, Inc.

UNDERGROUND DUCTS

- C. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29 inches.
 - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
 2. Cover Legend: Cast in. Selected to suit system.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
 3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.
- D. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.
- E. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- diameter eye, and 1-by-4-inch bolt.
1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.
- F. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- diameter eye, rated 2500-lbf minimum tension.
- G. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.
- H. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

UNDERGROUND DUCTS

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.
- I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
- J. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.
1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
 2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- K. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment.
 2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.
- L. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 degrees F. Capable of withstanding temperature of 300 degrees F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- M. Fixed Manhole Ladders: Arranged for attachment to wall, and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.
- N. Portable Manhole Ladders: UL-listed, heavy-duty fiberglass specifically designed for portable use for access to electrical manholes. Minimum length

UNDERGROUND DUCTS

shall be equal to distance from deepest manhole floor to grade plus 36 inches. One required.

- O. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

2.8 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by a independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-80-PVC, in concrete-encased duct bank, unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- C. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80-PVC, in direct-buried duct bank, unless otherwise indicated.
- D. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- E. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- F. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC installed in direct-buried duct bank, unless otherwise indicated.

UNDERGROUND DUCTS

- G. Underground Ducts Crossing Paved Paths, Walks, and Driveways, Roadways, and Railroads: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Manholes: Precast concrete.
 - 1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
 - 2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 2 Section "Earthwork," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Sections "Lawns and Grasses" and "Exterior Plants."

UNDERGROUND DUCTS

- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 1 Section "Cutting and Patching."

3.4 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Coordinate design of concrete-encased duct banks approaching building wall penetrations with building structural design to support ducts at wall, without reducing structural or watertight integrity of building. Do not use steel conduit in highly corrosive soils. Coordinate with Drawings.
- F. Sleeves and sleeve seals for conduits penetrating building walls below grade are specified in Division 16 Section "Basic Electrical Materials and Methods."
- G. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 16 Section "Basic Electrical Materials and Methods."

UNDERGROUND DUCTS

- H. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- I. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- J. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
 - 3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
 - 4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - 5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

UNDERGROUND DUCTS

6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

K. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 2 Section "Earthwork" for pipes less than 6 inches in nominal diameter.
4. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during

UNDERGROUND DUCTS

this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."

5. Delete subparagraph below if dimensioned duct sections are shown on Drawings.
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Direct-buried, PVC duct elbows in first subparagraph below are particularly vulnerable to damage by pulling lines when cable pulling tensions are high. Rigid steel conduit elbows are sometimes specified for these stub-ups to prevent such damage. However, concrete encasement of PVC duct elbows, together with reduced pulling tensions, is also used in these situations. Pulling tensions can be reduced by making duct runs from the closest manhole or handhole as short as possible and arranging duct banks so stub-up elbows have the longest possible radius. 5-inch (125-mm) duct elbows are available in standard radii of 24, 36, 48, and 60 inches (300, 900, 1200, and 1500 mm) and greater. Coordinate with Drawings and see Editing Instruction No. 3 in the Evaluations.
10. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
11. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
12. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an

UNDERGROUND DUCTS

additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

- A. Cast-in-Place Manhole Installation:
1. Finish interior surfaces with a smooth-troweled finish.
 2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
 3. Cast-in-place concrete, formwork, and reinforcement are specified in Division 3 Section "Cast-in-Place Concrete."
- B. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C 891, unless otherwise indicated.
 2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
 3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevations:
1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
 2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
 3. Install handholes with bottom below the frost line.
 4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
 5. Where indicated, cast handhole cover frame integrally with handhole structure.
- D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

UNDERGROUND DUCTS

- E. Manhole Access: Circular opening in manhole roof; sized to match cover size.
 - 1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
 - 2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
 - F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.
 - G. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 7 Section "Bituminous Dampproofing." After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.
 - H. Coordinate paragraph below with Drawings. Delete second option if nonmetallic cable racks are specified.
 - I. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
 - J. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
 - K. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
 - L. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.
- 3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE
- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required

UNDERGROUND DUCTS

for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and traffic ways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 - 1. Concrete: 3000 psi, 28-day strength, complying with Division 3 Section "Cast-in-Place Concrete," with a troweled finish.
 - 2. Dimensions: 10 inches wide by 12 inches deep.

3.7 GROUNDING

- A. Ground underground ducts and utility structures according to Division 16 Section "Grounding and Bonding."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80

UNDERGROUND DUCTS

percent fill of duct. If obstructions are indicated, remove obstructions and retest.

3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 16 Section "Grounding and Bonding."

- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.9 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 16140 WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge suppression units.
 - 4. Isolated-ground receptacles.
 - 5. Snap switches and wall-box dimmers.
 - 6. Wall-switch and exterior occupancy sensors.
 - 7. Communications outlets.
 - 8. Pendant cord-connector devices.
 - 9. Cord and plug sets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain all wiring devices and associated wall plates from a single manufacturer and one source. (No deviation without written permission from the owner and engineer.)
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; CR 5253IG.
 - b. Leviton; 5362-IG.
 - c. Pass & Seymour; IG6300.
 2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; TR8300.
 - b. Hubbell; HBL8300SG.
 - c. Leviton; 8300-SGG.
 - d. Pass & Seymour; 63H.
 3. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Cooper; GF20.
 - 2. Pass & Seymour; 2084.

2.4 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
 - 1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 - 2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- B. Duplex TVSS Convenience Receptacles:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5362BLS.
 - b. Hubbell; HBL5362SA.
 - c. Leviton; 5380.
 - 2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- C. Isolated-Ground, Duplex Convenience Receptacles:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; IG5362BLS.
 - b. Hubbell; IG5362SA.
 - c. Leviton; 5380-IG.
 - 2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green

WIRING DEVICES

grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

- A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Crouse-Hinds.
 - b. EGS/Appleton Electric.
 - c. Killark; a division of Hubbell Inc.

2.6 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - 2. Hubbell; IG2310.
 - a. Leviton; 2310-IG.
 - 3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

WIRING DEVICES

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

- D. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995L.
 - b. Hubbell; HBL1557L.
 - c. Leviton; 1257L.
 - d. Pass & Seymour; 1251L.

2.10 OCCUPANCY SENSORS

- A. Each manufacturer's switch rating is different, but rated design values are generally not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- B. Wall-Switch Sensors:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 6111 for 120 V, 6117 for 277 V.
 - b. Hubbell; WS1277.
 - c. Leviton; ODS 10-ID.
 - d. Pass & Seymour; WS3000.
 - e. Watt Stopper (The); WS-200.

WIRING DEVICES

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..
- C. Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
 - b. Leviton; ODS 15-ID.
 2. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.
- D. Long-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP1600WRP.
 - b. Leviton; ODWWV-IRW.
 - c. Pass & Seymour; WA1001.
 - d. Watt Stopper (The); CX-100.
 2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft..
- E. Long-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATD1600WRP.
 - b. Leviton; ODW12-MRW.
 - c. Watt Stopper (The); DT-200.
 2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft..
- F. Wide-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP120HBRP.
 - b. Leviton; ODWHB-IRW.

- c. Pass & Seymour; HS1001.
 - d. Watt Stopper (The); CX-100-3.
 - 2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft..
- G. Exterior Occupancy Sensors:
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Leviton; PS200-10.
 - b. Watt Stopper (The); EW-100-120.
 - 2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.11 COMMUNICATIONS OUTLETS

- A. Telephone Outlet:
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3560-6.
 - b. Leviton; 40649.
 - 2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.
- B. Combination TV and Telephone Outlet:
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3562.
 - b. Leviton; 40595.
 - 2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.12 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.

WIRING DEVICES

1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.05-inch- thick anodized aluminum.
 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant die-cast aluminum with lockable cover.

2.13 MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Wiremold Company (The).
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: PVC.
- D. Wire: No. 12 AWG.

2.14 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
1. Wiring Devices Connected to Normal Power System: As selected by Engineer, unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. TVSS Devices: Blue.
 4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

WIRING DEVICES

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

WIRING DEVICES

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- F. Recommendation in subparagraph below is made in IEEE 602.
- G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- H. Coordinate two paragraphs below with Drawings.
- I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- J. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 16 Section "Electrical Identification."

WIRING DEVICES

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with [black] [white] [red]-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 16150 ELECTRIC MOTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and poly-phase electric motors for use in the water and waste water environment

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

1.4 REFERENCES

- A. ANSI/AFBMA 9-1990, Load Ratings and Fatigue Life for Ball Bearings
- B. ASTM B117-90, Test Method of Salt Spray (Fog) Testing
- C. IEEE Standard 85-1973, IEEE Standard Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery
- D. IEEE Standard 112-1991, IEEE Standard Test Procedure for Polyphase Induction Motor and Generators
- E. IEEE Standard 841-1994, IEEE Standard for Petroleum and Chemical Industry - Severe Duty
- F. NEMA MG 13 -1984, Frame Assignments for Alternating Current Integral Horsepower Induction Motors

- G. NEMA MG 1-1993, Motors and Generators

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 DESIGN STANDARDS

- A. Motors shall be 3 phase induction machines rated continuous duty at 60 HZ, single voltage with across-the-line full voltage start, unless otherwise noted. Dual voltage motors are acceptable only for 230/460 volts.
- B. Production AC motors are available in 56 through 5811 frames at speeds of 3600, 1800, 1200, and 900RPM.
- C. Stock AC motors are available in 56T through 447T frames 1-200HP at speeds of 3600, 1800 and 1200RPM, 480 Volt designs.
- D. Motors comply with the frame size assignments of NEMA MG 13-1984.
 - 1. Any motors that require special modifications, such as "TZ" shafts or special "D" flanges shall be noted clearly in the submittals with spare recommendations from the manufacturer.
 - 2. All motors that are not standard NEMA 1964 re-rate "T" frame motors shall be factory painted blue with pink conduit boxes attached to be clearly identified to the owner. At installation, the Contractor shall paint the motors to the Owners choice of color.
- E. NO IEC MOTORS WILL BE ALLOWED.
- F. Motor manufacturer shall be an active member of NEMA.
- G. Motor manufacturer shall have experience in the design and manufacture of similar products for a minimum of 10 years. Buy-out or private labeled motors are not acceptable.
- H. All fractional to 2 HP direct current (DC) motors shall be either permanent magnet or shunt wound design with a constant torque speed range or 20:1

- I. Acceptable motor manufacturers will be US Motors, General Electric, Reliance or engineer approved equal.

2.3 ENCLOSURES

- A. All vertical motors shall be NEMA Weather Protected type 1 unless located with 10 feet of a process treatment unit. Vertical motors located within 10 feet of a process treatment unit shall be TEFC, Mill & Chemical or Corro-duty rated.
- B. All general purpose horizontal motors for outdoor operation or location in hostile environments shall be TEFC and meet specification IEEE 841.
- C. All general purpose horizontal motors for indoor operation in a clean environment shall be open drip-proof enclosure.
- D. All motors in hazardous locations shall be Division One explosion proof, as defined by UL, meeting the Class and Group as required by the hazard.

2.4 SERVICE CONDITIONS

- A. Motor are suitable for continuous duty operation without de-rating under the following service conditions:
 - 1. Exposure to ambient temperatures from -25C to 40C
 - 2. Exposure to altitudes up to 1000meters (3300feet)
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor. Motors may be constant or variable torque as required to meet the conditions of the load being serviced.
- C. Suitable for use in indoor or outdoor applications involving severe duty conditions such as high humidity or chemical laden, corrosive or salty atmospheres.
- D. Motors are capable of successfully accelerating inertia loads equal to what is specified in section 12.54 of NEMA MG 1-1193. 4.4 Variable Frequency Drive (VFD) or Full voltage, across-the-line starting.

2.5 ELECTRICAL DESIGNS

- A. Motors shall be NEMA Design B as defined in section 1.17.1.2 of NEMA MG 1-1993, unless specifically noted requiring different motor curves.

ELECTRIC MOTORS

- B. Motors shall operate successfully at rated load under the combinations of voltage and frequency variations specified in section 12.44 of NEMA MG 1-1993.
- C. Motors shall operate successfully under running conditions at rated load and frequency when voltage unbalance at the motor terminals does not exceed 1%.
- D. Motors shall be premium efficient designs that exceed the efficiency values in Table 1 of IEEE Standard 841-1994. Efficiency testing is done in accordance with IEEE standard 112-1991, subclause 6.4 Method B. The nominal efficiency, $\frac{3}{4}$ load efficiency and guaranteed minimum efficiency, are stamped on the motor's nameplate.
- E. Motors shall utilize a non-hygroscopic, chemical and humidity resistant insulation system. The thermal rating of the system is Class F as defined in section 1.66 on NEMA MG1-1993.
- F. The stator windings for 1-200HP and under 600 volts are random or form wound with copper wire utilizing inverter grade insulation system that meets and exceeds NEMA MG1-1993 Part 31.
- G. Stator is double dipped and baked in varnish to form a heavy build that exceeds the test criteria of moisture resistance per NEMA MG-1.
- H. When operated at rated horsepower, voltage and frequency, the temperature rise of the stator winding does not exceed 80C when measured by winding resistance.
- I. Motors shall utilize the inverter grade insulation system which consists of at a minimum Class F or better insulation materials with additional phase insulating material, extra end-turn bracing and Class H spike resistant wire. The resultant system shall withstand 2000 volt transients without premature motor failure and have no cable limitations in motor application.
- J. Motors shall operate successfully under inverter running conditions at rated load with variation in the voltage or the frequency not exceeding the following conditions:
 - 1. +/-10% rated voltage at rated constant volts/hertz ratio except for specific torque boost situations.
 - 2. Motors shall operate successfully under running conditions at rated load and volts/hertz ratio when the voltage unbalance at the motor terminals does not exceed one percent.
- K. Inverter Operating Characteristics - With rated volts/hertz ratio applied, motor performance shall be as follows for critical operating characteristics:

ELECTRIC MOTORS

1. Torque - Motors shall meet or exceed the minimum locked rotor (starting) and breakdown torque specified in NEMA Standard MG1 Part 12 for Design B for the rating specified when on sine wave power.
 2. Currents -Maximum overload current shall be 150% of nameplate for 60 seconds or 175% for 3 seconds.
- L. Motors shall be rated for a 1.15 service factor on sine wave power and 1.0 service factor on VFD power in a 40C ambient.

2.6 MECHANICAL DESIGN

- A. Motors are equipped with ball bearings have AFBMA C/3 clearances and shall be the same size on both ends (with exception of 440T frame - minimum 6318 on Drive end bearing).
- B. Bearings are re-greasable without disassembling the fan or fan cover and provide for the elimination of purged grease through fittings extending beyond the fan cover. Polyurea thickened grease shall be supplied.
- C. Inner bearing caps are provided for bearing retention and to prevent harmful amounts of lubricant from entering the motor interior.
- D. For direct coupled motors, stabilized bearing temperature shall not exceed a temperature rise of 45C for 4 and 6 pole motors and a maximum temperature rise of 50C for 2 pole motors as measured by a thermocouple on the surface of the bearing house.
- E. Bearings provide for an L-10 life of 200,000 hours per ANSI/AFBMA 9-1990 based on NEMA belting application limits per NEMA MG1-1993, section 14.41.
- F. Enclosures have a degree of protection IP55 (per NEMA MG1-1993 part 5). Bearing isolators are provided on all 143 to 5811 'T' frame motors to minimize entrance of moisture and contaminants into the bearing chamber. Motors shall be capable of field retrofit of an opposite drive end endshield bearing isolator.
- G. Condensation drain holes are provided at the low points in the end brackets and are supplied with corrosion resistant, breather drain plugs.
- H. Frame, brackets, fan cover and conduit box are a minimum of grade 25 cast iron.
- I. Rotor cage construction shall be of cast aluminum. The maximum permissible shaft runout at the end of the shaft extension of the assembled motor shall be:
 1. 0.875" to 1.625" diameter inclusive TIR < 0.001 6.10.2 Over 1.626" to 6.50" diameter, TIR,0.0015 (ball bearing) and , 0.002 (roller bearing)

ELECTRIC MOTORS

- J. Motor mounting feet, when placed on a flat granite surface, shall not exceed 0.005" between the granite surface and the motor feet at each mounting bolt hole.
- K. A drilled and tapped hole is provided in the motor frame on the same side as the conduit box for grounding purposes. Motor frame feet are flat within 0.005 inch as an assembled unit.
- L. Ventilating fans are of non-sparking conductive plastic material. Most ratings use bi-directional fans. On ratings where uni-directional fans are used, the rotation of the fan is indicated by a permanent label on the outside of the motor.
- M. Conduit box is diagonally split, rotatable in 90 degree increments, and twice the volume as specified in Section 11.06.2 of NEMA MG1-1993. A ground lug is provided in the box. Gaskets are provided between the conduit box and frame and between conduit box base and cover providing a moisture resistant barrier.
- N. Shouldered eyebolts with a minimum safety factor of 10 are provided for motor lifting.
- O. All fastening hardware is hex-head bolts or socket head cap screws with a grade 5, zinc/cadmium plating.
- P. Motor cast iron components are oxide primed and painted with vinyl phenolic paint to surpass 250-hour salt spray test per ASTM B117-90.
- Q. Motor nameplate is stainless steel and secured with 4 stainless steel drive pins. Nameplates are capable of meeting 720-hour salt spray test per ASTM B117-90. Each nameplate contains the following information in addition to that noted in section 10.40 of NEMA MG1-1993.
 - 1. AFBMA bearing ID
 - 2. Manufacture date code
 - 3. Compliance with IEEE Standard 841-1994
 - 4. Motor weight
 - 5. Guaranteed minimum efficiency
 - 6. Maximum space heater surface C temperature, if provided, when operating at rated voltage in a 40C ambient
 - 7. Balance
 - 8. NEMA MG1 Part 31

- R. Machined frame to endshield joints are protected by an application of 2 part epoxy before assembly.

2.7 AIRBORNE SOUND

- A. Motor sound power level when measured at a no load condition shall not exceed 90 dBA when determined in accordance with IEEE Standard 85-1973.

