CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

WATER WORKS, GAS AND SEWER BOARD
OF THE
CITY OF PIEDMONT

WASTEWATER LAGOON UPGRADES

CWSRF PROJECT NO. CS010899-01
CONTRACT NO. PI24 121

2024

Utility Engineering Consultants, LLC
WATER\WASTEWATER\GAS DESIGN • OPERATOR TRAINING

CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

WATER WORKS, GAS AND SEWER BOARD OF THE CITY OF PIEDMONT

WASTEWATER LAGOON UPGRADES

CWSRF PROJECT NO. CS010899-01
CONTRACT NO. PI24 121

2024

Certified by:

Dave B. Bechtel, P.E.
Reg. Engineer No. 16187
State of Alabama

ALABAMA LICENSED No. 16187 PROFESSIONAL ENGINEER DAVE B. BECHTEL

Utility Engineering Consultants, LLC
WATER\WASTEWATER\GAS DESIGN • OPERATOR TRAINING

NON-COLLUSION AFFIDAVIT

STATE OF ALABAMA

CALHOUN COUNTY

PROJECT NAME: Wastewater Lagoon Upgrades

Water Works, Gas and Sewer Board of the City of Piedmont

CWSRF Project No. CS010899-01

BID OPENING: December 10, 2024 at 10:00 A.M. local time

I certify that _____ has not, either
(Name of Contracting Firm)
directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this contract.

Signed: _____
(Name of Contracting Firm)

By: _____

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

_____
Notary Public

My Commission expires_____

FAILURE TO EXECUTE THIS AFFIDAVIT SHALL BE CAUSE FOR REJECTION OF THIS BID.

NOTICE TO CONTRACTORS
INVITATION FOR BIDS

Sealed Bids will be received by the Piedmont Water Works, Gas and Sewer Board at the City Council Chambers, 312 North Center Ave. Piedmont, AL 36272 on December 10, 2024 at 10:00 A.M.. local time, for furnishing all labor, materials, and equipment and doing the work of constructing, according to Plans, Specifications and Contract Documents on file in the office of the Owner, the improvements hereinafter described. No bids will be received after the time set forth hereinabove; and the Bids will be publicly opened and read.

The work of constructing Wastewater Lagoon Upgrades, CWSRF Project No. CS010899-01 will be let under one Contract, the principal items of work are detailed herein below.

1. Lagoon Aeration
2. Lagoon Baffle Curtains
3. UV Installation
4. Demolition

Plans, Specifications and Contract Documents are open to public inspection at the office of Owner, Piedmont Water Works, Gas and Sewer Board at the City Council Chambers, 312 North Center Ave. Piedmont, AL 36272 or may be obtained from the office of the Engineers, Utility Engineering Consultants, LLC, 130 Southcrest Drive, Suite 100, Homewood, Alabama 35209 for the amount of $ 100.00 per set, the actual cost of printing, reproducing, handling and distribution for each set of documents. No refunds will be made except to Prime Contractor Bidders, which shall be refunded for one bid set.

The Contractor is hereby advised that TIME IS OF THE ESSENCE on this project and that the contract time of 365 consecutive calendar days and noted restrictions shall be strictly observed. LIQUIDATED DAMAGES WILL BE ASSESSED IF THE CONTRACT TIME IS EXCEEDED. The Contractor may apply for an extension of time in accordance with the provisions of the contract; however, such an extension must be approved prior to the contract completion date to avoid the imposition of liquidated damages.

Utility Engineering Consultants, LLC
130 Southcrest Drive, Suite 100
Homewood, AL 35209
Phone: (205) 951-3838 ✶ Fax: (205) 951-3839
Website: uecllc.com

INDEX TO CONSTRUCTION CONTRACT DOCUMENTS AND SPECIFICATIONS
WATER WORKS, GAS AND SEWER BOARD OF THE CITY OF PIEDMONT
WASTEWATER LAGOON UPGRADES
CWSRF PROJECT NO. CS010899-01
CONTRACT NO. PI24 121

WATER WORKS, GAS AND SEWER BOARD OF THE CITY OF PIEDMONT
WASTEWATER LAGOON UPGRADES
CWSRF PROJECT NO. CS010899-01
CONTRACT NO. PI24 121

PAGE NO.

SECTION 00200

INSTRUCTIONS TO BIDDERS

TABLE OF CONTENTS

TABLE OF ARTICLES (Alphabetical by Subject)

INSTRUCTIONS TO BIDDERS

ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office* — The office of the Engineer from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement or Invitation to Bid may be obtained from the Issuing Office.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

A. The deposit shall be refunded in full to each prime contractor bidder upon return of the documents in reusable condition within ten days after bid opening. Additional sets for prime contractor bidders, subcontractors, vendors, or dealers may be obtained upon payment of the same deposit.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, within five days of Owner's request, Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for below. Each Bidder must submit evidence of Bidder's qualification to do business in the State of Alabama.

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.02 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

4.03 Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

4.04 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

D. obtain and carefully study (or accept consequences of not doing so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

E. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the Price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

F. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

G. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.05 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

5.01 A mandatory pre-Bid conference will not be conducted in accordance with the Notice to Contractors. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are required to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective. This section will not apply.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price or $50,000.00, whichever is less, and in the form of a certified check or bank money order or a Bid bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

ARTICLE 9 - CONTRACT TIME

9.01 The number of days within which, or the dates by which the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or those substitute or "or-equal" materials and equipment approved by Engineer and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type,. function and quality to be met by any proposed substitute or "or-equal" item. No item of material or equipment will be considered by Engineer as a substitute or "or-equal" unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids. Each such request shall conform to the requirements of Paragraph 6.05 of the General Conditions. The burden of proof of

the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner.

12.02 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents. Additional copies my be obtained from the Engineer.

13.02 All blanks on the Bid Form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each Bid item listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

13.05 A Bid 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 shall be shown below the signature.

13.06 A Bid by an individual shall show the Bidder's name and official address.
13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown below the signature.

13.08 All names shall be typed or printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.10 The address and telephone number for communications regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 - BASIS OF BID; COMPARISON OF BIDS

14.01 Unit Price

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

14.02 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on the account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 11.02 of the General Conditions.

ARTICLE 15 - SUBMITTAL OF BID

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The complete copy of the Bidding Documents is to be completed and submitted with the Bid security complete.

15.02 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 Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to the Piedmont Water Works, Gas and Sewer 128 South Center Ave, Piedmont, AL 36272

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 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.

16.02 If within 24 hours after Bids are opened, any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 - EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, individuals, or entities must be submitted as provided in the Supplementary Conditions.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.

19.06 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Base Bid plus any alternates that are in the best interests of the Project. Project will be awarded upon the base bid, if applicable, the Owner may choose to use the alternate bid if it is in the best interest of the Project.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

ARTICLE 22 - RETAINAGE

22.01 Provisions concerning Contractor's rights to deposit securities in lieu of retainage are set forth in the Agreement.