2.8 VIBRATION

- A. Motor vibration measured in any direction on the bearing housing meets the levels listed below when tested per section 12.08 of NEMA MG1-1993:
 - 1. Unfiltered vibration at rated voltage and frequency does not exceed 0.08 in/s peak velocity for 2, 4 and 6 pole motors and .06 in/s peak velocity for 8 pole motors.
 - 2. Filtered vibration does not exceed 0.05 in/s peak velocity at a frequency of 2f (twice line frequency)
 - 3. Unfiltered axial vibration does not exceed 0.06 in/s peak velocity on bearing housing (does not apply to roller bearings)

2.9 ACCESSORIES

- A. Winding thermostats shall be in each phase of the motor. There shall be one per phase, NC, connected in series with leads terminating in the auxiliary outlet box.
- B. Grounding provisions shall be in the main terminal box.
- C. For vertical hollow shaft motors, a ball-type non-reversing ratchet shall be provided to prevent back-spin of the pump and motor. Maximum reverse rotation shall be limited to 5 degrees or arc.
- D. Stabilizing bushings shall be provided on all vertical hollow shaft motors applied to pumps with mechanical seals. All 3600RPM hollow shaft motors shall be provided with stabilizing bushings.
- E. Motors 20HP and above shall be started on soft starts or variable frequency drives.
- F. Each motor over 20HP shall be equipped with a suitably sized space heater to prevent condensation from forming while the motor is not running. The space heater shall be 120V, single phase.
- G. All motors shall be provided with suitable coupling for connection to mechanical loads.

2.10 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Capacitor start, inductor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION

3.1 PRODUCTION TESTS

- A. The following tests are performed on all motors:
 - 1. Measurement of winding resistance
 - 2. No load readings of current, power, and speed at rated voltage and frequency
 - 3. Mechanical vibration check as described in 8.1, using either elastic or rigid mount
 - 4. High potential test in accordance with section 12.03 of NEMA MG1-1993
- B. The following test information is recorded and inserted in the motors' conduit box.
 - 1. Winding Resistance
 - 2. No load current, voltage and speed
 - 3. The following five unfiltered vibration readings, measured as described in 8.1: drive end (horizontal, vertical, and axial) and opposite drive end (horizontal and vertical)

3.2 WARRANTY

- A. Motor components shall have a full five year performance warranty on sine wave power and three year warranty on inverter power.
- B. The contractor shall be fully responsible for proper storage of motors prior to placing in service in accordance with the manufacturers' recommendations and instructions. Any problem with motors at start up due to mishandling or by not adhering to the manufacturers' recommendations for storage will be the sole responsibility of the contractor. All costs to repair the motors due to any mishandling or improper storage will be at no cost to the owner, the supplier, or the manufacturer of the motor, but shall be entirely the responsibility of the contractor.

END OF SECTION

SECTION 16289
SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes SPDs for low-voltage power, control, and communication equipment.
- B. Related Sections include the following:
 - 1. Division 16 Section "Wiring Devices" for devices with integral SPDs.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. SPD: Surge Protection Device.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
 - 1. UL 1283.
 - 2. UL 1449.
- C. Coordinate paragraph below with qualification requirements in Division 1 Section "Quality Requirements" and as supplemented in "Quality Assurance" Article.
- D. Field quality-control test reports, including the following:

TRANSIENT VOLTAGE SUPPRESSION

1. Test procedures used.
 2. Test results that comply with requirements.
 3. Failed test results and corrective action taken to achieve requirements.
- E. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- E. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- F. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Engineer's written permission.

TRANSIENT VOLTAGE SUPPRESSION

- B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, noncondensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

1.7 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.
- B. Coordinate surge protection devices with Division 16 Section "Electrical Power Monitoring and Control."

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Protection Technologies, Inc.
 - 2. Current Technology, Inc.
 - 3. Leviton Mfg. Company Inc.

TRANSIENT VOLTAGE SUPPRESSION

4. Liebert Corporation; a division of Emerson.
5. Square D; Schneider Electric.
6. Surge Suppression Incorporated.
7. Cuttler-Hammer

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
 1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts per phase rated at 5 A and 250-V ac, for remote monitoring of protection status. (Contacts shall be connected in either series or parallel as required to provide a single input to the plant control system.)
- B. Peak Single-Impulse Surge Current Rating: 300 kA per phase.
- C. Connection Means: Permanently wired.
- D. Protection modes and UL 1449 SVR for delta circuits with voltages of 480V, 3-phase, 3-wire circuits shall be as follows:
 1. Line to Line: 1500 V for 480V.
 2. Line to Ground: 1000 V for 480V.

2.3 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
 1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.

TRANSIENT VOLTAGE SUPPRESSION

- B. Peak Single-Impulse Surge Current Rating: 50 kA per phase.
- C. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
 - 1. Line to Neutral: 400 V for 208Y/120.
 - 2. Line to Ground: 400 V for 208Y/120.
 - 3. Neutral to Ground: 400 V for 208Y/120.
- D. Protection modes and UL 1449 SVR for delta circuits with voltages of 480V, 3-phase, 3-wire circuits shall be as follows:
 - 1. Line to Line: 1500 V for 480V.
 - 2. Line to Ground: 800 V for 480V.

2.4 PLUG-IN SURGE SUPPRESSORS

- A. Description: Non-modular, plug-in suppressors with at least four 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacles, suitable to plug into a NEMA WD 6, Configuration 15-15R receptacle; with the following features and accessories:
 - 1. LED indicator lights for power and protection status.
 - 2. LED indicator lights for reverse polarity and open outlet ground.
 - 3. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
- B. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
- C. Protection modes and UL 1449 SVR shall be as follows:
 - 1. Line to Neutral: 475 V.
 - 2. Line to Ground: 475 V.
 - 3. Neutral to Ground: 475 V.

2.5 ENCLOSURES

- A. Interior enclosures to be NEMA 1.
- B. Exterior enclosures to be NEMA 4X, Stainless Steel.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at each service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for each panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 - 1. Comply with manufacturer's written recommendation for conductor and circuit-breaker size for connecting SPD devices to distribution system. Match circuit-breaker size to conductor size. Coordinate with Drawings.
 - 2. Provide multipole, circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service entrance equipment, panelboards, control terminals, and data terminals to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation, including connections, and to assist in field testing. Report results in writing.
 - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. Testing: Perform the following field tests and inspections and prepare test reports:
 - 1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Complete startup checks according to manufacturer's written instructions.
 - 3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

TRANSIENT VOLTAGE SUPPRESSION

C. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 1 for training requirements.

END OF SECTION

TRANSIENT VOLTAGE SUPPRESSION

SECTION 16410
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Molded-case circuit breakers (MCCBs).
 - 5. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. First two paragraphs below are defined in Division 1 Section "Submittal Procedures" as "Action Submittals."
- B. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- C. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.
- D. Remaining paragraphs are defined in Division 1 Section "Submittal Procedures" as "Informational Submittals."
- E. Coordinate first paragraph below with qualification requirements in Division 1 Section "Quality Requirements" and as supplemented in "Quality Assurance" Article.
- F. Manufacturer's field service report.
- G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1.6 PROJECT CONDITIONS

- A. Specify unusual environmental or service conditions in first paragraph below. For equipment installed outdoors, indicate maximum and minimum ambient temperature and expected humidity range. For additional ambient compensation requirements for fuses, see Editing Instruction No.5 in the Evaluations.
- B. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2010 m).
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Engineer no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Engineer's written permission.
 - 4. Comply with NFPA 70E.

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Siemens
 - 2. Square D
 - 3. Allen-Bradley
 - 4. Cutler-Hammer
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Siemens
 2. Square D
 3. Allen-Bradley
 4. Cutler-Hammer
- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 RECEPTACLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Hubble
- B. Type 4, IP66 Rated, Twist lock, amp rated, combination safety switch and receptacle.
- C. Receptacle: Twist lock, three-phase, four-wire or five-wire receptacle (one wire connected to enclosure ground lug).

2.4 MOLDED-CASE CIRCUIT BREAKERS.

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following (all switches to be manufactured by the same manufacturer as the motor control centers used on the project):
 1. Cutler-Hammer
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. Instantaneous trip.
 2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I²t response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor. (Provide only when shown on the single line, or required by code)
 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact. (Provide when indicated on drawing)
 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay. (Provide when indicated on drawings)
 7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts. (Provide when indicated on drawing)

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped. (Provide when indicated on drawing)
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position. (Provide when indicated on drawing)

2.5 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 4X stainless steel.
 3. Corrosion Areas: NEMA 250, Type 4X fiberglass.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X stainless steel.
 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 4X stainless steel

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

3.3 IDENTIFICATION

- A. Comply with requirements in Division 16 Section "Electrical Identification."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 - D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
 - E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- 3.5 ADJUSTING
- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
 - B. Set field-adjustable circuit-breaker trip ranges as specified in Division 16 Section "Overcurrent Protective Device Coordination".

END OF SECTION

SECTION 16461
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.
 - 2. Buck-boost transformers.

1.3 SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- C. Qualification Data: For testing agency.
- D. Source quality-control test reports.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

LOW VOLTAGE TRANSFORMERS

1.4 QUALITY ASSURANCE

- A. If an independent testing agency is required, see Division 1 Section "Quality Requirements" for general testing and inspecting agency qualification requirements. If additional control is needed, retain one of first two paragraphs below to specify 29 CFR 1910.7 or other more specific criteria (e.g., NETA). 29 CFR 1910.7 defines a nationally recognized testing laboratory as it applies to testing and inspecting for safety, and lists, labels, or accepts equipment and materials that meet certain OSHA criteria.
- B. Retain first paragraph and subparagraph below if Contractor selects testing agency.
- C. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

LOW VOLTAGE TRANSFORMERS

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 3. Square D; Schneider Electric.
 - 4. Siemens

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Interior Noncorrosive Area Enclosures: Ventilated, NEMA 250, Type 2.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Exterior/Interior Corrosive Area Enclosures: Totally enclosed, nonventilated, NEMA 250, Type 4X, stainless steel.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: ANSI 49 gray.
- F. Taps for Transformers Smaller Than 3 kVA: None.

LOW VOLTAGE TRANSFORMERS

- G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- I. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- J. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 2. Tested according to NEMA TP 2.
- K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 2. Indicate value of K-factor on transformer nameplate.
- L. Wall Brackets: Manufacturer's standard brackets.
- M. Fungus Proofing: Permanent fungicidal treatment for coil and core.
- N. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.4 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
- B. Enclosure: Ventilated, NEMA 250, Type 2.
 - 1. Finish Color: ANSI 49 gray.

2.5 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section "Electrical Identification."

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 16 Section "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

LOW VOLTAGE TRANSFORMERS

- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
 - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 16491
FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers, and motor-control centers.
 - 2. Spare-fuse cabinets.

1.3 SUBMITTALS

- A. First paragraph below is defined in Division 1 Section "Submittal Procedures" as an "Action Submittal."
- B. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

5. Coordination charts and tables and related data.
 6. Fuse sizes for elevator feeders and elevator disconnect switches.
- C. Paragraph below is defined in Division 1 Section "Submittal Procedures" as an "Informational Submittal."
- D. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
1. Ambient temperature adjustment information.
 2. Current-limitation curves for fuses with current-limiting characteristics.
 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull. (Install in the Admin. Building as directed)
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse, where applicable, from fuse manufacturer.

5. Include in the cabinet a complete list of fuses used in the facility. (include: size, type, model, rating, quantity, and location)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses (provide fuse type indicated below unless otherwise shown on Drawings or required by breaker coordination study):
 1. Service Entrance: Class T, fast acting.
 2. Feeders: Class RK1, time delay.
 3. Motor Branch Circuits: Class RK5, time delay.
 4. Other Branch Circuits: Class RK5, time delay.
 5. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

FUSES

- A. Install labels complying with requirements for identification specified in Division 16 Section "Electrical Identification" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 16910 CONTROL PANEL CONSTRUCTION

PART 1 - GENERAL

1.1 SCOPE

- A. The Supplier shall furnish, test, and startup all furnished electrical control panels and control system components related to their furnished equipment.
- B. Specifically included are the following control panels:
 - 1. All Process Equipment (Vendor Supplied) Control Panels

1.2 SUBMITTALS

- A. Product Data: For each type of product supplied. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- C. Additional Shop Drawing Requirements:
 - 1. Point - to - Point Wiring Drawings.
 - 2. Process Loop Drawings
 - 3. Fabrication and nameplate legend drawings
 - 4. Internal wiring schematic and layout drawings
 - 5. Systems schematic drawings illustrating all components being supplied complete with electrical interconnections.
 - 6. Computer Input/Output lists and a written description of the control strategy

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CONTROL PANELS

- A. All control panes shall be constructed in accordance with the following standards: National Electrical Manufacturers Association (NEMA), Institute of Electrical and Electronics Engineers (IEEE), Underwriter Laboratories (UL),

CONTROL PANEL CONSTRUCTION

Nation Fire Protection Association (NFPA), and Instrumentation Systems and Automation Society (ISA)

- B. All control panels shall be constructed in a UL approved production facility and bear all applicable UL labels for panel construction (i.e. UL508A, etc.).
- C. The completed panel shall be factory tested prior to shipment. Field installation by the Contractor shall consist only of setting the panel in place and making necessary pneumatic and/or electrical connections.
- D. All control panels shall be designed to operate at the service voltage as indicated in the project plans.

2.2 CONTROL PANEL ENCLOSURES

- A. Unless otherwise noted, all control panels shall be NEMA 4X construction with a 3-point steel latching mechanism and padlocking stainless steel handles. Latch rods to have rollers for easier door closing. Enclosures shall be manufactured by Hoffman or engineer approved equal.
- B. All control panels and associated hardware shall be constructed of 316L 14 gauge stainless-steel unless otherwise noted on the Drawings.
- C. All interior components shall be mounted with stainless steel hardware and shall be clearly identified with plastic identification nametags. The tags shall be white with black lettering.
- D. Door shall be provided with heavy gauge stainless steel hinges.
- E. Control panels shall also include a 10 gauge mild steel sub-panel mounted on collar studs for equipment mounting.
- F. All control panel seams shall be continuously welded and ground smooth.
- G. Data pockets shall be provided on all interior panel doors. The equipment supplier shall provide laminated schematics in each pocket for the associated control panel.
- H. All cabinets shall be sized to accommodate the equipment required plus 25% spare space.

2.3 CONTROL PANEL COOLING REQUIREMENTS

Sun shields shall be supplied as required to keep the equipment mounted inside the control panels operating within the manufacturers operating temperature requirements.

CONTROL PANEL CONSTRUCTION

- A. All exterior control panels designed for exterior mounting shall be provided with equipment rated for 60° Celsius or provided with air conditioners.

2.4 PLC EQUIPMENT (NOT APPLICABLE FOR THIS PROJECT)

- A. Unless otherwise noted, all control panels that perform logic or control functions shall be provided with a Programmable Logic Controller (PLC). For vendor supplied process control panels the PLC shall be an Allen Bradley Micrologix 1400. The Main and Effluent control panels shall be supplied with Allen Bradley 1769 CompactLogix 5370 series PLCs capable of running firmware version 20 and later.
- B. All Programmable Logic Controllers shall be provided with removable memory modules or SD cards.
- C. Control panels shall be supplied with all communication equipment to facilitate interconnection and integration into the plant control system network.
- D. Vendor supplied control panels shall be supplied with Allen Bradley 1762 Micrologix I/O. The Main and Effluent control panels shall be supplied with Allen Bradley 1769 CompactLogix I/O.
- E. The PLC power supply shall be sized to provide 25% spare capacity.
- F. All PLC units shall be provided with battery backup. All exterior control panels shall be provided with a battery back-up system that consists of a power supply, DCUPS, and sealed re-chargeable batteries. The use of an off the shelf UPS shall not be considered acceptable.
- G. Each vendor supplied control panel shall be provided with a Human Machine Interface (HMI) that allows the operator to control and monitor the status of the devices connected/controlled by the associated control panel in the event that push button operators (lights and switches) can't provide the necessary monitoring and control capabilities. The operator interface shall be mounted on the panel exterior and shall be provided with a NEMA 4X window kit to provide protection from the elements when not in use. The Human Machine Interface shall be provided with Touch functions and an Ethernet communication module. The Human Machine Interface shall be Allen-Bradley Panelview Component or Panelview Plus series or engineer approved equal. All HMI devices shall be configured to use screensavers with a 5-minute delay.
- H. Each control panel shall be supplied with a DIN rail mounted industrial Ethernet switch with fiber optic connections (if necessary) to allow connection of the control panel to the control system network (the connector styles shall be coordinated by the system integrator). The industrial Ethernet switches shall be manufactured by Allen Bradley, Ntron or engineered approved equal. All switches shall be provided with at least two spare RJ-45 Ethernet ports.

CONTROL PANEL CONSTRUCTION

2.5 PLC / HMI PROGRAMMING (NOT APPLICABLE FOR THIS PROJECT)

- A. All PLC / HMI script/code shall be supplied to the Owner with fully descriptive instruction and comments.
- B. The control panel manufacture shall provide the Owner with a flow chart of all PLC code as well as a written algorithm of the codes functions.
- C. The Engineer will define the graphic standards to be used for all HMI equipment. The control panel manufactures shall assume that all control screens will be custom.
- D. The control panel manufacture shall provide the Owner with all tag addressing and I/O mapping of all process variables in the PLC.
- E. All PLC code shall be the property of the Owner.
- F. The Contractor shall provide three copies of all commented PLC, HMI, and Operator Interface code/script/screen layouts to the Owner in electronic format prior to acceptance by the Owner. Any documentation not containing symbol information or comments will not be considered acceptable.

2.6 CONTROL PANEL WIRING

- A. Wiring, where required, shall be general-purpose open type, neatly bundled and laced or installed in plastic wiring troughs. Wire shall be stranded No. 16 AWG minimum, with thermoplastic insulation rated for 600V and 90 degrees C.
- B. All equipment mounting backboards shall be provided with nonmetallic slotted ducts. All nonmetallic slotted ducts shall have spare space equal to 40% of the depth of the duct.
- C. Wiring colors shall be as follows:
 - 1. All ungrounded AC conductors operating at the supply voltage shall be "Black"
 - 2. All grounded AC current carrying conductors shall be "White"
 - 3. All ground conductors shall be "Green"
 - 4. All ungrounded AC control conductors operating at a voltage less than or equal to the supply shall be "Red"
 - 5. All ungrounded DC control conductors shall be "Orange"

CONTROL PANEL CONSTRUCTION

6. All grounded DC control conductors shall be "Brown"
 7. All intrinsically safe circuits shall be "Blue"
 8. A wiring color code legend shall be mounted inside the control panel door.
- D. All wires entering and leaving all panels shall be terminated at barrier type terminal strips with integral surge protection. All terminals shall be identified and labeled per the Owner's standard naming conventions. It shall be the Supplier's responsibility to coordinate with the Owner for the accepted naming conventions. (All terminal strips shall be designed for #12 AWG, XHHW-2, 90 degree C field wiring for terminations.)
- E. No terminal strip may be located closer than 8" from any side or bottom of the control panel. This is designed to allow for adequate wire bending radius for field terminations.
- F. All wiring shall be clearly marked with an identification number consistent with the wiring schematic.
- G. Devices mounted on the enclosure door or interior dead front panel shall be run in spiral wrap to avoid pinch points when opening and closing the enclosure door(s) or interior panels

2.7 SURGE PROTECTION

- A. All power and digital I/O signals shall be protected from surges at the control panel with suitable surge suppression devices. Panel mounted surge protection shall be Plug in Style & DIN rail mounted to allow for easy replacement. The power and digital I/O signals shall be protected with solid state surge suppression devices manufactured by Phoenix Contact or Engineer approved equal. MOV only type surge suppression is not acceptable.
- B. All analog I/O signals shall be protected by loop powered isolators manufactured by Phoenix Contact or Engineer approved equal.
- C. All incoming power to the control panel shall be protected by Phoenix Contacts "Trabtech" surge protectors or Engineered approved equal rated for the voltage being supplied. Protection shall be provided for all phase and neutral conductors.

2.8 PANEL MOUNTED DEVICES

- A. Indicating lights to be heavy duty, push-to-test type, oil tight, industrial type with integral transformer for 120 VAC applications. Lenses shall be colored as noted on drawings or as required by the equipment manufacturers if not

CONTROL PANEL CONSTRUCTION

specified on the drawings. Legend plates shall be factory engraved as required. Pilot lights shall be Allen-Bradley Bulletin 800T 30.5mm or approved equal.

- B. Momentary pushbuttons to be heavy duty, oil tight, industrial type with full guard and momentary contact rated at 10 Amps continuous at 120 VAC. Legend plates shall be factory engraved as required. Pushbutton shall be Allen-Bradley Bulletin 800T 30.5mm or approved equal.
- C. Selector switches, on/off and H.O.A. to be heavy duty, oil tight, industrial type with contact rated at 120 VAC, 10 amps continuous service. Legend plates shall be factory engraved as required. Switches shall be Allen-Bradley Bulletin 800T 30.5mm or approved equal.
- D. Current to voltage converters, 4-20mA_{dc} to 1-5V_{dc} shall be as manufactured by Phoenix Contact or Engineer approved equal.
- E. D.C. power supplies shall be as manufactured by PLC Manufacturer, PULS, or approved equal and shall be sized for 1.5 times the application requirements. (No open power supplies will be allowed.)
- F. All relays shall be Potter Brumfield or engineer approved equal based on the application requirements for switching and ampacity. Units shall incorporate a lamp in parallel with relay coil.
- G. All circuit breakers shall be of the same AIC rating as the panel or MCC to which they are connected, and shall be required to selectively coordinate above 0.1 seconds.
- H. All motor starters shall be manufactured by the manufacturer of the MCC equipment. All starters shall be NEMA rated (no IEC devices). All motor speed controllers shall have the following capabilities: remote start/stop, status output, running output, and remote speed.
- I. All reduced voltage starters shall be manufactured by the provider of the power distribution equipment (size/type as required) to match the reduced voltage starters installed in the Motor Control Centers.
- J. All variable frequency drives shall be manufactured by the provider of the power distribution equipment (size/type as required) to match the variable frequency drives installed in the Motor Control Centers.
- K. H-O-A selector switches are required for each motor starter contained within a control panel. All adjustable speed controllers shall be provided with manual speed adjustment devices (separate from any HMI or Operator Interface Panel), which may be located on the face of the enclosure. H-O-A selector switches and manual speed switches shall allow the operator to control all motors and valves manually in the event of a PLC failure.

CONTROL PANEL CONSTRUCTION

- L. Runtimes for each motor starter located in the control panel shall be tracked in the PLC and displayed on the HMI.
- M. Power distribution blocks shall be block style distribution blocks manufactured by Mersen or Engineer approved equal. All distribution blocks shall be provided with polycarbonate safety covers to provide dead front protection. The safety cover shall have a test prod hole for testing purposes.
- N. Fuse blocks/holders shall be UL style fuse blocks manufactured by Mersen or Engineer approved equal.
- O. General purpose fuses shall be Mersen UL Power Fuse style or Engineer approved equal. Unless otherwise noted the fuse rating and type shall be determined based on the equipment (which the fuse is protecting) manufacturer's recommendations for overcurrent protection.
- P. Semiconductor fuses shall be Mersen Amp Trap series fuses or Engineer approved equal. Unless otherwise noted the fuse rating and type shall be determined based on the equipment (which the fuse is protecting) manufacturer's recommendations for overcurrent protection.
- Q. All control transformers shall be sized to provide 25% spare capacity. The transformer connections shall be provided with protective covers to guard against accidental contact, and the transformer shall be provided with primary and secondary fusing per the manufacturer's recommendations.
- R. Each control panel shall be provided with a ground fault duplex service receptacle that is accessible from the interior dead-front panel. The service receptacle shall be capable of providing 15A at 125VAC
- S. Each control panel shall be provided with a series connected suppression filter system to protect the programmable logic controller and instrumentation power from high-frequency noise and electrical transients. The suppression filter shall be a current technology LoadGuard or Engineer approved equal.
- T. All intrinsically safe barrier relays shall be UL listed and shall be manufactured by Phoenix Contact or Engineer approved equal.
- U. All circuit breakers shall be manufactured by Square D, Allen Bradley, or Engineer approved equal. A main circuit breaker shall be provided for each control panel.
- V. Pilot lights shall be provided for each starter located inside the control panel. The lights shall be as follows: Green (Run), Red (Off), Amber (Fault).

CONTROL PANEL CONSTRUCTION

- W. Control power transformers shall be provided in each control panel with a supply voltage other than 120V or 120/208V. Control power transformers shall be manufactured by Allen Bradley and provided with both primary and secondary fuses per the NEC.

2.9 MISCELLANEOUS

- A. Engraved laminated plastic nameplates shall be furnished for each front panel mounted instrument. The Contractor shall coordinate with the Owner for nameplate color and naming conventions. All instruments and components shall be tagged on rear with embossed plastic tape labels.
- B. No pneumatic tubing shall be installed inside the control panels.

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

- A. The Contractor shall coordinate the work of the service personnel during construction, testing, and acceptance of the work.
- B. The Contractor shall receive final approval on all panel, enclosure, and equipment layouts by the Engineer prior to fabrication or installation.

3.2 QUALITY ASSURANCE

- A. All control panels shall be factory tested and certified prior to releasing for shipment. The testing shall consist of but not limited to the following:
 - 1. Point to point testing of all wiring prior to application of power
 - 2. The intended supply voltage shall be applied to the control panel and all components shall be tested for proper operation and calibration.
 - 3. The programmable logic controller and operator interface code shall be loaded, and each shall be tested for functionality.
 - 4. All components shall be checked to confirm that each device has been installed per the plans and specifications as well as the Manufacturer's recommendations.
 - 5. The enclosure shall be inspected for defects and shall be repaired or replaced if necessary.
 - 6. All labeling and identification tags shall be verified and be clean and visible.

CONTROL PANEL CONSTRUCTION

- B. An Electrical Engineer, registered in the state of Florida, shall be required to document the results of the control panel testing. The documentation shall contain the results of the tests listed above as well as any rework items and subsequent repairs that were required prior to shipment. In addition, he/she must certify this document prior to the release for shipment. Prior to shipment all one copy of the applicable documentation shall be placed in the drawing pocket of each enclosure, and three copies shall be sent to the Engineer.

3.3 INSTALLATION

- A. All equipment and devices for the work shall be installed in the locations shown on the drawings, in accordance with the manufacturer's recommendations, and in compliance with the requirements of these specifications.
- B. The Contractor shall be responsible for coordinating the installation of all equipment in the proposed locations with all other trades performing work on the project that may be affected.

3.4 FINAL INSPECTION

- A. Include all changes and/or alterations in the control panels prior to final inspection and acceptance by the owner.
- B. Any changes and/or alterations in the Control Panels shall be reflected/updated in all Control Panel Schematics prior to acceptance by the Owner. This includes all electronic copies delivered to the Owner.

END OF SECTION

CONTROL PANEL CONSTRUCTION

C:\CIVIL 3D PROJECTS\BEASLEY PARK SANITARY SEWER IMPROVEMENTS\DWG\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.
January 16, 2019

BEASLEY PARK GRAVITY SEWER AND FORCE MAIN DRAWINGS

for the

OKALOOSA COUNTY BOARD OF COMMISSIONERS

BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT

OKALOOSA COUNTY
TOURIST DEVELOPMENT COUNCIL

JENNIFER ADAMS, DIRECTOR

COUNTY ADMINISTRATOR

JOHN HOFSTAD

CHAIRMAN

KELLY WINDES (DISTRICT 5)

BOARD MEMBERS

- GRAHAM FOUNTAIN (DISTRICT 1)
- CAROLYN KETCHEL (DISTRICT 2)
- NATHAN BOYLES (DISTRICT 3)
- TREY GOODWIN (DISTRICT 4)

CLERK

J. D. PEACOCK, II

PREPARED FOR



DATE PREPARED:

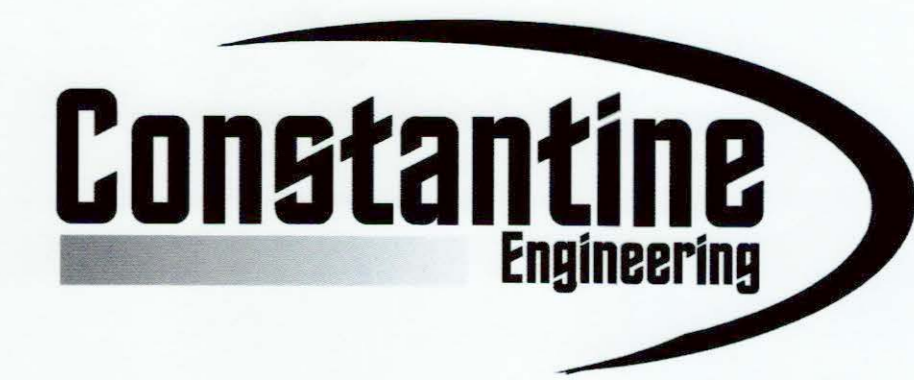
FEBRUARY 2019



VICINITY MAP

FOR BID

PREPARED BY:



1988 LEWIS TURNER BLVD.
FORT WALTON BEACH, FL 32547
PH. 850-244-5800

FOR INFORMATION REGARDING THIS PROJECT, CONTACT:
JOSEPH G. CREWS, P.E. FT. WALTON BEACH, FLORIDA
(850) 244-5800



NO.	DATE	DRAWN BY	CHECKED BY	APPROVED BY
			JPK	JCC
			MSC	

COVER SHEET
BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT



FILE	SEE LEFT
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING	
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	G-0

C:\CIVIL 3D PROJECTS\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
 January 16, 2019
 REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.

OWNER:

OKALOOSA COUNTY WATER & SEWER DEPARTMENT
 1804 LEWIS TURNER BOULEVARD, SUITE 300
 FORT WALTON BEACH, FLORIDA 32547
 PHONE: (850) 651-7171

LEGEND:

- No. OR # = NUMBER
- = DISTANCE NOT TO SCALE
- L.B. = LICENSED BUSINESS
- L.S. = LICENSED SURVEYOR
- P.S.M. = PROFESSIONAL SURVEYOR AND MAPPER
- O.R. = OFFICIAL RECORDS BOOK / PAGE
- P.B. = PLAT BOOK / PAGE
- D.B. = DEED BOOK / PAGE
- ± = MORE OR LESS
- R/W = RIGHT OF WAY
- ID = IDENTIFICATION
- NO ID = NO IDENTIFICATION
- NAD = NORTH AMERICAN DATUM
- NAVD = NORTH AMERICAN VERTICAL DATUM
- INV = INVERT
- (F) = FIELD MEASURED DATA
- (D) = DEED DATA
- (P) = RECORD PLAT DATA
- = WATER METER
- = POWER POLE AND GUY ANCHOR
- = TELEPHONE SERVICE BOX
- = SANITARY SEWER MANHOLE
- = WATER VALVE
- = TELEVISION SERVICE BOX
- = LIGHT POLE
- = ROAD SIGN
- SWR— = SANITARY SEWER PIPE
- TEL— = TELEPHONE CABLE
- UFO— = FIBER-OPTIC CABLE
- ELE— = ELECTRIC CABLE
- GAS— = GAS MAIN
- OHU— = OVERHEAD UTILITIES
- WL— = WATER LINE
- F.M.— = FORCE MAIN
- LAMP POST— = LAMP POST
- = FIBER-OPTIC MARKER

VERTICAL LETTERING HALF TONE — EXISTING FEATURES
 SLANTED LETTERING FULL TONE — PROPOSED FEATURES

INDEX OF SHEETS

DWG NO.	DESCRIPTION
G-0	COVER
G-1	NOTES, INDEX OF SHEETS, SHEET LAYOUT, AND LEGEND
C-1	EXISTING CONDITIONS
C-2	PLAN & PROFILE
M-1	PUMP STATION
M-2	PUMP STATION SECTION
M-3	MECHANICAL DETAILS
E-1	CONTROL PANEL
E-2	WIRING DIAGRAM

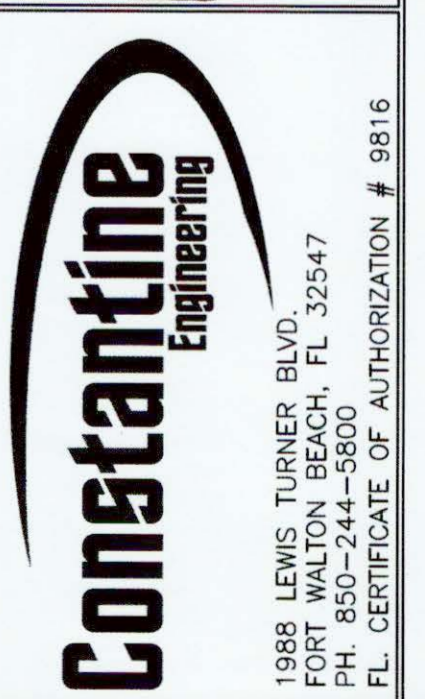
CONSTRUCTION NOTES:

1. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE EXACT LOCATION, SIZE AND MATERIAL OF ANY EXISTING UTILITIES IN THE CONSTRUCTION AREA.
2. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE EXACT LOCATION, SIZE AND MATERIAL OF ANY EXISTING WATER OR SEWER FACILITY PROPOSED FOR CONNECTION OR USE BY THIS PROJECT.
3. ALL CONSTRUCTION OF WATER AND SANITARY SEWER LINES SHALL BE IN ACCORDANCE TO OKALOOSA COUNTY WATER & SEWER DEPARTMENT'S STANDARDS AND SPECIFICATIONS.
4. OKALOOSA COUNTY WATER & SEWER DEPARTMENT SHALL BE NOTIFIED 24 HOURS PRIOR TO ANY CONSTRUCTION, TIE-INS, OR TESTING OF WATER OR SANITARY SEWER LINES. (850-651-7176) IF NO ANSWER LEAVE MESSAGE.
5. DISTURBANCE TO ANY SURVEY MARKERS OR MONUMENTS REQUIRES RE-ESTABLISHMENT BY A LICENSED SURVEYOR AT THE CONTRACTOR'S EXPENSE.
6. CONTRACTOR SHALL CONTACT THE STATE "ONE CALL" CENTER SERVICE IN ORDER TO LOCATE UTILITIES PRIOR TO STARTING ANY EXCAVATION OR CONSTRUCTION. THE LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE AS DETERMINED FROM EXISTING RECORDS.
7. THE CONTRACTOR SHALL COORDINATE THE WORK OF THE UTILITY COMPANIES.
8. THE CONTRACTOR SHALL VERIFY ALL INVERT ELEVATIONS (I.E.) OF ALL EXISTING PIPES BEFORE BEGINNING CONSTRUCTION.
9. ANY DISCREPANCIES, ERRORS, OR OMISSIONS DISCOVERED ON THE PLANS OR IN THE SPECIFICATIONS SHOULD BE NOTED ON THE CONTRACTOR'S PROPOSAL AND DOES NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO CORRECT THE SAME.
10. CLEARING AND GRUBBING SHALL BE COORDINATED WITH OKALOOSA COUNTY WATER AND SEWER TO ENSURE MINIMAL CLEARING.
11. ALL MATERIALS DEEMED SALVAGEABLE BY OKALOOSA COUNTY WATER & SEWER DEPARTMENT ARE THE PROPERTY OF OKALOOSA COUNTY AND WILL BE REMOVED AND STORED ON SITE IN A SECURED AREA DETERMINED DURING CONSTRUCTION BY THE CONTRACTOR, AND OKALOOSA COUNTY WATER & SEWER DEPARTMENT.
12. ALL CONCRETE SHALL BE CLASS "A" TYPE AND HAVE A MINIMUM 28 DAY STRENGTH OF 4000 PSI.
13. EXACT LOCATIONS OF PROPOSED WATER AND SEWER MAINS SHALL BE DETERMINED DURING CONSTRUCTION. FINAL PLACEMENT SHALL BE COORDINATED BY THE CONTRACTOR AND LOCATED IN SUCH A MANNER AS TO NOT CONFLICT WITH OTHER UTILITIES WITHIN THE RIGHT-OF-WAY OR EASEMENTS.
14. THE CONTRACTOR SHALL HAVE A COPY OF ALL PERMITS, INCLUDING FDEP, FDOT, CITY AND OKALOOSA COUNTY.
15. SEWER FORCE MAINS SHALL MAINTAIN A MINIMUM HORIZONTAL SEPARATION FROM EXISTING WATER MAINS AS REQUIRED BY FDEP. EVERY EFFORT SHALL BE MADE TO OBTAIN 12" CLEARANCE FROM THE CROWN OF THE SEWER FORCE MAIN TO THE INVERT OF THE WATER MAIN. THE SEWER MAIN SHALL BE BENEATH THE WATER MAIN.
16. ALL ROAD CUTS SHALL BE OVERLAYED. ASPHALT OVERLAY SHALL BE A MINIMUM OF 1 1/2" THICK COMPACTED TYPE "F" ASPHALT.
17. ALL EXISTING OKALOOSA COUNTY ROAD STRUCTURES SUCH AS STORM MANHOLES, INLET BOXES, DRAINAGE DITCHES, ETC. SHALL BE PRESERVED, ADJUSTED, OR RECONSTRUCTED AS NEEDED IN ORDER TO MAINTAIN CURRENT ACCESSIBILITY, USABILITY, AND CAPACITY.
18. SEWER FORCE MAIN SHALL BE PLACED AS DESCRIBED BY STANDARD ANSI/AWWA C150/A21.50 LAYING CONDITIONS FOR DUCTILE IRON PIPE, TYPE 2 OR CLASS A TRENCH BACKFILL/BEDDING AS SHOWN ON SHEET C11.
19. SEWER FORCE MAIN SHALL BE TESTED IN ACCORDANCE WITH SECTION 9, OKALOOSA COUNTY WATER AND SEWER STANDARD SPECIFICATIONS AND DESIGN MANUAL.
20. COPPER WIRE (12 GAUGE, INSULATED) SHALL BE ATTACHED ALONG TOP OF ALL BURIED SEWER FORCE MAINS AND STUBBED UP INTO ALL VALVE BOXES FOR LOCATING PURPOSES.
21. THERE SHALL BE NO CONNECTION TO EXISTING SANITARY SEWER LINES UNTIL THE PROPOSED SEWER LINE IS INSPECTED AND APPROVED BY THE OKALOOSA COUNTY WATER & SEWER DEPARTMENT.
22. SEWER FORCE MAINS INSTALLED UNDER THIS CONTRACT SHALL HAVE A MINIMUM COVER OF 36 INCHES, UNLESS NOTED OTHERWISE ON THE DRAWING AND EXCEPT WHERE THERE IS A CONFLICT WITH EXISTING OR PROPOSED STRUCTURES. IN THE CASE OF SUCH CONFLICT, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY AND DETERMINE ALL PERTINENT GRADES PRIOR TO INSTALLATION. THE CONTRACTOR SHALL INSURE THAT SUFFICIENT BURIAL DEPTH OF SEWER FORCE MAINS AND APPURTENANCES IS ACHIEVED TO ELIMINATE ANY GRADE OR PLAN CONFLICTS.
23. THE CONTRACTOR IS TO BE AWARE THAT THERE ARE OTHER EXISTING UTILITIES, BOTH ABOVE AND BELOW GROUND ON THIS PROJECT. THE CONTRACTOR IS TO COORDINATE INSTALLATION WITH OTHER UTILITIES.
24. THE CONTRACTOR IS TO BE AWARE THAT IT IS THEIR RESPONSIBILITY FOR CLEARING ALL TREE UNDERGROWTH, ROCKS, AND ANY OTHER OBSTRUCTION THEY MAY ENCOUNTER IN ORDER TO PERFORM THE REQUIRED WORK.
25. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL REPAIR ANY DAMAGES TO OTHER UTILITIES AT NO ADDITIONAL COST TO THE OWNER.
26. THE CONTRACTOR SHALL VERIFY CONNECTIONS WITH THE OWNER PRIOR TO INSTALLATION.
27. ALL BURIED SHUT-OFF VALVES SHALL BE TYPE GV-1 AS SPECIFIED.
28. ALL VALVES SHALL BE PLUG VALVES.
29. PROVIDE PROPRIETARY RESTRAINT AT ALL FITTINGS AS SHOWN.
30. BURIED VALVES SHALL INCLUDE A VALVE BOX, MARKER, AND CONCRETE PAD.
31. ALL FITTINGS AND VALVES SHALL BE DUCTILE IRON MECHANICAL JOINT UNLESS OTHERWISE NOTED.
32. THE IMPLEMENTATION OF BEST MANAGEMENT PRACTICES (BMP'S) FOR EROSION AND SEDIMENT CONTROL IN ACCORDANCE WITH THE EROSION CONTROL AND STORM WATER MANAGEMENT PLAN SHALL BE INSTALLED AND MAINTAINED AT ALL TIMES.
33. CONTRACTOR TO FIELD VERIFY ACTUAL LINE HIGH POINTS LOCATION AND ADJUST AS NECESSARY.
34. FIBER PULL BOXES SHOULD BE INSTALLED IN ACCORDANCE WITH THE LATEST VERSION OF THE FLORIDA DOT STANDARDS.
35. FIBER PULL BOXES SHOULD BE BACKFILLED WITH #57 STONE INSIDE BOX FOR DRAINAGE; WITH THE TOP OF BOX FLUSH WITH FINISHED GRADE.
36. FIBER CONDUIT SHOULD BE RAN UNDER AND UP INTO THE PULL BOXES AND NOT THROUGH THE SIDES.



NO.	DATE	DESIGNED BY:	DRAWN BY:	REVISION	CHECKED BY:	APPROVED BY:
		JGC			JPK	JGC

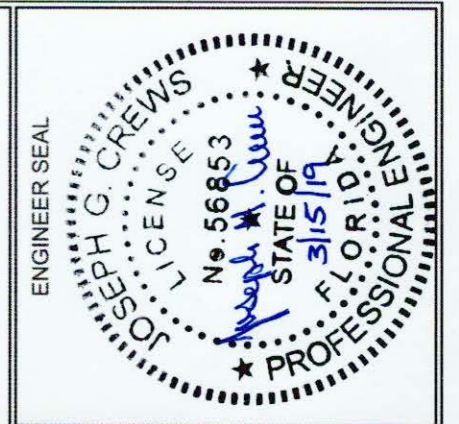
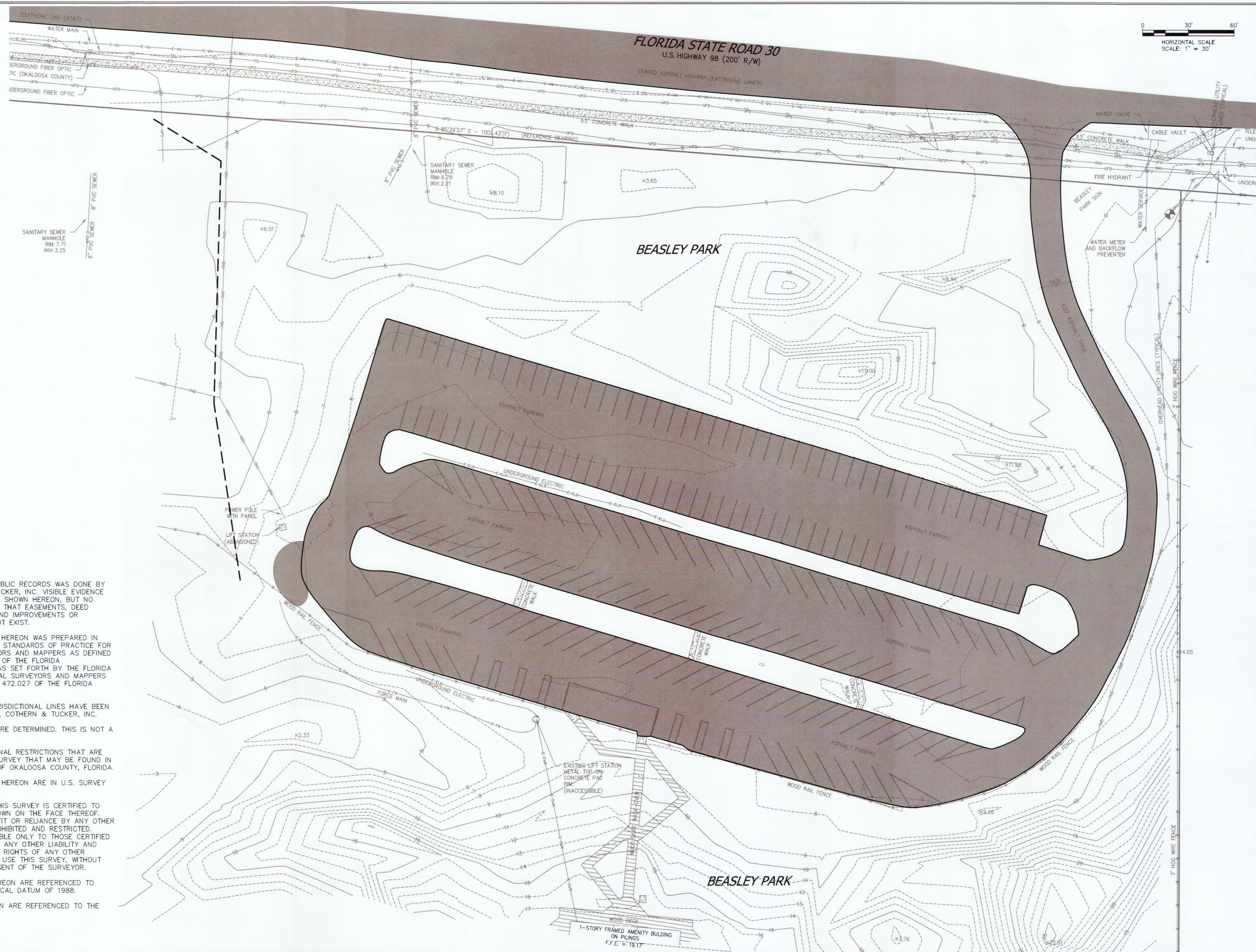
**NOTES, INDEX OF SHEET,
 AND LEGEND**
**BEASLEY PARK SANITARY SEWER
 IMPROVEMENTS PROJECT**



FILE	SEE LEFT
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING	
0 1"	
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	G-1

SURVEY REPORT

1. NO SEARCH OF THE PUBLIC RECORDS WAS DONE BY GUSTIN, COTHERN & TUCKER, INC. VISIBLE EVIDENCE OF EASEMENTS WILL BE SHOWN HEREON, BUT NO CERTIFICATION IS GIVEN THAT EASEMENTS, DEED OVERLAPS, UNDERGROUND IMPROVEMENTS OR APPARENT USES DO NOT EXIST.
2. THIS SURVEY DEPICTED HEREON WAS PREPARED IN ACCORDANCE WITH THE STANDARDS OF PRACTICE FOR PROFESSIONAL SURVEYORS AND MAPPERS AS DEFINED IN CHAPTER 5J-17.051 OF THE FLORIDA ADMINISTRATIVE CODE AS SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS PURSUANT TO SECTION 472.027 OF THE FLORIDA STATUTES.
3. NO ENVIRONMENTAL JURISDICTIONAL LINES HAVE BEEN DETERMINED BY GUSTIN, COTHERN & TUCKER, INC.
4. NO APPARENT USES WERE DETERMINED. THIS IS NOT A BOUNDARY SURVEY.
5. THERE MAY BE ADDITIONAL RESTRICTIONS THAT ARE NOT SHOWN ON THIS SURVEY THAT MAY BE FOUND IN THE PUBLIC RECORDS OF OKALOOSA COUNTY, FLORIDA.
6. THE DISTANCES SHOWN HEREON ARE IN U.S. SURVEY FEET.
7. NOTICE OF LIABILITY: THIS SURVEY IS CERTIFIED TO THOSE INDIVIDUALS SHOWN ON THE FACE THEREOF. ANY OTHER USE, BENEFIT OR RELIANCE BY ANY OTHER PARTY IS STRICTLY PROHIBITED AND RESTRICTED. SURVEYOR IS RESPONSIBLE ONLY TO THOSE CERTIFIED AND HEREBY DISCLAIMS ANY OTHER LIABILITY AND HEREBY RESTRICTS THE RIGHTS OF ANY OTHER INDIVIDUAL OR FIRM TO USE THIS SURVEY, WITHOUT EXPRESS WRITTEN CONSENT OF THE SURVEYOR.
8. ELEVATIONS SHOWN HEREON ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988.
9. BEARING SHOWN HEREON ARE REFERENCED TO THE LINE AS SHOWN ABOVE.



NO. 1 DATE	DESIGNED BY:	JGC
REVISION	CHECKED BY:	JPK
DRAWN BY:	APPROVED BY:	JGC

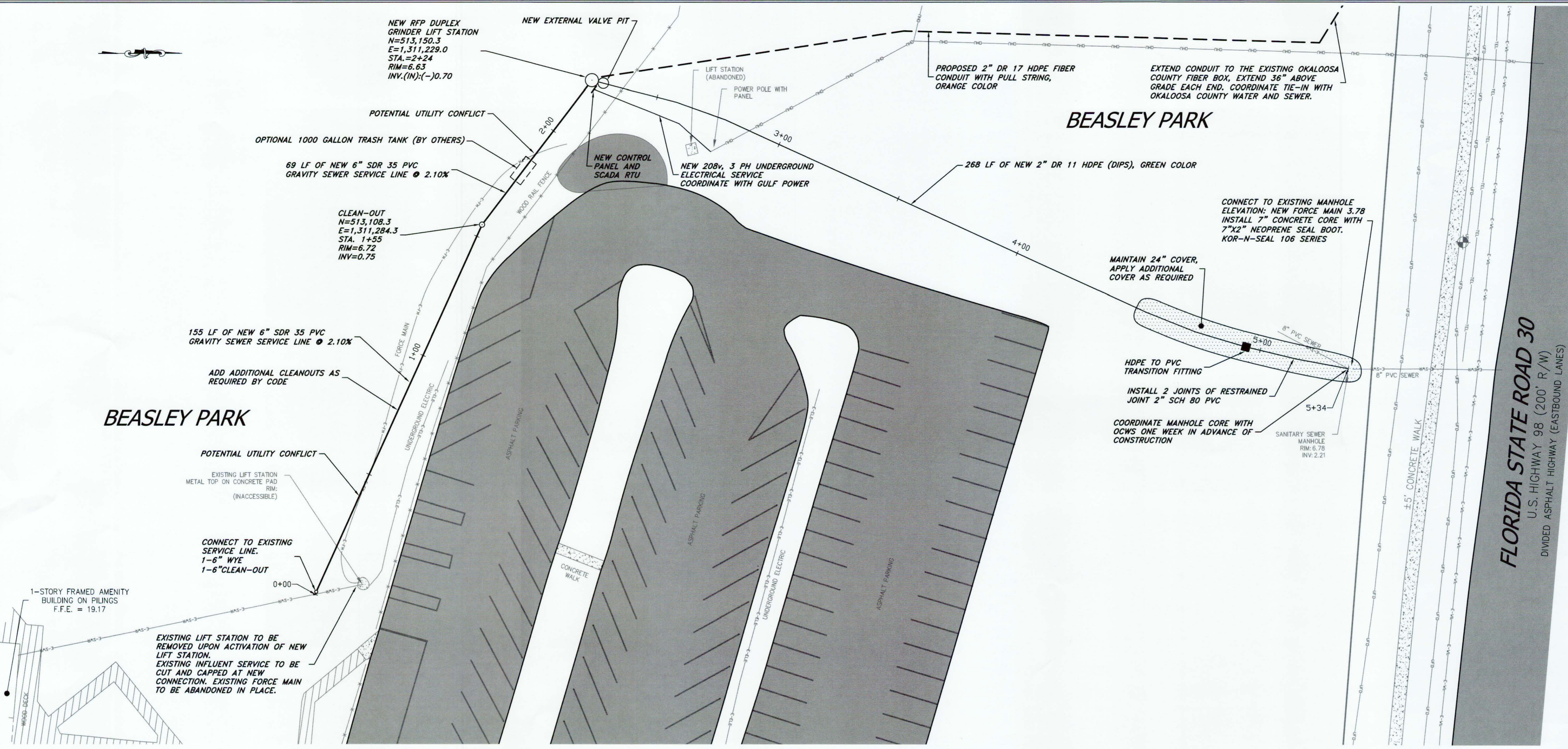
EXISTING CONDITIONS
BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT



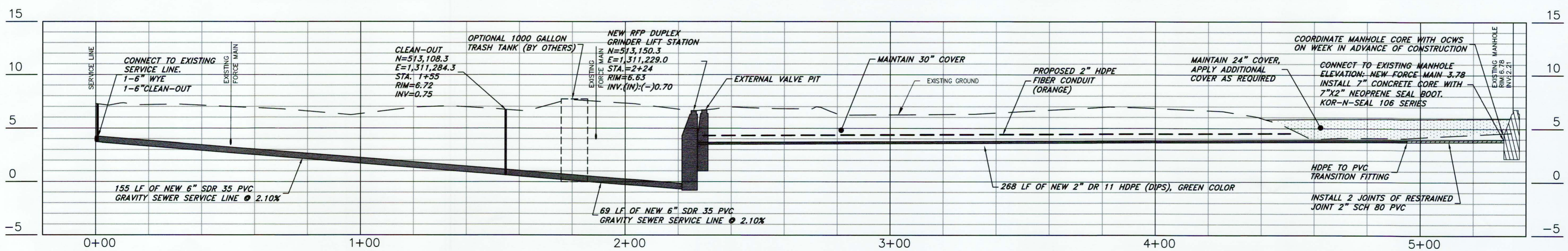
FILE	SEE LEFT
VERIFY SCALE	BAR IS ONE INCH ON ORIGINAL DRAWING
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	C-1

1988 LEWIS TURNER BLVD
FORT WALTON BEACH, FL 32547
PH. 850-244-5800
FL CERTIFICATE OF AUTHORIZATION # 9816

C:\PROJECTS\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
 REUSE OF DOCUMENTS AND THE IDEAS AND DESIGNS INCORPORATED HEREIN AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.
 January 16, 2019



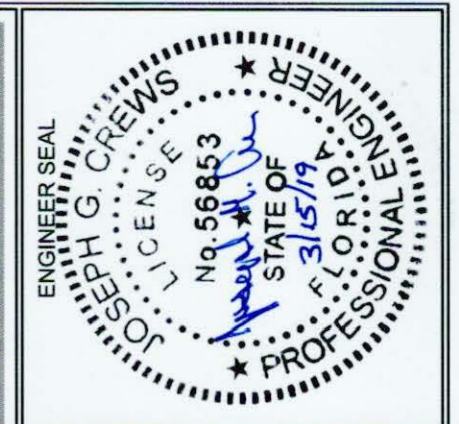
PLAN
SCALE: 1" = 20'



PROFILE
SCALE: VERT. - 1" = 5'
HORIZ. - 1" = 20'

BEASLEY PARK

FLORIDA STATE ROAD 30
U.S. HIGHWAY 98 (200' R/W)
DIVIDED ASPHALT HIGHWAY (EASTBOUND LANES)