SECTION 00410

BID FORM

TABLE OF ARTICLES

BID FORM

ARTICLE 1 - BID RECIPIENT

1.01 This Bid is submitted to:

Piedmont Water Works, Gas and Sewer Board 312 North Center Ave. Piedmont, AL 36272

1.02 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 ACKNOWLEDGMENTS

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 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

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

Addendum No.	Addendum Date

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

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

E. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

F. 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.

G. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

J. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 - FURTHER REPRESENTATIONS

4.01 Bidder further represents 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 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 sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 - BASIS OF BID

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

PROPOSAL FORM
WATER WORKS, GAS AND SEWER BOARD OF THE CITY OF PIEDMONT
WASTEWATER LAGOON UPGRADES
CWSRF PROJECT NO. CS010899-01
CONTRACT NO. PI24 121

CONTRACTOR_____ **LICENSE #**_____

Item No.	Description	Est. Quan.	Bid Unit Price	Bid Price
1.	Wastewater Lagoon Including Site Work, Concrete, Mechanized, Piping, Electrical and all Necessary Appurtenances in Complete Accordance with Plans, Specifications and Contract Documents Furnish and Install Complete Per LS	1 LS		
2.	Mobilization and Demobilization ($100,000 Maximum) Furnish and Install Complete Lump Sum	1 LS		
3.	Mechanical Modifications and Additions to Existing Lagoon Per Engineer's and Owner's Approval Per LS	1 LS	$ 50,000.00	$ 50,000.00
4.	Electrical Modifications and Additions for Existing Lagoon Per Engineer's and Owner's Approval Per LS	1 LS	$ 50,000.00	$ 50,000.00
			TOTAL AMOUNT OF BID	

Unit Prices have been computed in accordance with Paragraph 11.03.B of the General Conditions.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

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 14.07.B 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 in the event of failure to complete the Work within the Contract Times.

ARTICLE 7 - ATTACHMENTS TO THIS BID

7.01 The following documents are attached to and made a condition of this Bid:

2. Required Bid security in the form of Bid Bond or check

3. List of Proposed Subcontractors

4. List of Proposed Suppliers

5. List of Project References

6. Affidavit of Non-Collusion

7. Bid Bond

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

9.01 This Bid submitted by:

If Bidder is:

<u>An Individual</u>

Name (typed or printed):_____

By: _____
(SEAL) (*Individual's signature)*

Doing business as: _____

A Partnership

Partnership Name: _____
(SEAL)

By: _____

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

Name (typed or printed): _____

A Corporation

Corporation Name: _____
(SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature — attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____
(CORPORATE SEAL)

Attest _____

Date of Authorization to do business in *Alabama* is _____/_____/_____.

A Joint Venture

Name of Joint Venture:_____

First Joint Venturer Name:_____
(SEAL)

By: _____

(Signature of first joint venturer partner — attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Second Joint Venturer Name: _____
(SEAL)

By: _____

(Signature of second joint venturer partner — attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

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

All Bidder's _____

Business Address _____

Phone No:_____Fax No._____

SUBMITTED on _____, 2024.

State Contractor License No. _____

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

Bid Due Date: _____

Project (Brief Description Including Location): _____

BOND

Bond Number: _____

Date (Not later than Bid due date): _____

Penal sum _____ _____
(Words) (Figures

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER	SURETY
(Seal)	(Seal)
_____	_____
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature and Title	Signature and Title (Attach Power of Attorney)
Attest: _____	Attest: _____
Signature and Title	Signature and Title

Note: Above addresses are to be used for giving required notice.

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 Surety's liability.

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 by 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 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 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 00520

AGREEMENT

BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT

THIS AGREEMENT is by and between **Water Works, Gas and Sewer Board of the City of Piedmont** (Owner)

and _____ (Contractor).

Owner and Contractor, in consideration of the mutual covenants set forth herein, agree as follows:

ARTICLE 1 - WORK

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

Wastewater Lagoon Upgrades - CWSRF Project No. CS010899-01
Contract No. PI24 121

ARTICLE 2 - THE PROJECT

2.01 The Project for which the work under the Contract Documents may be the whole or only a part is generally described as follows:

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by

Utility Engineering Consultants, LLC
130 Southcrest Drive, Suite 100
Homewood, Alabama 35209
Phone: (205) 951-3838 ✶ Fax: (205) 951-3839
Website: uecllc.com

(Engineer), who is 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 Days to Achieve Substantial Completion and Final Payment

A. The Work will be substantially completed within 365 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 400 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 of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 11 of the General Conditions. 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), Contractor shall pay Owner $ 100.00 for each day that expires after the time specified in Paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner $ 125.00 for each day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 - CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraph 5.01.A below:

A. For all Work, a total sum of $_____ as shown on Contractor's Bid Form, attached hereto as an exhibit.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

A. Contractor shall submit Application for Payment in accordance with Article 13 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 on or about the 25th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of 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 in the General Requirements:

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 Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 15.01 of the General Conditions:

    a. 10 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, Owner, on recommendation of Engineer, may determine that as long as the character and progress of the Work remain satisfactory to them, there will be no additional retainage; and
    b. 10 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

2. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 95 percent of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 15.03 of the General Conditions and less 100 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion.

6.03 Final Payment

A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 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 moneys not paid when due as provided in Article 15 of the General Conditions shall not bear interest. The Owner shall make payment promptly when proper invoice is issued by the Contractor.

ARTICLE 8 - CONTRACTOR'S REPRESENTATIONS

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

A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all federal, state, and local 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 contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 5.03 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Conditions, if any, at the Site which has been identified in the Supplementary Conditions as provided in Paragraph 4.06 of the General Conditions.

E. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.

F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data as 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 Documents.

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 correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

I. 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.

J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 - CONTRACT DOCUMENTS

9.01 Contents

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to 6, inclusive).
2. Performance bond (pages 1 to 3 inclusive).
3. Payment bond (pages 1 to 3, inclusive).
4. Other bonds (pages _____ to _____, inclusive).
    a. _____ (pages _____ to _____, inclusive).
    b. _____ (pages _____ to _____, inclusive).
    c. _____ (pages _____ to _____, inclusive).
5. General Conditions (pages 1 to 61, inclusive).
6. Supplementary Conditions (pages 1 to 11, inclusive).
7. Specifications as listed in the table of contents of the Project Manual.
8. Drawings consisting of _____ sheets with each sheet bearing the following general title: Wastewater Lagoon Upgrades CWSRF Project No. CS010899-01 Contract No. PI24 121.
9. Addenda (numbers _____ to ____, inclusive).
10. Exhibits to this Contract (enumerated as follows):
    a. Contractor's Bid (pages 1 to ___, inclusive).
    b. Documentation submitted by Contractor prior to Notice of Award (pages _____ to _____, inclusive).
    c. _____.
11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    a. Notice to Proceed (pages _____ to _____, inclusive).
    b. Work Change Directives.
    c. Change Order(s)

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 Paragraph 11.01 of 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. 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, moneys that may become due and moneys that are 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 partners, successors, assigns, and legal representatives to the other party hereto, its partners, 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.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement in quadruplicate. One counterpart each has been delivered to Owner and Contractor. All portions of the Contract Documents have been signed or identified by Owner and Contractor or on their behalf.

This Agreement will be effective on _____, 2024 (which is the Effective Date of the Agreement).

OWNER:	CONTRACTOR:
WWG&SB of the City of Piedmont	_____
By: _____	By: _____
Title: _____	Title: _____
	[CORPORATE SEAL]
Attest: _____	Attest: _____
Title: _____	Title: _____
Address for giving notices:	Address for giving notices:
312 North Center Ave	_____
Piedmont, AL 36272	_____
_____	_____
	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 Owner-Contractor Agreement.)	
	Agent for service or process: _____
	_____
	(If Contractor is a corporation or a partnership, attach evidence of authority to sign.)

PERFORMANCE BOND

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

CONTRACTOR
(Name and Address):

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

OWNER (Name and Address):
Piedmont Water Works, Gas and Sewer
312 North Center Ave. Piedmont, AL 36272

CONTRACT
Date:
Amount: **$**

Description (Name and Location): **Wastewater Lagoon Upgrades CWSRF Project No. CS010899-01**
PI24 121

BOND
Bond Number:
Date (Not earlier than Contract Date:
Amount: **$**
Modifications to this Bond Form:

Surety and a Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company:
Signature: (Seal)
Name and Title:

SURETY
(Seal)
Surety's Name and Corporate Seal

By:
Signature and Title
(Attach Power of Attorney)

Attest:
Signature and Title

(Space is provided below for signatures of additional parties, if required.)

CONTRACTOR AS PRINCIPAL
Company:
Signature: (Seal)
Name and Title:

SURETY
Surety's Name and Corporate Seal

By:
Signature and Title
(Attach Power of Attorney)

Attest:
Signature and Title:

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

2 If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.

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

3.1 Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contractor. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contractor, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and

3.2 Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and

3.3 Owner has agreed to pay the Balance of the Contract Price to:

3.3.1 Surety in accordance with the terms of the Contract;

3.3.2 Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.

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

4.1 Arrange for Contractor, with consent of Owner, to perform and complete the Contractor; or

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

4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or

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

4.4.1 After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner, or

4.4.2 Deny liability in whole or in part and notify Owner citing reasons therefor.

5 If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4., and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

6 After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

6.1 The responsibilities of Contractor for correction of defective. Work and completion of the Contract.

6.2 Additional legal, design, professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and

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

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

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

9 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 Contractor Default or within two years after Contractor ceased working or within two years after 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 period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10 Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

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

12 Definitions

12.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under this Contract.

12.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3 Contractor Default: Failure of Contractor, which has neither been remedied not waived, to perform or otherwise to comply with the terms of the Contract.

12.4 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY — Name, Address and Telephone
Surety Agency or Broker:
Owner's Representative:
Utility Engineering Consultants, LLC
130 Southcrest Drive, Suite 100, Homewood, Alabama 35209, Phone (205) 951-3838

PAYMENT BOND

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

CONTRACTOR
(Name and Address):

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

OWNER (Name and Address):
Piedmont Water Works, Gas and Sewer
312 North Center Ave. Piedmont, AL 36272

CONTRACT
Date:
Amount: **$**

Description (Name and Location): **Wastewater Lagoon Upgrades CWSRF Project No. CS010899-01 PI24 121**

BOND
Bond Number:
Date (Not earlier than Contract Date:
Amount: **$**
Modifications to this Bond Form:

Surety and a Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company:
Signature: (Seal)
Name and Title:

SURETY
(Seal)
Surety's Name and Corporate Seal

By:
Signature and Title
(Attach Power of Attorney)

Attest:
Signature and Title

(Space is provided below for signatures of additional parties, if required.)

CONTRACTOR AS PRINCIPAL
Company:
Signature: (Seal)
Name and Title:

SURETY

Surety's Name and Corporate Seal

By:
Signature and Title
(Attach Power of Attorney)

Attest:
Signature and Title:

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to Owner, this obligation shall be null and void if Contractor:

2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2 Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contractor, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

4.1 Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the addresses described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2 Claimants who do not have a direct contract with Contractor:

1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and

2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and

3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.

5. If a notice by a Claimants required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.

6. When a Claimants has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:

6.1 Send an answer to that Claimants, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2 Pay or arrange for payment of any undisputed amounts.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.

9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimants under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. Surety hereby waives notice of any change, including changes of time, to the Contractor or to related Subcontractors, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimants under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimants gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, 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.

12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

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

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. DEFINITIONS

15.1 Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and 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.

15.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY — Name, Address and Telephone
Surety Agency or Broker:
Owner's Representative: Utility Engineering Consultants, LLC
130 Southcrest Drive, Suite 100, Homwood, Alabama 35209, Phone (205) 951-3838

SECTION 00700

GENERAL CONDITIONS

TABLE OF CONTENTS

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, expediters, 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 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, 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 00800
SUPPLEMENTARY CONDITIONS

SUPPLEMENTARY CONDITIONS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01 Defined Terms

SC 1.01.A.48 Add the following language at the end of the last sentence of Paragraph

A Work Change Directive cannot change Contract Price or Contract Times without a subsequent Change Order.

SC 1.01.A.49 Add the following new Paragraph after Paragraph 1.01.A.48:

Abnormal Weather Conditions – Conditions of extreme or unusual weather for a given region, elevation, or season as determined by Engineer. Extreme or unusual weather that i typical for a given region, elevation, or season should not be considered Abnormal Weather

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.01 Delete paragraphs 2.01 B. and C. in their entirety and insert the following in their place:

B. Evidence of Contractor's Insurance: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies of insurance (including all endorsements, and identification of applicable self-insured retentions and deductibles) required to be provided by Contractor in Article 6. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

C. Evidence of Owner's Insurance: After receipt from Contractor of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner under Article 6 (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

SC 2.02.A AMEND THE FIRST SENTENCE OF PARAGRAPH 2.02.A. TO READ AS FOLLOWS:

OWNER SHALL FURNISH TO CONTRACTOR FIVE COPIES OF THE CONTRACT DOCUMENTS (INCLUDING ONE FULLY EXECUTED COUNTERPART OF THE AGREEMENT), AND ONE COPY IN ELECTRONIC PORTABLE DOCUMENT FORMAT (PDF).