NO.	DATE	DESIGNED BY	DRAWN BY	REVISION	CHECKED BY	APPROVED BY

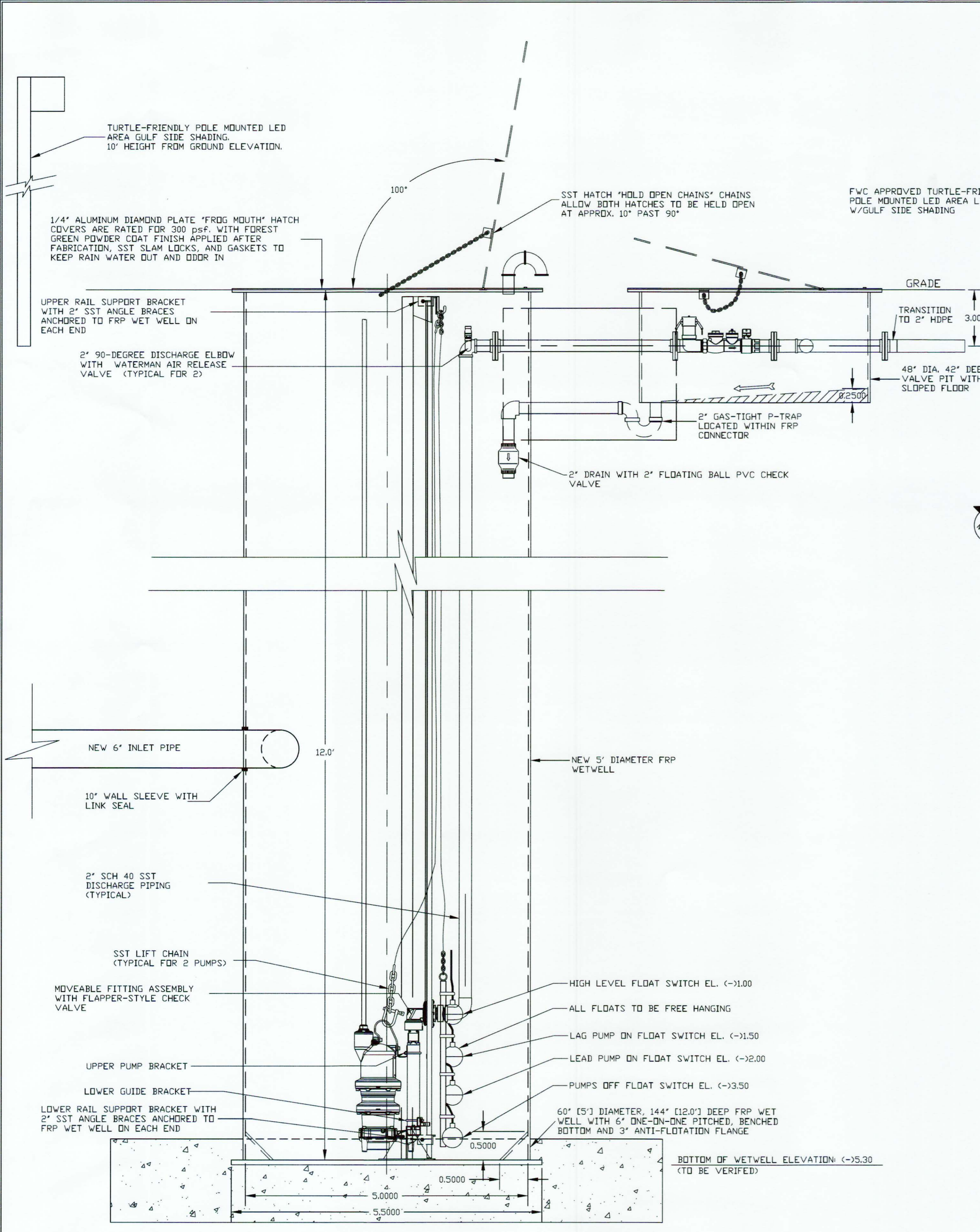
PLAN & PROFILE
BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT



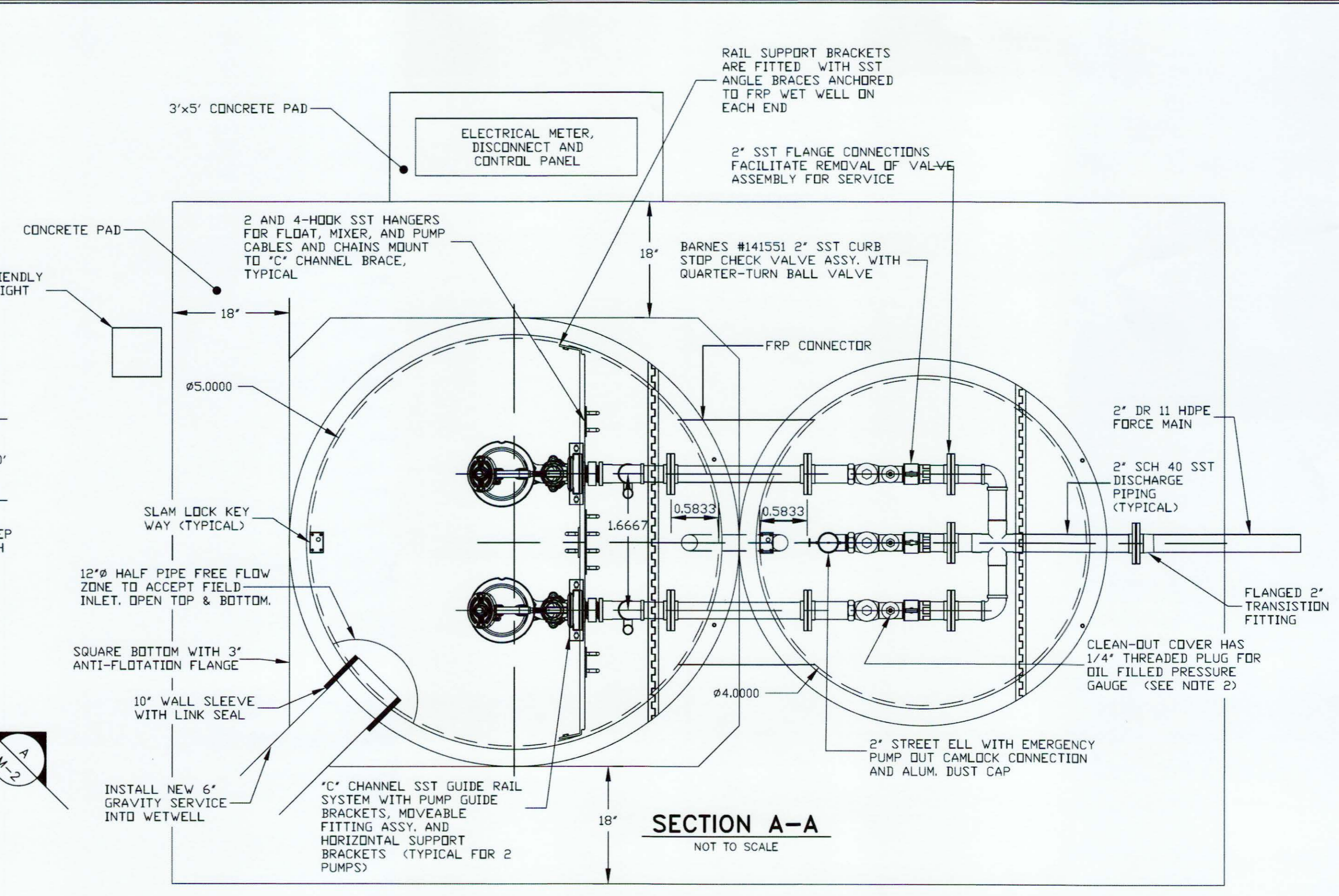
FILE	SEE LEFT
VERIFY SCALE	BAR IS ONE INCH ON ORIGINAL DRAWING
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	C-2

C:\CIVIL 3D PROJECTS\BEASLEY PARK SANITARY SEWER IMPROVEMENTS\DWG\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
 REUSE OF DOCUMENTS, THIS DOCUMENT AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.

January 16, 2019



SECTION B-B
NOT TO SCALE

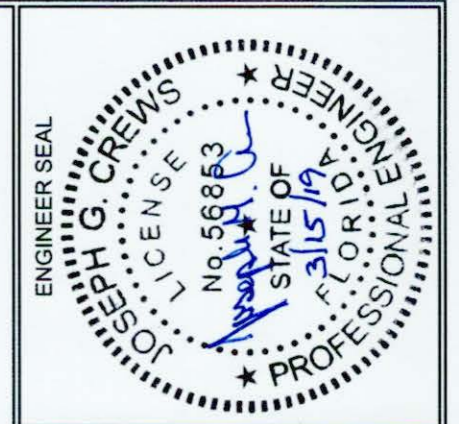


SECTION A-A
NOT TO SCALE

NOTES:

1. ALL MATERIALS AND EQUIPMENT SHALL COMPLY WITH OKALOOSA COUNTY WATER AND SEWER STANDARD SPECIFICATIONS.
2. FRP WETWELL AND VALVE BOX SHALL MEET OR EXCEED ALL APPLICABLE ASTM REQUIREMENTS.
3. CONCRETE BASE AND ANCHORING FOR WETWELL SHALL BE CONSTRUCTED PER MANUFACTURER'S RECOMMENDATION AND SHALL BE SUFFICIENT TO PREVENT FLOTATION OF THE WETWELL FOR A GROUNDWATER ELEVATION EQUAL TO THE WETWELL TOP ELEVATION. PROPOSED DESIGN AND ANTI-FLOTATION CALCULATIONS SHALL BE SUBMITTED TO ENGINEER PRIOR TO CONSTRUCTION.
4. CONTRACTOR SHALL VERIFY THE SIZE OF ALL VALVES, FITTINGS, PIPE, AND APPURTENANCES AND PROVIDE PREFABRICATED VALVE VAULT WITH SUFFICIENT WIDTH, LENGTH, AND DEPTH TO ALLOW THE REQUIRED CLEARANCES AND PERMIT EASY REMOVAL OF CHECK VALVE SPINDLES.

PUMP INFORMATION	PUMP STATION
PUMP STATION	DUPLEX
MANUFACTURER	BARNES/FLYGT
TYPE PUMP	GRINDER (EXPLOSION PROOF)
MODEL NO.	BY MANUFACTURE
SINGLE PUMP CAPACITY	35 GPM/65 FT
IMPELLER SIZE & NO.	4.50 (114 MM)
DISCHARGE SIZE (MIN.)	1.5
HP-RATED RPM	1750-3450
VOLTAGE	208V/3ph/60HZ
MAX. PUMP HORSEPOWER EACH	3.0 HP (NOL)



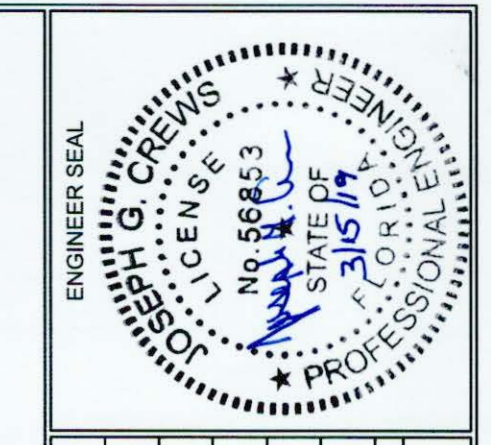
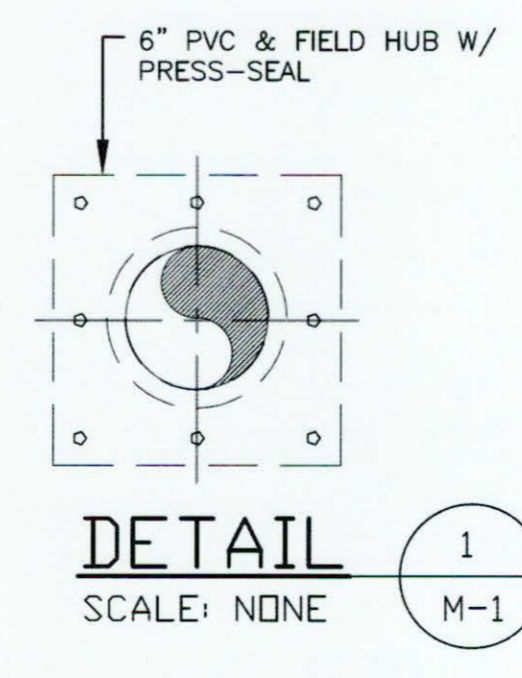
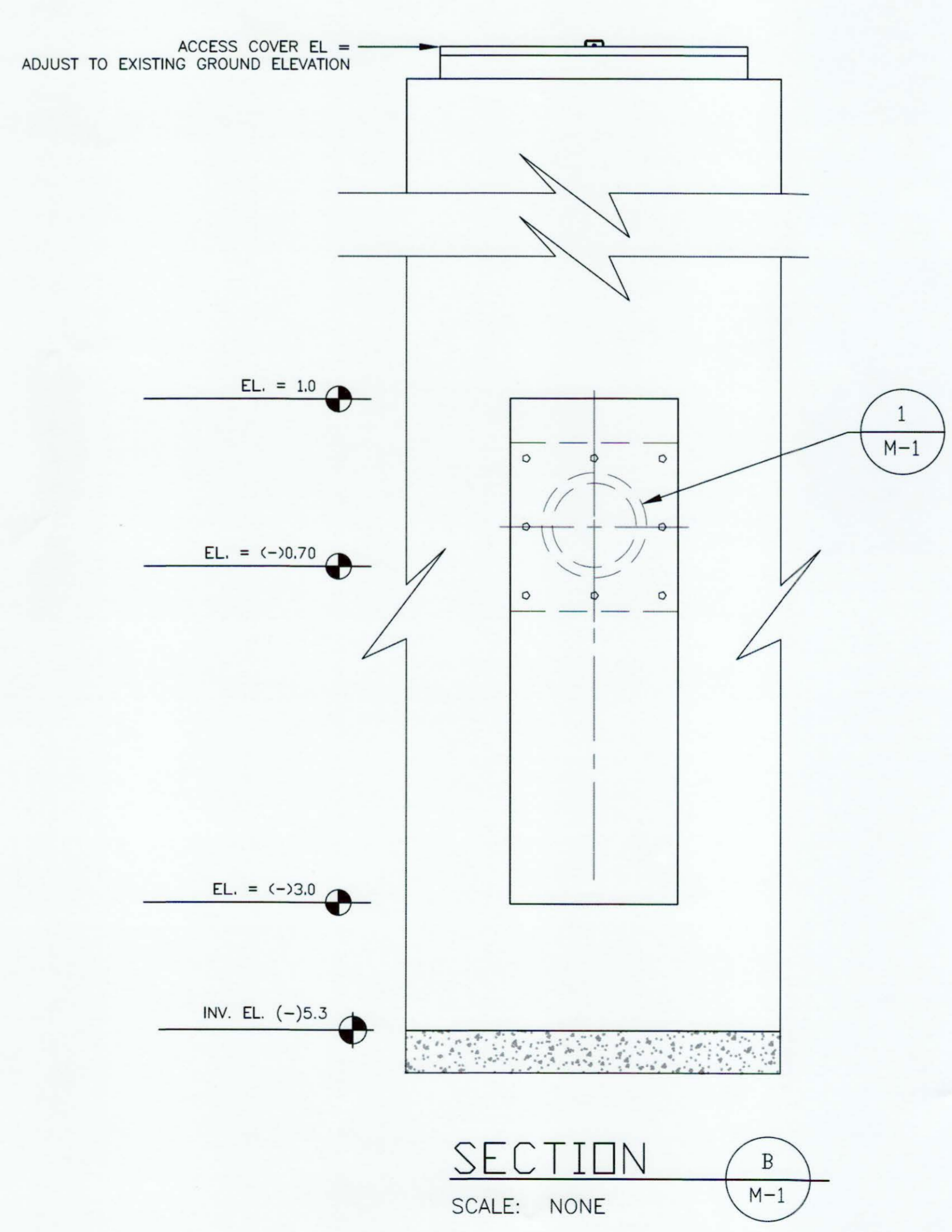
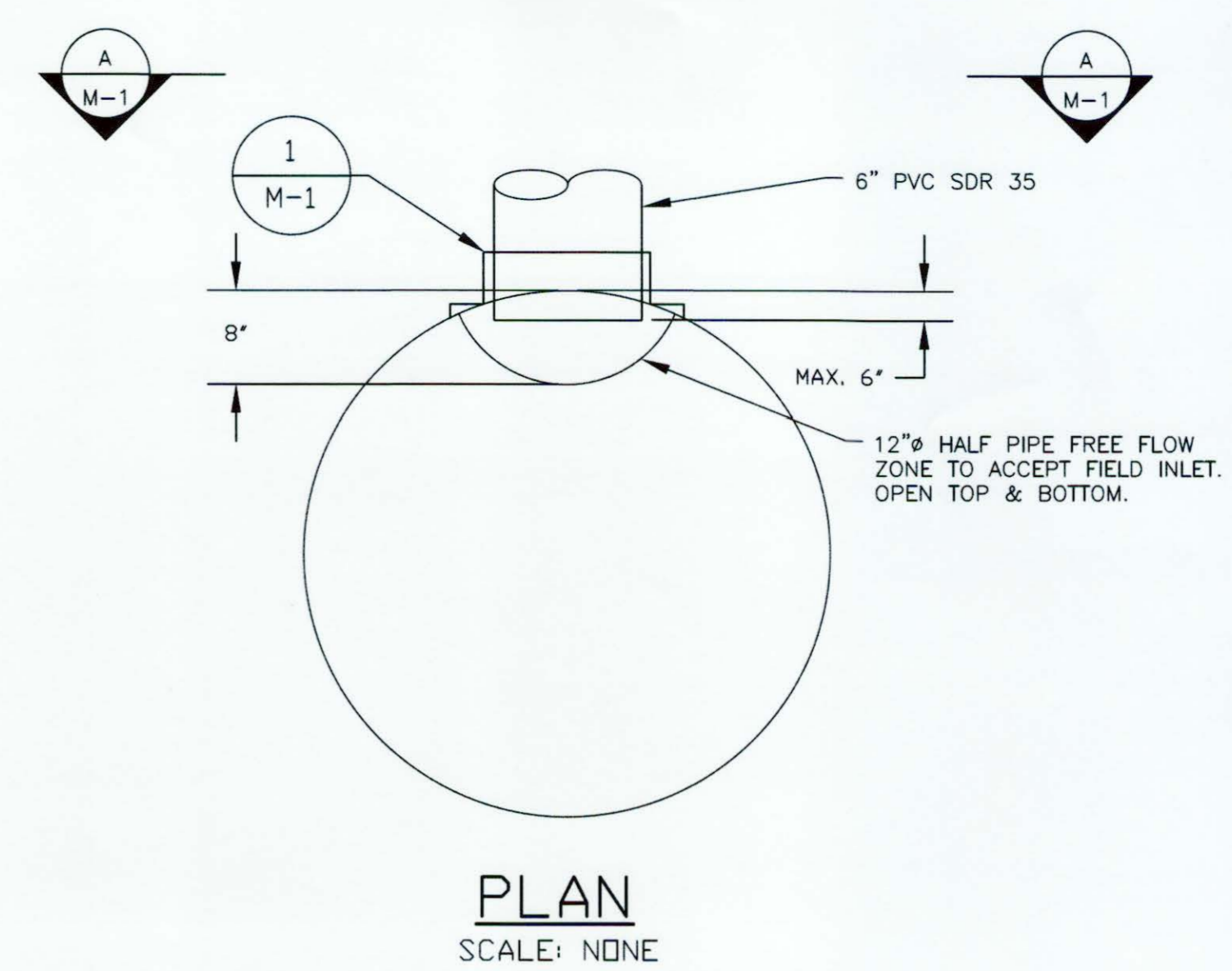
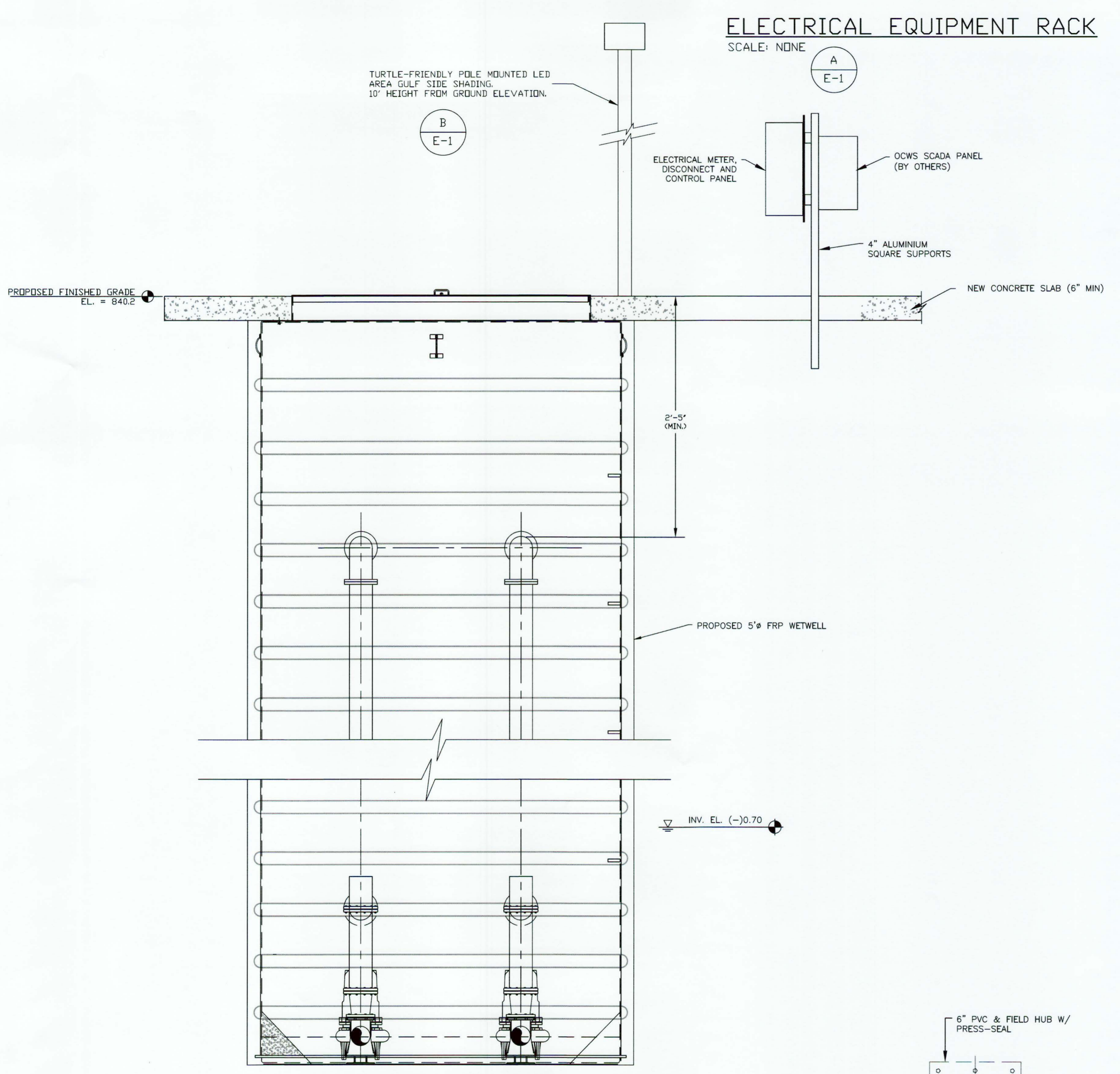
DESIGNED BY:	JGC
DATE:	
DRAWN BY:	MSC
REVISION:	
CHECKED BY:	JPK
APPROVED BY:	JGC