***SC-** 2.02.B Delete Paragraph 2.01.B and replace with the term [Deleted]*

ARTICLE 3– DOCUMENTS; INTENT, REQUIREMENTS, REUSE

***SC-**3 No Changes*

ARTICLE 4– COMMENCEMENT AND PROGRESS OF WORK

***SC-**4 No Changes*

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

SC-5.03 Replace with the following:

SC-5.03 Subsurface and Physical Conditions

No reports of explorations or tests of subsurface conditions at or adjacent to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

SC – 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

A. **No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.**

B. **Not Used**

ARTICLE 6 – BONDS AND INSURANCE

SC-6.02 Insurance—General Provisions

SC6.02 Add the following paragraph immediately after Paragraph 6.02.B

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

6.03 Contractor's Liability Insurance

SC-6.03 Add the following paragraph immediately after Paragraph 6.03.J.

K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:		**Statutory**
Federal, if applicable (e.g., Longshoreman's):		**Statutory**
Jones Act coverage, if applicable:		
Bodily injury by accident, each accident	**$**	**500,000**
Bodily injury by disease, aggregate	**$**	**1,000,000**
Employer's Liability:		
Bodily injury, each accident	**$**	**500,000**
Bodily injury by disease, each employee	**$**	**500,000**
Bodily injury/disease aggregate	**$**	**1,000,000**

For work performed in monopolistic states, stop-gap liability coverage shall be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of: **$ N/A**

Foreign voluntary worker compensation **Statutory**

2. **Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:**

General Aggregate	**$ 1,000,000**
Products - Completed Operations Aggregate	**$ 500,000**
Personal and Advertising Injury	**$ 500,000**
Each Occurrence (Bodily Injury and Property Damage)	**$ 500,000**

3. **Automobile Liability under Paragraph 6.03.D. of the General Conditions:**

Bodily Injury:

Each person	**$ 500,000**
Each accident	**$ 1,000,000**
Combined Single Limit of	**$ 1,000,000**

4. **Excess or Umbrella Liability:**

Per Occurrence	**$ 500,000**
General Aggregate	**$ 1,000,000**

5. **Contractor's Pollution Liability:**

Each Occurrence	**$ N/A**
General Aggregate	**$ N/A**

☐ **If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract**

6. **Additional Insureds: In addition to Owner and Engineer, include as additional insureds the following: None**

7. **Contractor's Professional Liability:**

Each Claim	**$ 500,000**

Annual Aggregate	**$ 100,000**

[See Paragraph 6.03.H of the General Conditions.]

SC-6.05 Property Insurance add the following to the list of requirements in Paragraph 6.05.A as a number item

SC-14. be subject to a deductible amount of no more than [$5,000] for direct physical loss in any one occurrence.

SC-6.05.A.1 Add the following new subparagraph after subparagraph 6.05.A.1:

a. In addition to Owner, Contractor, and all Subcontractors, include as insureds the following: N/A

SC-6.05.A. Add the following to the list of items in Paragraph 6.05.A, as numbered items:

15. include for the benefit of Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorneys fees and engineering or other consultants' fees, if not otherwise covered;

16. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:

17. include by express endorsement coverage of damage to Contractor's equipment.

SC-6.05.A. Add the following to the list of items in Paragraph 6.05.A, as numbered items:

15. include for the benefit of Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorneys fees and engineering or other consultants' fees, if not otherwise covered;

16. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:

17. include by express endorsement coverage of damage to Contractor's equipment.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.02 Labor; Working Hours

SC-7.02.B. **Amend the first and second sentences of Paragraph 7.02.B to state "…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.**

SC-7.02.C. Add the following new paragraph immediately after Paragraph 7.02.B:

Contractor shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as

overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC 7.09 **Add a new paragraph immediately after Paragraph 7.09.A:**

B. Owner is exempt from payment of sales and compensating use taxes of the State of *Alabama* and of cities and counties thereof on all materials to be incorporated into the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.

2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

ARTICLE 8 – OTHER WORJ AT SITE

***SC**-8 No Changes*

ARTICLE 9 – OWNER'S RESPONSIBILITIES

***SC**-9 No Changes*

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.A:

B. The Resident Project Representative (RPR) will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.

1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.

2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.

3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.

4. Liaison:

a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

6. Shop Drawings and Samples:

a. **Record date of receipt of Samples and Contractor-approved Shop Drawings.**

b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.

7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.

8. Review of Work and Rejection of Defective Work:

a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

9. Inspections, Tests, and System Start-ups:

a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.

b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

10. Records:

a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather

conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

c. Maintain records for use in preparing Project documentation.

11. Reports:

a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.

b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

14. Completion:

a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.

b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.

c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.

5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.

8. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11– AMENDING THE CONTRACT DOCUMENTS; CHANGE IN WORK

***SC**-11 No Changes*

ARTICLE 12– CLAIMS

***SC**-12 No Changes*

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

SC 13.02.C Delete Paragraph 13.02.C in its entirety and insert the following in its place:

Deleted

***SC**-13.03 Unit Price Work*

SC 13.03.E Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:

1. if the extended price of a particular item of Unit Price Work amounts to 25 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and

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

3. **if Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.**

ARTICLE 14 – TEST AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF WORK

***SC**-15 No Change*

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

SC 15.01.D.1 Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place:

The Application for Payment with Engineer's recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 15.01.E will become due twenty (20) days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

SC 15.02.A Amend Paragraph 15.02.A by striking out the following text: "no later than seven days after the time of payment by Owner" and insert "no later than the time of payment by Owner."

SC 15.03.B Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

ARTICLE 16 - SUSPENSION OF WORK AND TERMINATION

***SC**-16 No Changes*

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

SC-17.02 Arbitration

A. All matters subject to final resolution under this Article will be decided by arbitration in accordance with the rules of mutually agreed upon arbitrator subject to the conditions and limitations of this paragraph. This agreement to arbitrate and any other agreement or consent to arbitrate entered into will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event shall any such demand be made after the date when institution of legal or

equitable proceedings based on such matter in question would be barred by the applicable statute of limitations. The demand for arbitration should include specific reference to Paragraph SC-17.02.D below.

C. No arbitration arising out of or relating to the Contract shall include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and

2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings.

D. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.

E. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

F. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02.

SC-17.03 Attorneys' Fees: For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

ARTICLE 18 MISCELLANEOUS

SC-*18 No Changes*

State of Alabama
Alabama Department of Environmental Management
State Revolving Fund (SRF) Loan Program

SRF Section
Permits and Services Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

(334) 271-7793
(334) 271-7950 FAX

Supplemental General Conditions

for SRF Assisted

Public Drinking Water and Wastewater
Facilities Construction Contracts

Clean Water
State Revolving Fund

Protect Our Health from Source to Tap
Drinking Water State Revolving Fund

SRF Project Number: CS010899-01

Table of Contents:

I – ADEM Special Conditions

1. Construction within State rights-of-way shall be in accordance with the Alabama Department of Transportation policies and procedures.

2. Construction is to be carried out in compliance with applicable NPDES permits and in a manner that prevents bypassing of raw wastewater flows during construction. If bypassing is anticipated, the ADEM NPDES Enforcement Branch (334-271-7975) shall be advised in advance and the contractor shall take all necessary steps to minimize the impacts of bypassing.

3. Siltation and soil erosion shall be minimized during construction. The contractor shall obtain an NPDES storm water permit for construction if required.

4. The owner shall provide and maintain competent and adequate supervision and inspection.

5. ADEM and EPA shall have access to the site and the project work at all times.

6. These Special Conditions shall supersede any conflicting provisions of this contract.

7. **A project sign is required.** See **Parts XVII and XVIII, pages SGC-36 – SGC-37**, for more information.

II – Bonds and Insurance

Bonding requirements shall comply with Alabama Act No. 97-225. Provisions of the Act are summarized below:

1. Bid Bond – Not less than 5% of either the owner's estimated cost or of the proposed prime contractor's bid up to a maximum of $10,000. The bid guarantee shall consist of a cashier's check drawn on an Alabama bank or a bid bond executed by a surety company duly authorized and qualified to make bonds in the State of Alabama.

2. Performance Bond – In an amount not less than 100% of the contract price.

3. Payment Bond – Payable to the awarding authority, shall be executed in an amount not less than 50% of the contract price.

In addition to the insurance requirements elsewhere in the specifications, the owner or the contractor, as appropriate, must acquire any flood insurance made available by the Federal Emergency Management Agency as required by 40 CFR 30.600 (b), if construction will take place in a flood hazard area identified by the Federal Emergency Management Agency.

III – Utilization of Disadvantaged Businesses Enterprises (DBEs)

It is the policy of the State Revolving Loan Fund (SRF) to promote a "fair share" of sub-agreement awards to **small, minority, and/or women-owned businesses** for equipment, supplies, construction, and services. Compliance with these contract provisions is required in order for project costs to be eligible for SRF funding. *The "fair share" objective is a goal, not a quota.* DBE (Disadvantaged Business Enterprise) is an all-inclusive business classification, which includes MBE (minority business enterprises and/or WBE (women business enterprises) and is used synonymously when these entities are referenced individually or collectively.

Failure on the part of the apparent successful bidder to submit required information to the Loan Recipient (Owner) may be considered (by the Loan Recipient (Owner)) in evaluating whether the bidder is responsive to the bid requirements. The project objectives for utilization of Minority Business Enterprises (MBEs) and Women's Business Enterprises (WBEs) are as follows:

Commodities (Supplies)	MBE 4%	WBE 11%
Contractual (Services)	MBE 8%	WBE 30%
Equipment	MBE 5%	WBE 20%
Construction	MBE 2.5%	WBE 3%

For purposes of clarification:

- This objective applies to any Federally assisted procurement agreement in excess of $10,000.
- This objective necessitates three responsibilities; separate solicitations must be made of small and minority and women's business enterprises.
- A minority business is a business, at least 51 percent of which is owned and controlled by minority group members (Black; Hispanic; Asian American; American Indian; and, any other designations approved by the Office of Management and Budget).
- A women's business is a business, at least 51 percent of which is owned and controlled by one or more women.
- The control determination will revolve around the minority or woman owner's involvement in the day-to-day management of the business enterprise.
- Solicitation should allow adequate time for price analysis. ADEM recommends that contact be made no later than 15 days before bid opening.
- Efforts taken to comply with this objective must be documented in detail; maintain records of firms contacted, including any negotiation efforts to reach competitive price levels, and awards to the designated firms.
- ADEM recommends that the Loan Recipient (Owner) or proposed Prime Contractor utilizes the services of the Minority Business Development Service Centers. These Centers are funded by the U.S. Department of Commerce to provide technical, financial and contracting assistance to minority and women's business enterprises. These Centers are located in a number of Regional cities.
- Use of the services provided by these Centers does not absolve the Loan Recipient (Owner) or proposed Prime Contractor from pursuing additional efforts to meet this objective.

IV – Six Affirmative Steps for Good Faith DBE (MBE-WBE) Solicitation

The Loan Recipient (Owner) shall follow the six affirmative steps found in the SRF application when using loan funds to procure sources of supplies, construction and services.

If the successful bidder plans to subcontract a portion of the project, the bidder must submit to the owner within 10 days after bid opening, evidence of the affirmative steps taken to utilize small, minority and women's businesses. These six affirmative steps or ‘good faith efforts’ are required methods to ensure that DBEs have the opportunity to compete for procurements funded by EPA financial assistance dollars. Such affirmative steps are described as follows:

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. This will include placing DBEs on solicitation lists and soliciting them whenever there are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the resources, services, and assistance of the AL Department of Transportation (ALDOT), Small Business Administration (SBA), and the Minority Business Development Agency of the Department of Commerce (MBDA).

6. If the Contractor awards subcontracts, it must take the steps described in items (1) through (5) listed above.

V – Documentation Required from Loan Recipient (Owner) and Contractor

The low, responsive, responsible bidder must forward the following items, in duplicate, to the loan recipient (owner) no later than 10 days after bid opening. The Loan Recipient (Owner) shall transmit one (1) copy of its DBE documentation of the prime contractor solicitation and one (1) copy of the prime contractor's/bidder's DBE documentation of all subcontractor solicitation to the SRF Section within 14 days after bid opening.

1. SRF project number and project name/loan name*. (*not contract name)

2. List of **all** subcontractors (DBE **and** non-DBE) with name, address, telephone number, estimated contract dollar amount and duration. If there are to be no subcontractors, please indicate such in a letter on company letterhead.

3. List of any subcontract work yet to be committed with estimate of dollar amount and duration of contract.

4. MBE-WBE (DBE) Documents - See **Part V, page SGC-6**.

5. Debarred Firms Certification – See **Part XIV, page SGC-25**.

6. Certification Regarding Equal Employment Opportunity – See **Part XIII, page SGC-24.**

The Loan Recipient (Owner) shall submit annual MBE/WBE Utilization Reports (EPA Form 5700-52A, **pages SGC-16 - SGC-17**) within 30 days of the end of the annual reporting period **(October 30th, i.e. by November 30th)**. Submit reports directly to:

Laketa Ross, Accountant
Administrative Section
Fiscal Branch
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

The proposed Prime Contractor must submit the following items to the Loan Recipient (Owner):

1) DBE Compliance Form. The Loan Recipient (Owner) must submit this information to the SRF Section to demonstratecompliance with the DBE requirements. ADEM's approval is required prior to award of the construction contract and commencement of any SRF-funded construction. **(Page SGC-8)**