PUMP STATION
BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT



FILE	SEE LEFT
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING	
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	M-1

C:\CIVIL 3D PROJECTS\BEASLEY PARK SANITARY SEWER IMPROVEMENTS\DWG\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
 BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG, BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
 REUSE OF DOCUMENTS, THIS DOCUMENT AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.
 January 16, 2019



DESIGNED BY:	JCC
DRAWN BY:	MSC
CHECKED BY:	JPK
APPROVED BY:	JCC

PUMP STATION SECTION
BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT



Constantine Engineering
 1988 LEWIS TURNER BLVD. SUITE 200
 FORT WORTH, TX 76104
 PH: 850-244-5800
 FL CERTIFICATE OF AUTHORIZATION # 9816

FILE	SEE LEFT
VERIFY SCALE	BAR IS ONE INCH ON ORIGINAL DRAWING
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	M-2

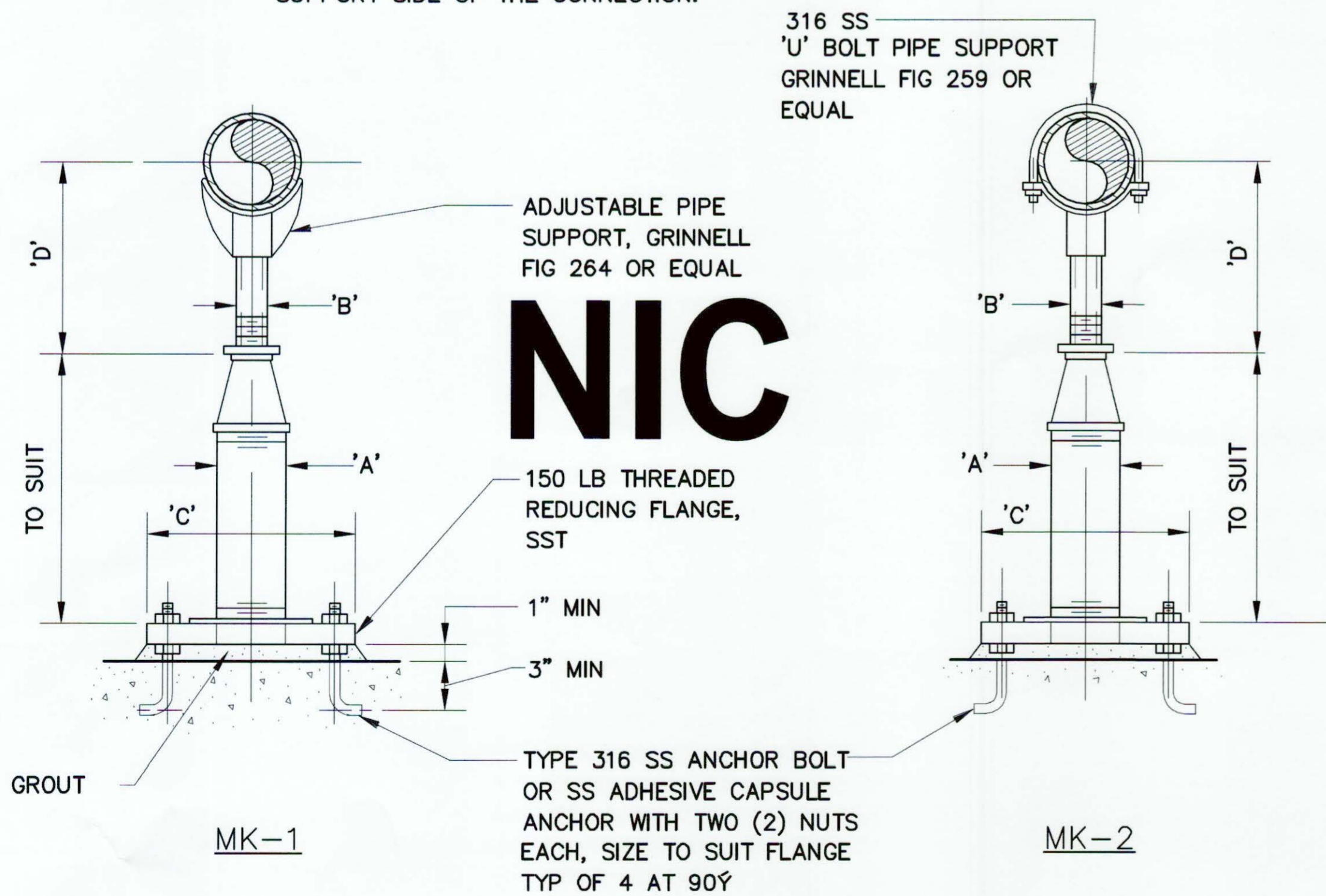
C:\CIVIL 3D PROJECTS\BEASLEY PARK SANITARY SEWER IMPROVEMENTS\DWG\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
 BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG (BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG) IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.
 BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG (BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG) IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.

ADJUSTABLE PIPE SUPPORT APPROX DIMENSIONS IN INCHES					
PIPE SIZE	A	B	C	D MIN	D MAX
2	2	1	9	8	11
3	2	1	9	8	11
3	2	1	9	8	12
4	3	2	9	10	14
6	3	2	9	11	15
8	3	2	9	13	16
10	3	2	9	14	18
12	3	2	9	15	19
14	4	3	11	18	20
16	4	3	11	19	22
18	6	3	13	21	24
20	6	3	13	23	25
24	6	4	13	26	28
30	6	4	13	29	31
32	6	4	13	30	32
36	6	4	13	32	34

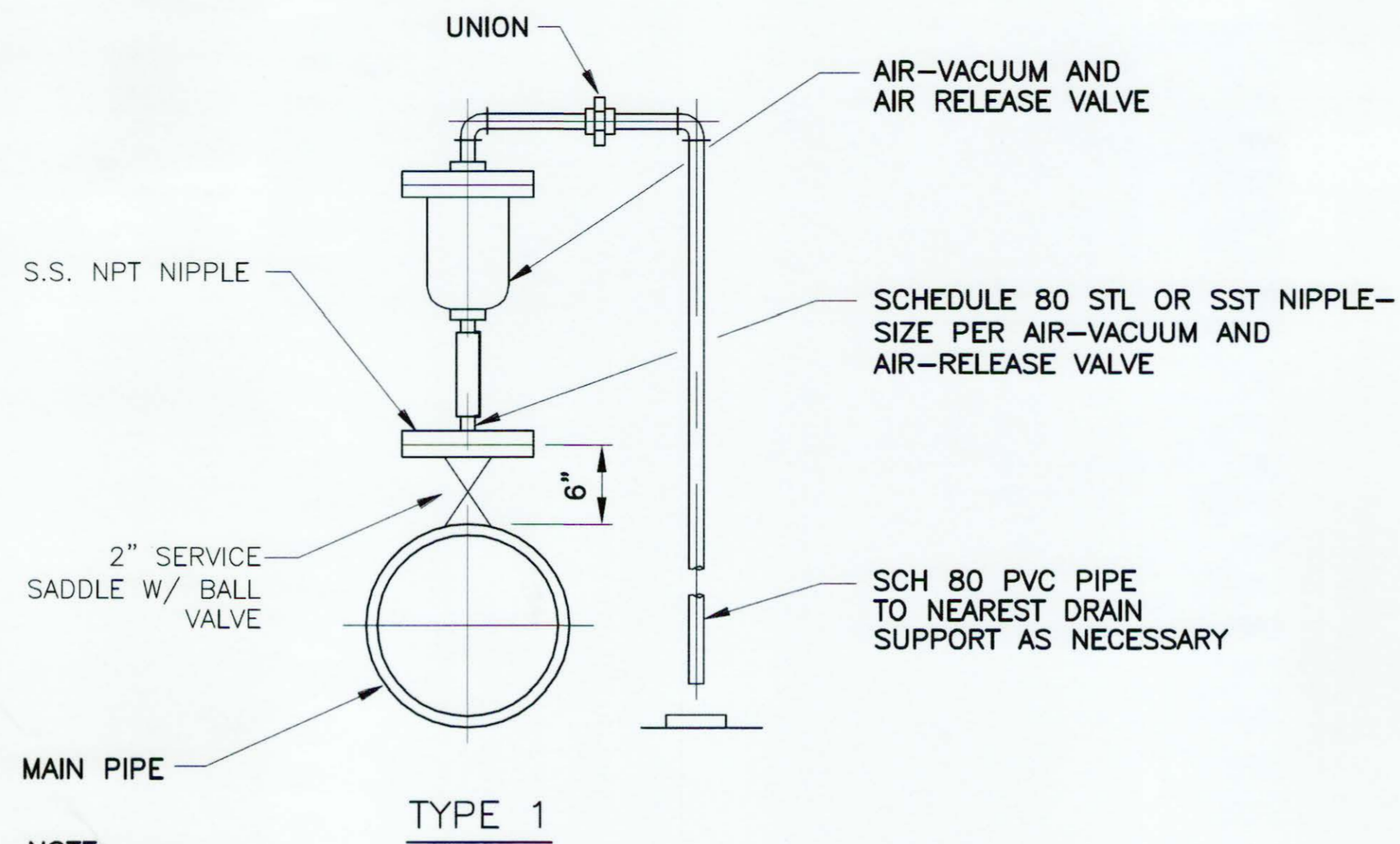
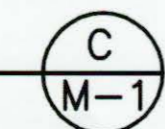
NIC

- NOTE:**
- UNDER VALVES, METERS OR OTHER SPECIAL APPURTENANCES A FABRICATED SUPPORT PIECE MAY BE UTILIZED AS ACCEPTABLE TO ENGINEER
 - CONTRACTOR SHALL COAT/PAINT THE SUPPORT IMMEDIATELY AFTER INSTALLATION.

* INCREASE 4" CLEARANCE AS REQUIRED IF BOLT HAS TO BE INSERTED FROM THE SUPPORT SIDE OF THE CONNECTION.

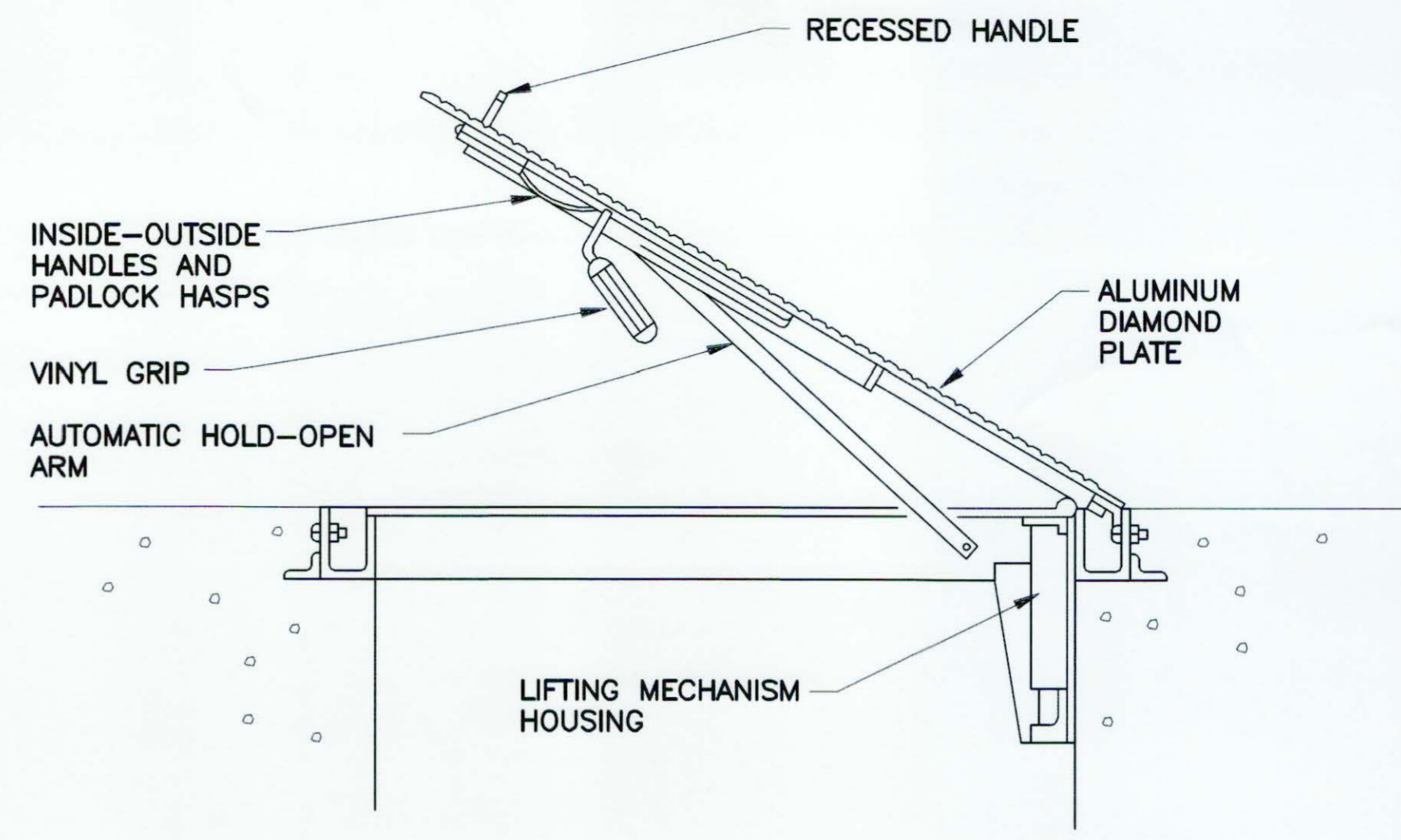
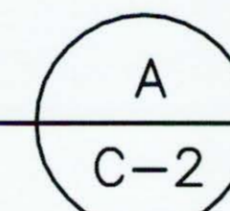


ADJUSTABLE PIPE SUPPORT
DETAIL
NTS



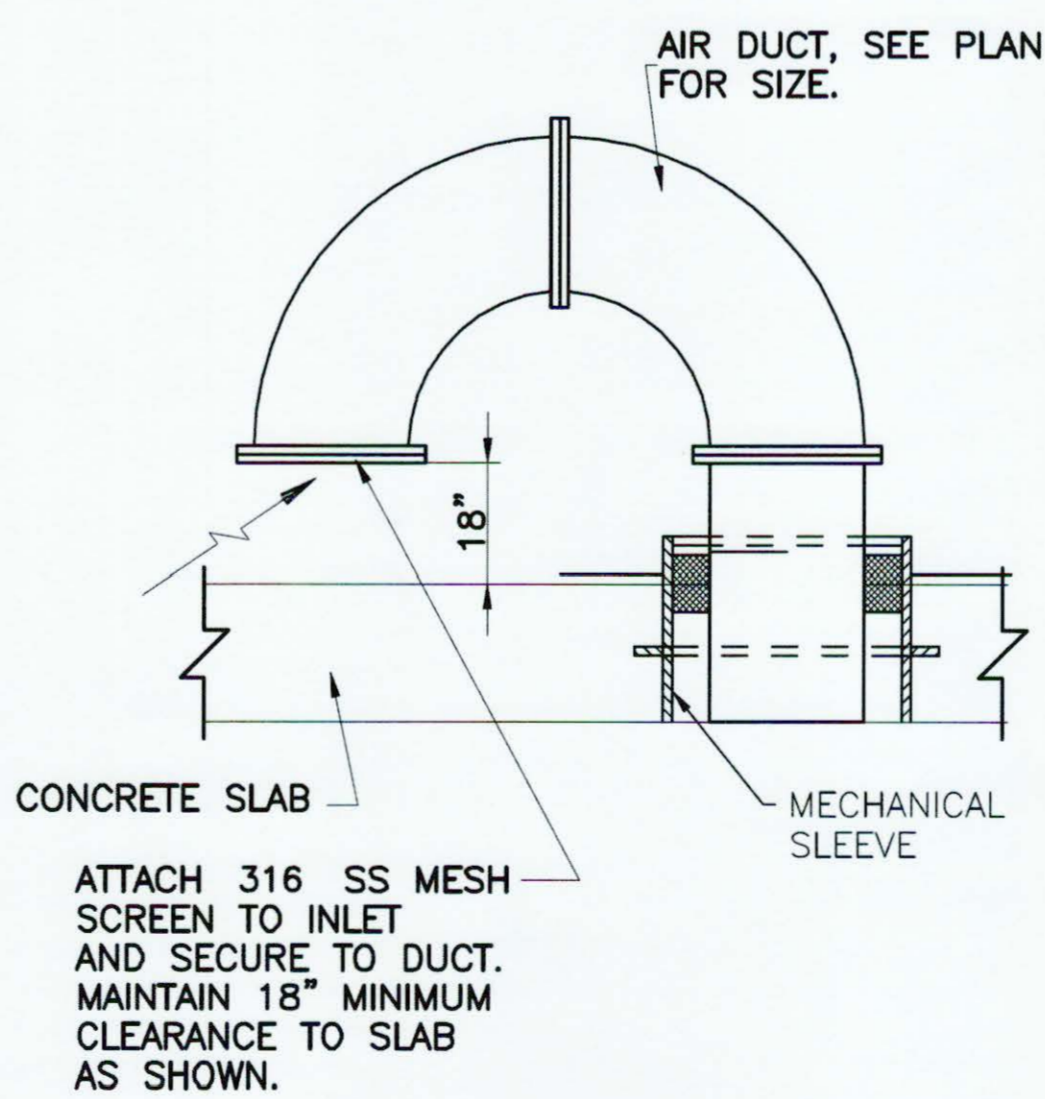
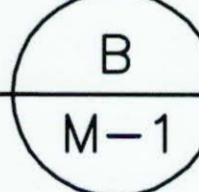
NOTE:
FOR STL OR SST PIPE, USE THREADED OUTLET OR HALF COUPLING

AIR RELEASE AND VACUUM
DETAIL
NTS

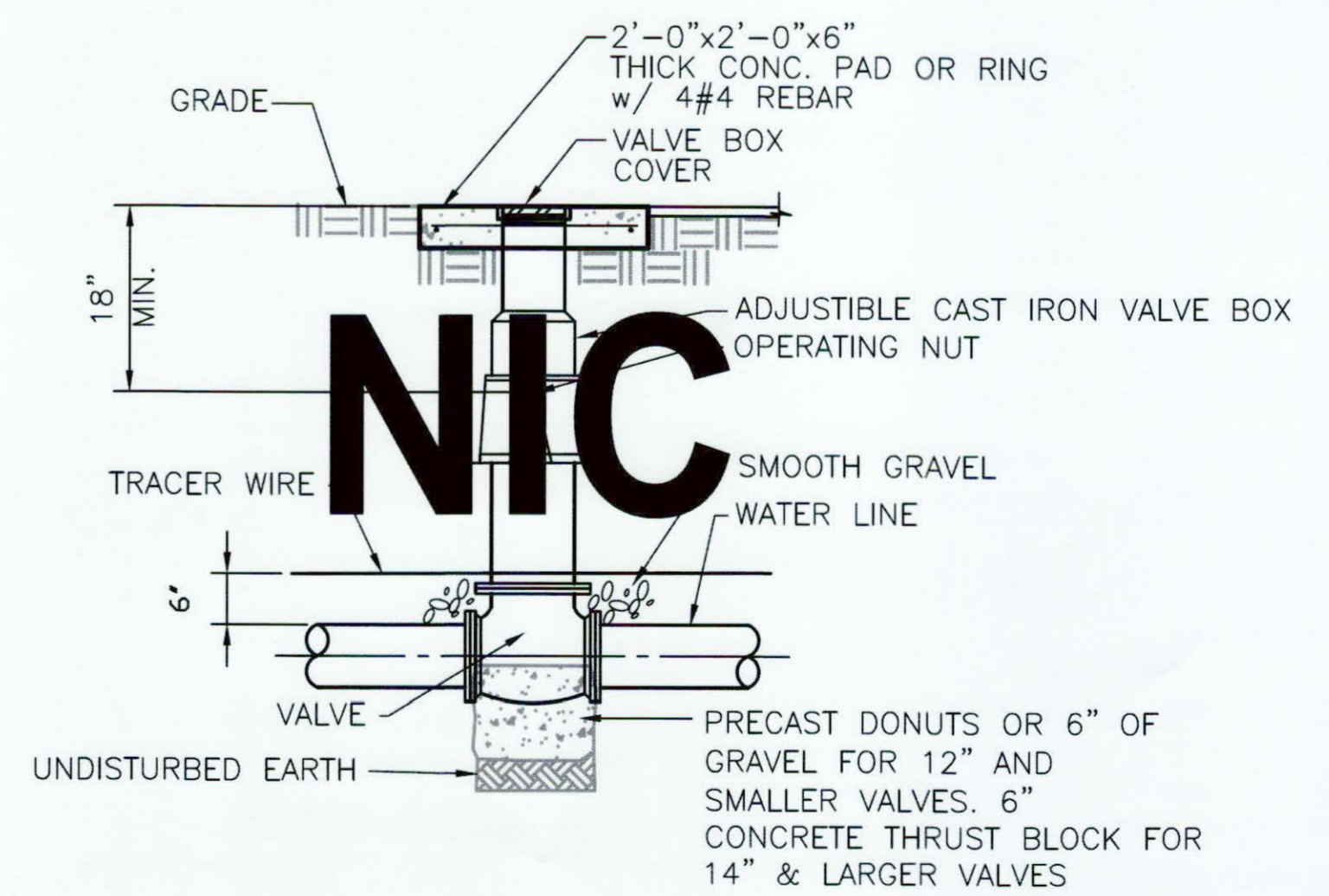
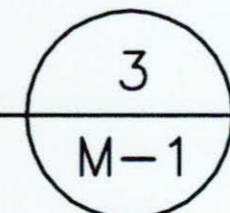


- HATCH NOTES
- ALUMINUM HATCHES TO BE SUPPLIED WITH STAINLESS STEEL HARDWARE.
 - ALL HATCHES TO BE SUPPLIED WITH SAFETY CHAINS. CORNER POST WITH FLOOR INSERTS MUST ALSO BE PROVIDED FOR SINGLE LEAF HATCHES.
 - ALL HATCHES TO BE SUPPLIED WITH HIGH SECURITY DETENTION LOCKS.
 - HINGE PINS SHALL NOT BE ACCESSIBLE WHEN THE HATCH IS IN THE CLOSED POSITION.
 - HATCHES TO BE EQUIPPED WITH FALL PROTECTION SAFETY GRATING (SAFETY ORANGE COLOR)

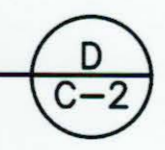
SINGLE LEAF HATCH
DETAIL
NTS



AIR INTAKE
DETAIL
NTS



VALVE DETAIL
NOT TO SCALE



NO.	DATE	DESIGNED BY:	JGC
REVISION	DRAWN BY:	CHECKED BY:	JPK
APPROVED BY:	JGC		

MECHANICAL DETAILS

BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT



FILE	SEE LEFT
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING	
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	M-3

C:\CIVIL 3D PROJECTS\BEASLEY PARK SANITARY SEWER IMPROVEMENTS\DWG\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
 January 16, 2019
 REUSE OF DOCUMENTS, THIS DOCUMENT AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.

ENCLOSURE: SPN12AL-242412 (24"H x 24"W x 12"D) NEMA 4X RATED, 5052 ALUMINUM, OUTER DOOR HAS 3-POINT PAD-LOCKABLE HANDLE.

BACKPANEL: SPP-2424 (21"H x 21"W) FABRICATED FROM 12ga. CARBON STEEL WITH WHITE POWDER COAT FINISH.

INNER DOOR: PC 250-CL24 FABRICATED FROM .250 PLEXIGLASS WITH CONTINUOUS HINGE AND TWIST LATCH.

VENTILATED AIRBREAK BOX: SPLN1AL-122412 (12"H x 24"W x 12"D) FABRICATED FROM ALUMINUM. HINGED ACCESS DOOR IS STAINLESS STEEL EXPANDED METAL WITH PAD-LOCKABLE SUITCASE LATCH.

CONTROL PANEL MUST MEET CURRENT OCS STANDARDS
 CONTROL PANEL ENCLOSURE AND 'AIR BREAK' BOX

CELLULAR ANTENNA MOUNTS TO 4 x 4" ALUMINUM BACKBOARD POST

DUPLEX PUMP CONTROL PANEL WITH ATTACHED 'AIR BREAK' BOX MOUNTS TO ALUMINUM BACK BOARD

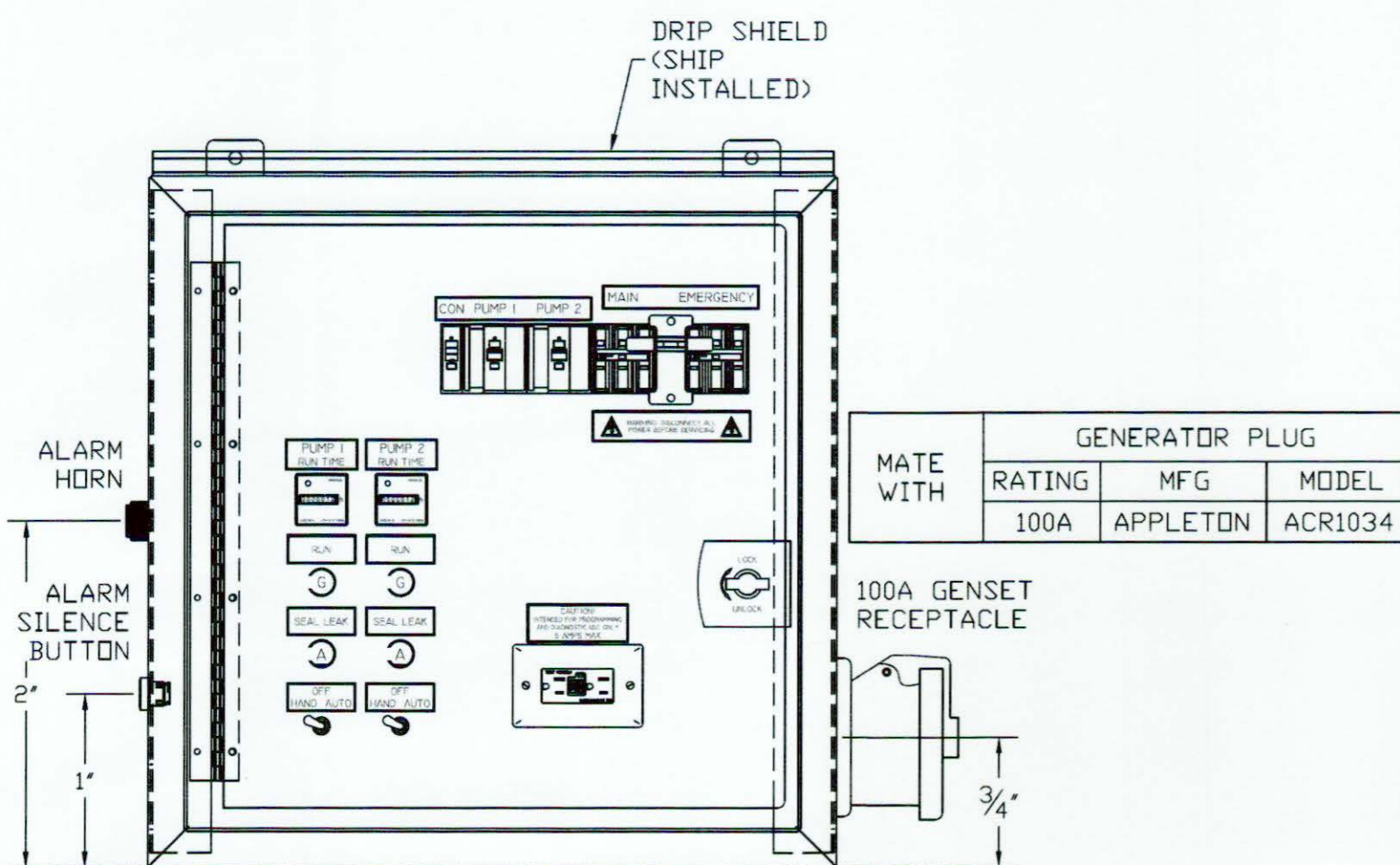
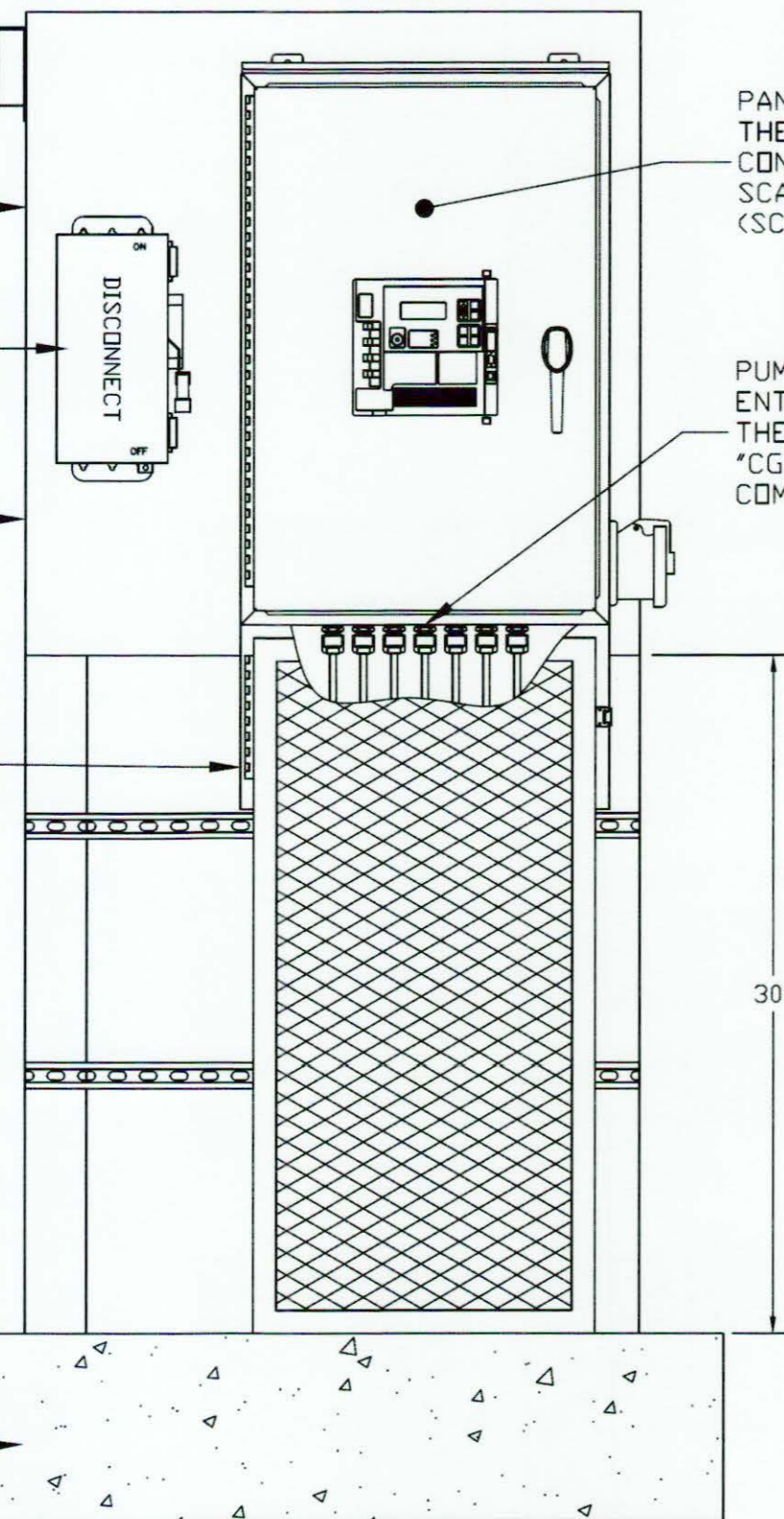
THE 100 AMP POWER DISCONNECT TO BE INSTALLED BY ELECTRICAL CONTRACTOR