2) Certification Regarding Equal Employment Opportunity. This form is required of the proposed prime contractor(re: all subcontracts executed) and should be submitted with the prime proposed contractor's MBE-WBE solicitation submittal to the Loan Recipient (Owner). (**Page SGC-24**)

3) Debarred Firms Certification. This form is required of the proposed prime contractor (re: all subcontracts executed) and should be submitted with the prime proposed contractor's MBE-WBE solicitation submittal to the Loan Recipient (Owner). (**Page SGC-25**)

4) EPA Form 6100-2 DBE Subcontractor Participation Form. This form gives a DBE subcontractor the opportunity to describe the work the DBE subcontractor received from the proposed prime contractor, how much the DBE subcontractor was paid, and any other concerns the DBE subcontractor might have. The proposed prime contractor must provide this form to each DBE subcontractor for the DBE subcontractor's submittal to the SRF Section's MBE-WBE Compliance Staff (to be forwarded to EPA's DBE Coordinator). **(Page SGC-10)**

5) EPA Form 6100-3 DBE Subcontractor Performance Form. This form captures an intended DBE subcontractor's description of work to be performed for the proposed prime contractor and the price of the work. The proposed prime contractor must provide this form to each DBE subcontractor for the DBE subcontractor's submittal to the SRF Section's MBE-WBE Compliance Staff (to be forwarded to EPA's DBE Coordinator). **(Page SGC-12)**

6) EPA Form 6100-4 DBE Subcontractor Utilization Form. This form captures the proposed prime contractor's intended use of all identified DBE subcontractors and the estimated dollar amount of the work. The proposed prime contractor must provide this form to each DBE subcontractor for the DBE subcontractor's submittal to the SRF Section's MBE-WBE Compliance Staff (to be forwarded to EPA's DBE Coordinator). **(Page SGC-14)**

7) EPA Form 5700-52 A MBE/WBE Utilization Reports (DBE Annual Report), if applicable. The Loan Recipient (Owner) must submit this information to the SRF Section within 30 days of the end of the annual reporting period (October 30th), i.e., **by November 30th)**. **(Pages SGC-16 - SGC-17)**

8) Changes to Approved DBE Compliance Form, if applicable. If any changes, substitutions, or additions are proposed to the subcontractors included in previous Department approvals, the Owner must submit this information to the Department for prior approval in order for the affected subcontract work to be eligible for SRF funding. **(Page SGC-23)**

9) Certified Payrolls. These should be submitted to the Loan Recipient (Owner), at least, monthly for the prime contractor and all subcontractors. The Loan Recipient (Owner) must maintain payroll records and make these available for inspection

Please note that DBEs, MBEs, and WBEs must be certified **in writing** by EPA, SBA, or DOT (or by state, local, Tribal, or private entities whose certification criteria match EPA's). Depending upon the certifying agency, a DBE may be classified as a Disadvantaged Business Enterprise (DBE), a Minority Business Enterprise (MBE), or a Women's Business Enterprise (WBE). Written certification as a DBE (MBE or WBE) is required in order to be counted toward the Loan Recipient/Owner's MBE-WBE accomplishments.

The documentation of these good faith solicitation efforts must be detailed in order to allow for satisfactory review. Such documentation might include fax confirmation sheets, copies of solicitation letters/emails, printouts of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The proposed prime contractor is strongly encouraged to follow up each written, fax, or email solicitation with, at least, 1 logged phone call.

The proposed prime contractor must employ the six affirmative steps to subcontract with DBEs, even if the proposed prime contractor has achieved its fair share objectives.

The prime contractor must employ the six affirmative steps to subcontract with DBEs, even if the proposed prime contractor has achieved its fair share objectives. If a DBE subcontractor fails to complete work under the subcontract for any reason, the proposed prime contractor must notify the Loan Recipient (Owner) in writing prior to any termination and must employ the six 'good faith efforts' described above if using a replacement subcontractor. Any proposed changes from an approved DBE subcontractor must be reported to the Loan Recipient (Owner) and to the SRF Section on the Changes to Approved Subcontractors Form prior to initiation of the action. EPA Forms Nos. 6100-3 and 6100-4 must also be submitted to the SRF Section for new DBE subcontracts.

VI – Resources for Identifying MBE-WBE (DBE) Contractors/Subcontractors

The following organizations may provide assistance in soliciting DBE participation:

City of Birmingham
Office of Economic Development
ATTN: **Monique Shorts**, Economic Specialist
710 20th Street North
Birmingham, Alabama 35203
Ph: (205) 254-2799
Fax: (205) 254-7741
Monique.shorts@birmingham.gov

U.S. Small Business Administration
http://www.pro-net.sba.gov

National Association of Minority Contractors (NAMC)
https://namcatlanta.org/

Alabama Department of Transportation
ATTN: **John Huffman**
1409 Coliseum Boulevard
Montgomery, Alabama 36130
Ph: (334) 244-6261
http://www.dot.state.al.us

U.S. Department of Commerce
Minority Business Development Agency
ATTN: **Donna Ennis**
75 5th Street NW,
Suite 300
Atlanta, Georgia 30308
Ph: (404) 894-2096
http://www.mbda.gov/

Governor's Office of Minority and Women's Business Enterprises
Hilda Lockhart, STEP Project Director
401 Adams Avenue
Suite 360
Montgomery, Alabama 36130
Ph: (334) 242-2220

Birmingham Construction Industrial Authority ATTN: **Ashley Orl** or **Kimberly Bivins**
601 37th Street South
Birmingham, Alabama 35222
Ph: (205) 324-6202
aorl@bcia1.org
kbaylorbivins@bcia1.org

NOTE:

(1) The Loan Recipient (Owner) and the proposed Prime Contractor shall use the necessary resources to identify and directly solicit no less than three (3) certified DBE/MBE/WBE companies to bid in each expected contract/subcontract area. If a diligent and documented search of ALDOT, SBA, and MBDA directories does not identify three (3) potential certified DBE/MBE/WBE firms, then the proposed Prime Contractor shall post an advertisement in, at least, one (1) of the other online or print resources. Whenever possible, post solicitation for bids or proposals should be posted/advertised for a minimum of 30 calendar days before the bid or proposal closing date.

(2) Expenditures to a DBE that acts merely as a broker or passive conduit of funds, without performing, managing, or supervising the work of its subcontract in a manner consistent with normal business practices may not be counted.

(3) The proposed Prime Contractor should attempt to identify and first solicit DBEs in the geographic proximity of the project before soliciting those located farther away.

(4) In addition, our SRF DBE Compliance Staff is readily available for assistance, as follows: Laketa Ross at (334) 271-7727 or laketa.ross@adem.alabama.gov OR Diane Lockwood (DBE Coordinator) at (334) 271-7815 or dpl@adem.alabama.gov.