BACK BOARD TO HAVE A MINIMUM 36"x36" MOUNTING SURFACE

ALUMINUM 'AIR-BREAK' BOX HAS A HINGED EXPANDED METAL DOOR WITH LATCH AND PADLOCK HASP, 12"H WITH WIDTH AND DEPTH TO MATCH CONTROL PANEL

PANEL SHALL INCLUDE THE PROVISIONS FOR CONNECTION TO OCS SCADA (SCADA BY OTHERS)
 PUMP AND FLOAT CABLES SHALL ENTER THE CONTROL PANEL FROM THE 'AIR BREAK' BOX VIA A 'CGB' WATER-TIGHT COMPRESSION-TYPE CORD GRIPS

CONCRETE BASE



INNER DOOR LAYOUT

1/4" AL BACK-BOARD WELDED TO RACK

BACK BOARD TO HAVE A MINIMUM 36"x36" MOUNTING SURFACE

PANEL RACK CONSTRUCTED OF WELDED 4"x4" AL

POWER FROM UTILITY TRANSFORMER

AREA LIGHT(S)

2-1" CONDUIT (SPARES)

PUMP 1 POWER CABLE

PUMP 2 POWER CABLE

ELECTRICAL EQUIPMENT RACK A

NOT TO SCALE

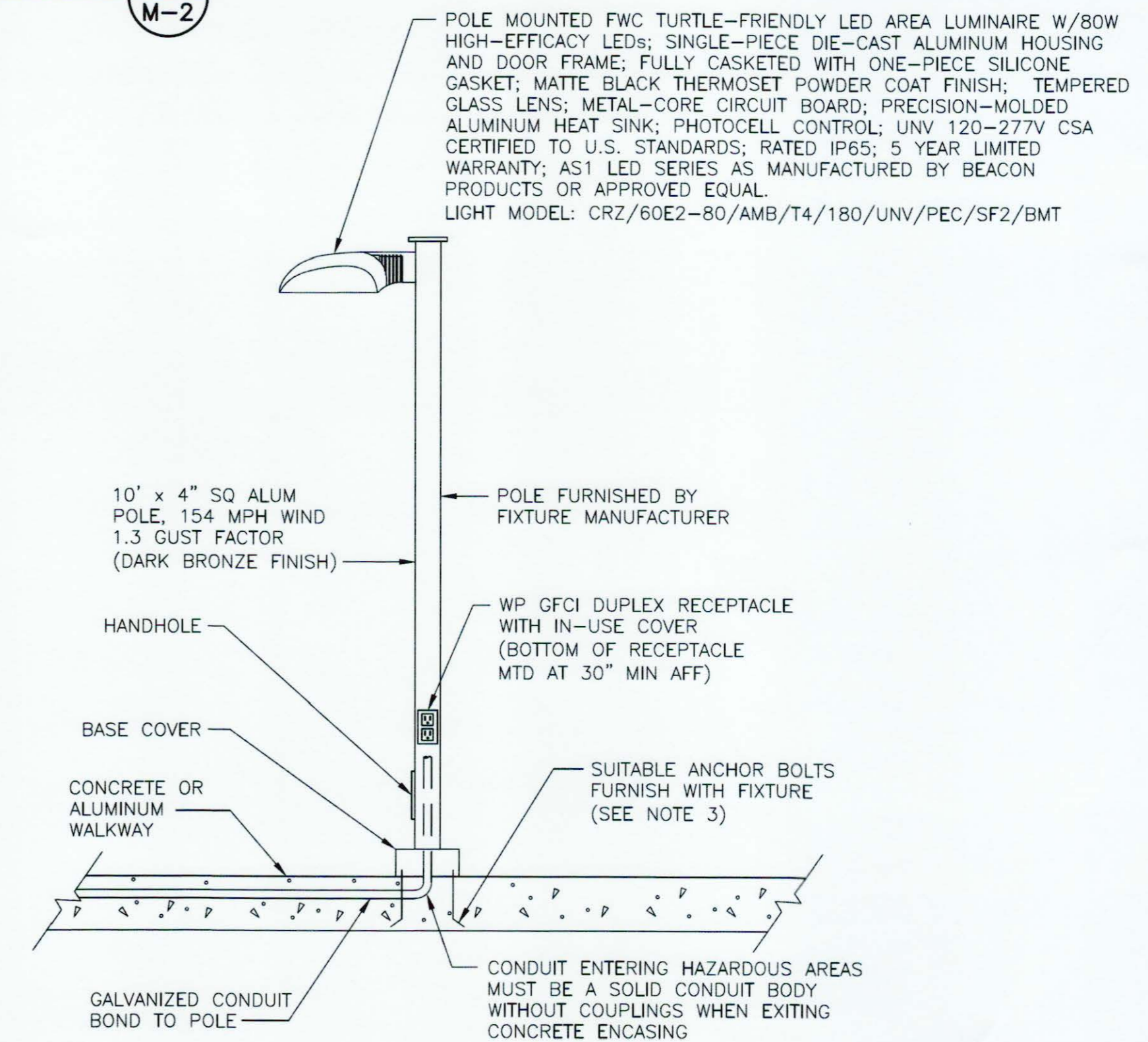
M-2

STR-IN RELIEF AND CORD GRIP

AIR BREAK CAGE, 3/4" EXPANDED METAL ON FRONT BACK AND SIDES OF BASE. TACH WELDED TO INSIDE OF BASE

THE FRONT SHALL BE BOLTED ON TO ALLOW PERSONNEL TO ACCESS CABLES.

36" EMBEDMENT FOR COLUMN. COLUMN SHALL BE WRAPPED TWICE IN ANTI-CORROSION TAPE.



POLE MOUNTED FIXTURE

DETAIL B

NTS

M-1

NOTES:

1. PROVIDE EXPLOSION-PROOF SEAL OFF FITTINGS AT ALL AREAS REQUIRED BY THE NEC FOR THE NOTED CLASSIFIED AREA. FITTINGS SHALL BE CAST ALUMINUM.
2. PROVIDE SEAL OFF FITTING AT CONDUIT TO POLE LIGHT.
3. WHERE POLES ARE MOUNTED TO STRUCTURES, POLE MANUFACTURER SHALL PROVIDE DESIGN FOR ANCHOR TO MEET THE SPECIFIED WIND RATINGS.



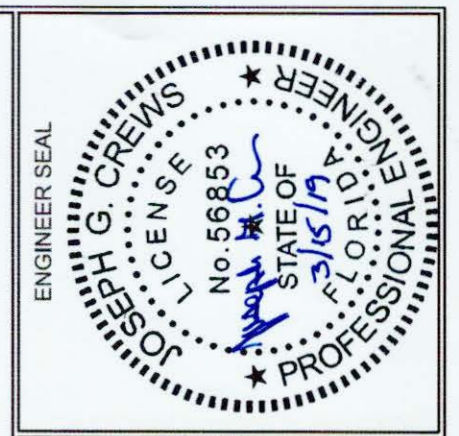
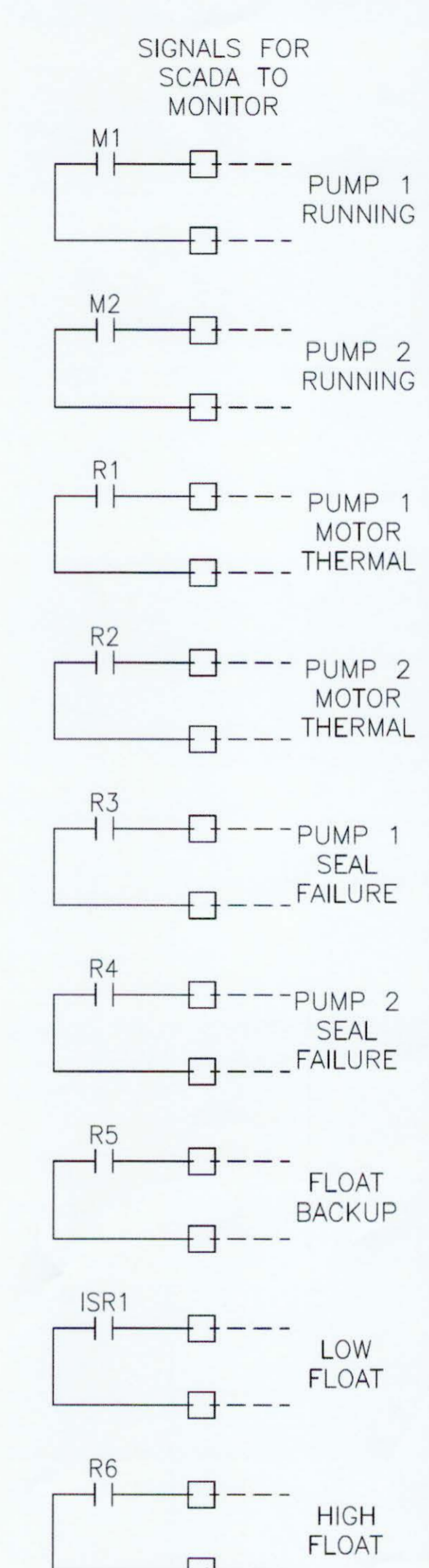
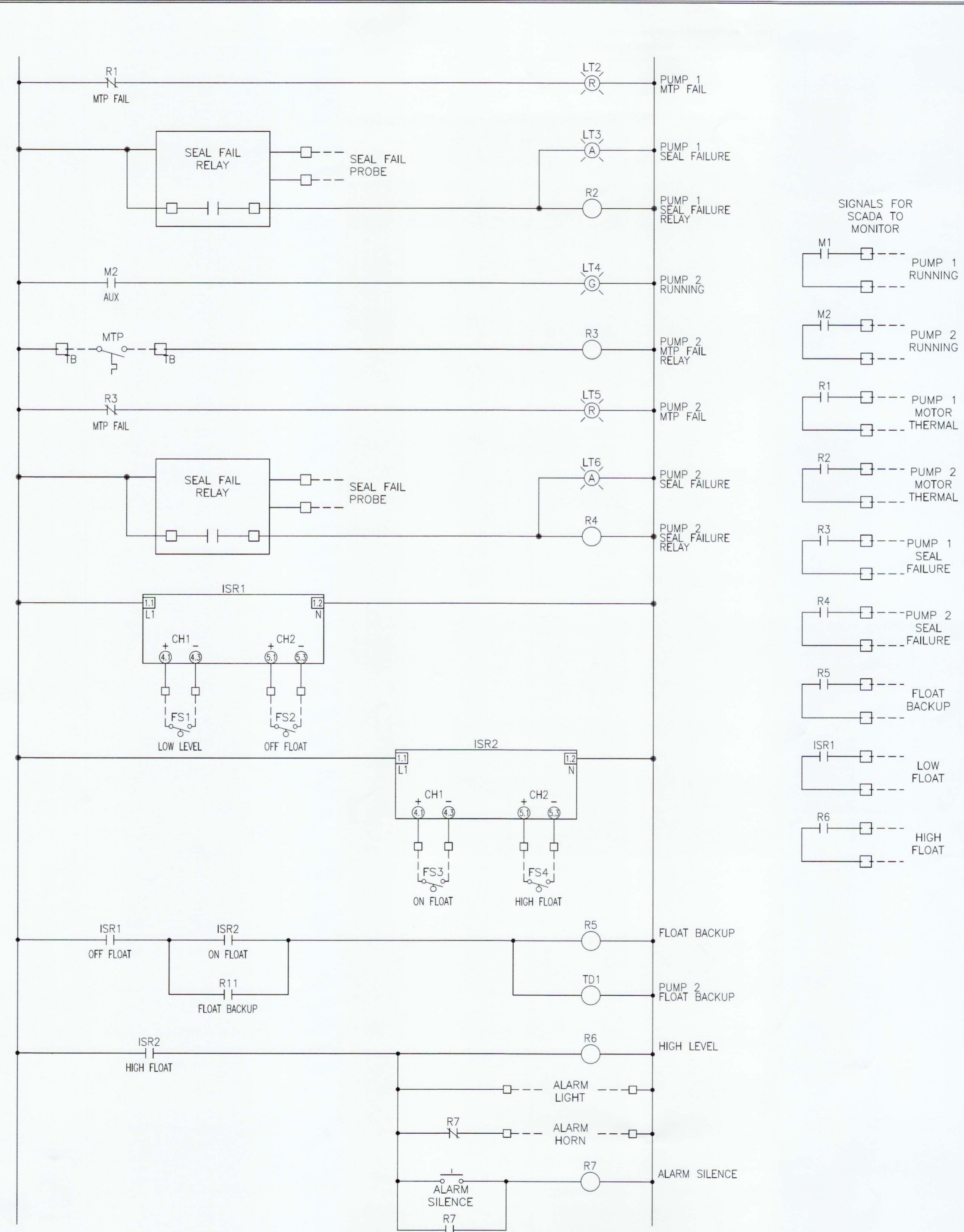
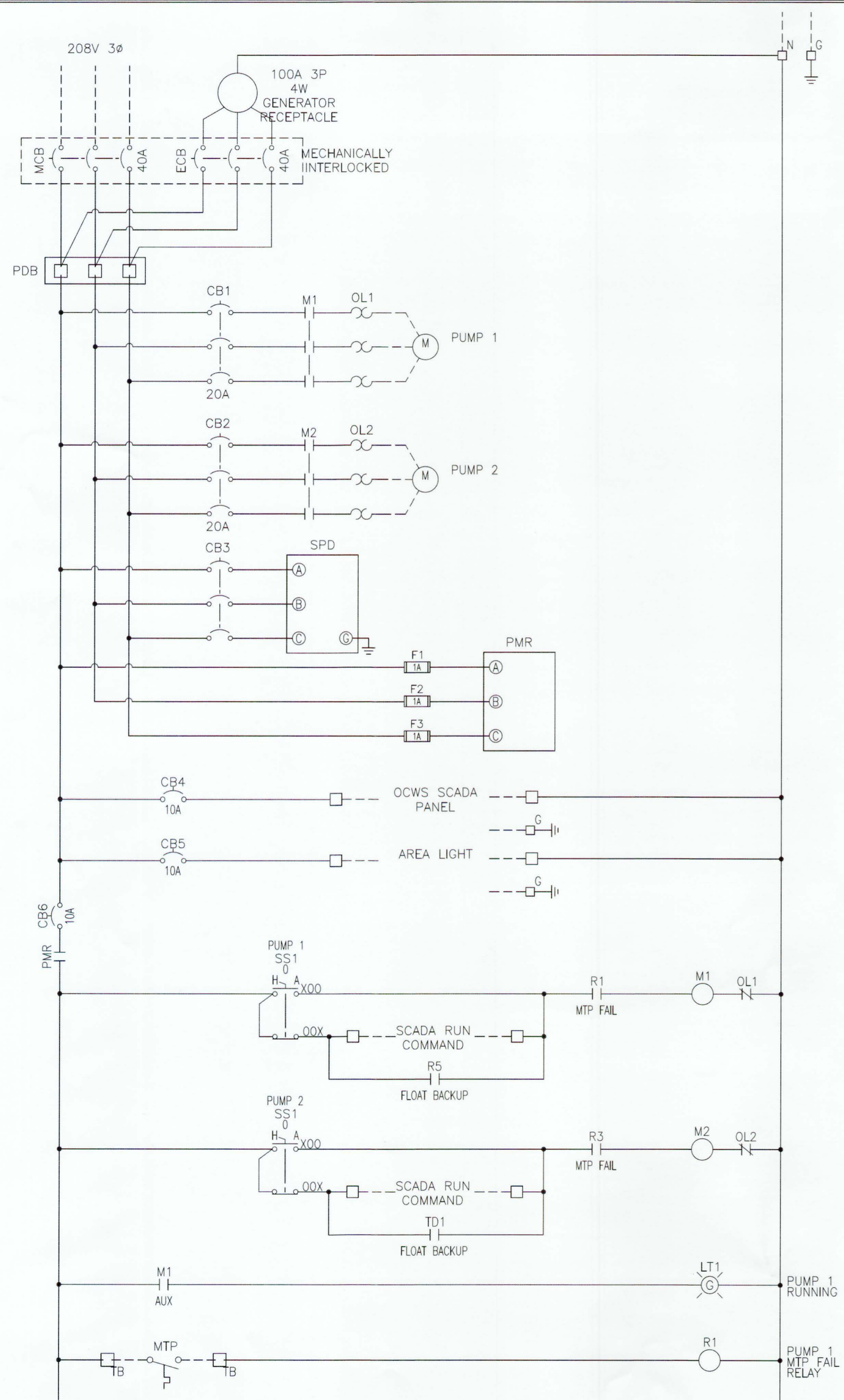
NO.	DATE	DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
		JCC	JPK	MSC	JCC

CONTROL PANEL
BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT



FILE	SEE LEFT
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING	
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	E-1

C:\CIVIL 3D PROJECTS\BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG BEASLEY PARK SANITARY SEWER IMPROVEMENTS.DWG
 REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF CONSTANTINE ENGINEERING. HOWEVER, THIS SHALL NOT PROHIBIT THE REUSE OF THIS DOCUMENT BY THE CLIENT AS PROVIDED FOR BY THE CONTRACT.
 January 16, 2019



DESIGNED BY:	JGC
DRAWN BY:	MSC
CHECKED BY:	JPK
APPROVED BY:	JGC

WIRING DIAGRAM
BEASLEY PARK SANITARY SEWER IMPROVEMENTS PROJECT



Constantine Engineering
 1988 LEWIS TURNER BLVD
 FORT WALTON BEACH, FL 32547
 PH: 850-244-5800
 FL CERTIFICATE OF AUTHORIZATION # 9816

FILE	SEE LEFT
VERIFY SCALE	
DATE	JANUARY 2019
PROJ.	100502.01
DWG.	E-2