VII – DBE Compliance Form

NOTE: FOR DBE COMPLIANCE, ONE (1) COPY OF THIS FORM (WITH ALL INFORMATION OUTLINED) IS REQUIRED (WITH THE LOAN RECIPIENT (OWNER)'S DBE SUBMITTAL) FOR EACH PR&CS REVIEW. THE LOAN RECIPIENT (OWNER) AND PROPOSED PRIME CONTRACTOR SHOULD ENSURE THAT THIS INFORMATION IS COMPLETE *PRIOR TO THE PR&CS SUBMITTAL TO THE SRF SECTION*.

Loan Recipient: Water Works, Gas and Sewer Board of the City of Piedmont SRF Loan (Project) Number: CS010899-01

CERTIFICATIONS:

I certify that the information submitted on and with this form is true and accurate and that this company has met and will continue to meet the conditions of this construction contract regarding DBE solicitation and utilization. I further certify that criteria used in selecting subcontractors and suppliers were applied equally to all potential participants and that EPA Forms 6100-2 and 6100-3 were distributed to all DBE subcontractors.

_____ Date_____
(Proposed Prime Contractor Signature)

_____
(Printed Name and Title)

I certify that I have reviewed the information submitted on and with this form and that it meets the requirements of the Loan Recipient's/Owner's State Revolving Fund loan contract.

(Only ONE (1) signature required below.)**

_____ Date_____
(Signature of Loan Recipient (Owner))

OR**

_____ Date_____
(Loan Recipient's (Owner's) Representative's Signature, (**P.E.**))

Dave Bechtel, P. E.
(Printed Name and Title)

GENERAL INFORMATION:

Loan Recipient (Owner) Contact: _____

Loan Recipient (Owner) Phone Number/Email: _____

Consulting Engineer Contact: Utility Engineering Consultants, LLC. / Dave Bechtel, P. E.

Consulting Engineer Phone Number/Email: (205) 951-3838 / dbechtel@uecllc.com

Proposed Prime Contractor: _____

Proposed Prime Contractor Contact: _____

Proposed Prime Contractor Phone Number/Email:_____

Proposed Prime Contract Amount: $ _____

Proposed Total DBE/MBE Participation: $ _____ Percentage: ____% Goal: 2.5%

Proposed Total WBE Participation: $ _____ Percentage: ____% Goal: 3.0%

_____

Please ensure the following is submitted in the *full* DBE submittal (with the DBE COMPLIANCE FORM (page SGC-8)):

(1) **List of all committed and uncommitted subcontractors** by trade, including company name, address, telephone number, contact person, dollar amount of subcontract, and DBE/MBE/WBE status. Indicate in writing if no solicitations were made because the contractor intends to use only its own forces to accomplish the work.

(2) **Proof of certification (certificate or letter)** by EPA, SBA, DOT (or by state, local, Tribal, or private entities whose certification criteria match EPA's) for each subcontractor listed as a DBE, MBE, or WBE.

(3) **Documentation of solicitation effort for prospective DBE firms**, such as fax confirmation sheets, copies of solicitation letters/emails, printout of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The prime contractor is strongly encouraged to follow up each written, fax, or email solicitation with at least 1 logged phone call. Whenever possible, post solicitation for bids or proposals should be for a minimum of 30 calendar days before the bid or proposal closing date.

(4) **Justification for not selecting a certified DBE subcontractor** that submitted a low bid for any subcontract area.

(5) **Certification By Proposed Prime Contractor or Subcontractor Regarding Equal Opportunity Employment. (Page SGC-24**)

(6) **Debarred Firms Certification**. (**Page SGC-25**)

(7) **EPA Form 6100-2 DBE Subcontractor Participation Form** for **each** proposed **certified** DBE subcontractor.* (**Page SGC-10**) (*This form is completed by the proposed prime contractor. It is signed by **each** proposed subcontractor **only**.)

(8) **EPA Form 6100-3 DBE Subcontractor Performance Form** for each DBE subcontractor.** (**Page SGC-12**) (**This form is completed by the proposed prime contractor and signed by each proposed certified subcontractor and the proposed prime contractor per subcontract.)

(9) **EPA Form 6100-4 DBE Subcontractor Utilization Form** to summarize all DBE subcontracts/subcontractors.*** (**Page SGC-14**) (***This form is completed and signed by the proposed prime contractor **only**.)

NOTE:

ALL DBE contractors selected must have a current DBE certificate or letter of certification by an approved certifying agency.

Loan Recipient (Owner) DBE Submittal

At minimum, the Loan Recipient (Owner)'s DBE submittal should **always** consist of **a cover letter** (*preferred, but optional*) **and a VII - DBE Compliance Form (page SGC-8) and DBE solicitation documentation** (i.e., DBE solicitation list(s) with source(s) of list(s) clearly identified, contractor contact information and results/outcomes of each solicitation (or of the overall solicitation effort, if all results/outcomes were the same), documentation of solicitation method (i.e., copies of emails, phone logs, faxes, etc.).

Prime Contractor DBE Submittal

At minimum, the Prime Contractor's DBE submittal should **always** consist of **a cover letter** (*preferred, but optional*) **and DBE solicitation documentation** (i.e., DBE solicitation list(s) with source(s) of list(s) clearly identified, subcontractor contact information and results/outcomes of each solicitation (or of the overall solicitation effort, if all results/outcomes were the same), documentation of solicitation method (i.e., copies of emails, phone logs, faxes, etc.) **OR** a "No Subcontractors" Letter (*if none will be utilized*) **and** a List of ***ALL*** *(DBE/non-DBE) subcontractors* contracted/yet to be contracted **and** ***ALL EPA 6100 Forms*** *described above* (*DBE subcontractors selected **or not***) **and** Certification Regarding Equal Employment Opportunity **and** Debarred Firms Certification.

United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name		Project Name Wastewater Lagoon Upgrades
Bid/ Proposal No.	Assistance Agreement ID No. (if known) CS010899-01	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity: CWSRF

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-2 (DBE Subcontractor Participation Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-2 (DBE Subcontractor Participation Form)

United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name	Project Name Wastewater Lagoon Upgrades	
Bid/ Proposal No.	Assistance Agreement ID No. (if known) CS010899-01	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity: CWSRF	

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services, Equipment or Supplies	Price of Work Submitted to the Prime Contractor

DBE Certified By: O DOT O SBA O Other: _____	Meets/ exceeds EPA certification standards? O YES O NO O Unknown

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractors[2] and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name Wastewater Lagoon Upgrades
Bid/ Proposal No.	Assistance Agreement ID No. (if known) CS010899-01	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity: CWSRF		

I have identified potential DBE certified subcontractors	○ YES	◉ NO
If yes, please complete the table below. If no, please explain:		

Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt	Currently DBE Certified?

Continue on back if needed

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

EPA United States Environmental Protection Agency

OMB Control No: 2090-0030

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

U.S. ENVIRONMENTAL PROTECTION AGENCY
MBE/WBE UTILIZATION UNDER FEDERAL GRANTS AND COOPERATIVE AGREEMENTS

PART I OF II
(PAGES SGC-16 & SGC-17)

FOR COOPERATIVE AGREEMENTS OR OTHER FEDERAL FINANCIAL ASSISTANCE WHERE THE COMBINED TOTAL OF FUNDS BUDGETED FOR PROCURING SUPPLIES, EQUIPMENT, CONSTRUCTION OR SERVICES EXCEED $150,000.

PART 1: PLEASE REVIEW INSTRUCTIONS BEFORE COMPLETING

1A. FEDERAL FISCAL YEAR (Oct 1- Sep 30)	1B. REPORT TYPE
20_____	☐ Annual ☐ Last Report (Project completed)

1C: REVISION OF A PRIOR YEAR REPORT? ◯ No ◯ Yes, Year_____

IF YES, BRIEFLY DESCRIBE THE REVISIONS YOU ARE MAKING:

2A. EPA FINANCIAL ASSISTANCE OFFICE ADDRESS (ATTN: DBE COORDINATOR)	3A. RECIPIENT NAME AND ADDRESS
2B. EPA DBE COORDINATOR Name: Email: Phone: Fax:	3B. RECIPIENT REPORTING CONTACT Name: Address: Phone: Email:
4A. FINANCIAL ASSISTANCE AGREEMENT ID NUMBER (SRF State Recipients, refer to Instructions for Completion of blocks 4A, 5A and 5C)	4B. FEDERAL FINANCIAL ASSISTANCE PROGRAM TITLE OR CFDA NUMBER:
5A. TOTAL ASSISTANCE AGREEMENT AMOUNT EPA Share: $ _____ Recipient Share: $ _____ ☐ **N/A (SRF Recipient)/Loan Amount: $_____**	5B. If NO procurements and NO accomplishments were made this reporting period (by the recipients, sub-recipients, loan recipients, and prime contractors), **CHECK and SKIP to Block No. 7**. (Procurements are all expenditures through contract, order, purchase, lease or barter of supplies, equipment, construction, or services needed to complete Federal assistance programs. Accomplishments, in this context, are procurements made with MBEs and/or WBEs.) ☐

5C. Total Procurements This Reporting Period (Only include amount not reported in any prior reporting period)

Total Procurement Amount $_____

(Include total dollar values awarded by recipient, sub-recipients and SRF loan recipients, including MBE/WBE expenditures.)

5D. Were sub-awards issued under this assistance agreement? Yes ◯ No ◯

Were contracts issued under this assistance agreement? Yes ◯ No ◯

5E. MBE/WBE Accomplishments This Reporting Period

Actual MBE/WBE Procurement Accomplished (Include total dollar values awarded by recipient, sub-recipients, SRF loan recipients and Prime Contractors.)

	Construction	Equipment	Services	Supplies	Total
$MBE:	_____	_____	_____	_____	0.00
$WBE:	_____	_____	_____	_____	0.00

6. COMMENTS: (If no MBE/WBE procurements, please summarize how certified MBEs/WBEs were notified of the opportunities to compete for the procurement dollars entered in Block 5C and why certified MBEs /WBEs were not awarded any procurements during this reporting period.)

7. NAME OF RECIPIENT'S AUTHORIZED REPRESENTATIVE	TITLE
8. SIGNATURE OF RECIPIENT'S AUTHORIZED REPRESENTATIVE	DATE

EPA FORM 5700-52A available electronically at https://www.epa.gov/sites/production/files/2014-09/documents/epa_form_5700_52a.pdf

If reporting DBE procurement, please enter the Loan Project Number and the information in the grid below, as applicable.
If no additional DBE procurement to report, please enter the Loan Project Number and enter 'N/A' in the black box below.

PART II OF II
(PAGES SGC-16 & SGC-17)

PART II.

MBE/WBE PROCUREMENTS MADE DURING REPORTING PERIOD

SRF Financial Assistance Agreement Number: _____

1. Procurement Made By			2. Business Enterprise		3. $ Value of Procurement	4. Date of Procurement MM/DD/YY	5. Type of Product or Service (Enter Code)	6. Name/Address/Phone Number of MBE/WBE Contractor or Vendor
Recipient	Sub-Recipient and/or SRF Loan Recipient	Prime	Minority	Women				

Type of Product or Service Codes: 1 = Construction 2 = Supplies 3 = Services 4 = Equipment

Note: Recipients are required to submit MBE/WBE reports to EPA beginning with the Federal fiscal year the recipients receive the award, continuing until the project is completed.

Instructions:

A. General Instructions:

MBE/WBE utilization is based on 40 CFR Part 33. The reporting requirement reflects the class deviation issued on November 8, 2013, clarified on January 9, 2014 and modified on December 2, 2014. EPA Form 5700-52A must be completed annually by recipients of financial assistance agreements where the combined total of funds budgeted for procuring supplies, equipment, construction or services exceeds $150,000.This reporting requirement applies to all new and existing awards and voids all previous reporting requirements.

In determining whether the $150,000 threshold is exceeded for a particular assistance agreement, the analysis must focus on funds budgeted for procurement under the supplies, equipment, construction, services or "other" categories, and include funds budgeted for procurement under sub-awards or loans

Reporting will also be required in cases where the details of the budgets of sub-awards/loans are not clear at the time of the grant awards and the combined total of the procurement and sub-awards and/or loans exceeds the $150,000 threshold.

When reporting is required, all procurement actions are reportable, not just the portion which exceeds $150,000.

If at the time of award the budgeted funds exceed $150,000 but actual expenditures fall below, a report is still required.

If at the time of award, the combined total of funds budgeted for procurements in any category is less than or equal to $150,000 and is maintained below the threshold, no DBE report is required to be submitted.

Recipients are required to report 30 days after the end of each federal year, per the terms and conditions of the financial assistance agreement.

Last reports are due October 30th or 90 days after the end of the project period, whichever comes first.

MBE/WBE program requirements, including reporting, are material terms and conditions of the financial assistance agreement.

B. Definitions:

Procurement is the acquisition through contract, order, purchase, lease or barter of supplies, equipment, construction or services needed to accomplish Federal assistance programs.

A ***contract*** is a written agreement between an EPA recipient and another party (also considered "prime contracts") and any lower tier agreement (also considered "subcontracts") for equipment, services, supplies, or construction necessary to complete the project. This definition excludes written agreements with another public agency. This definition includes personal and professional services, agreements with consultants, and purchase orders.

A ***minority business enterprise*** **(MBE)** is a business concern that is (1) at least 51 percent owned by one or more minority individuals, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more minority

individuals; and (2) whose daily business operations are managed and directed by one or more of the minority owners. In order to qualify and participate as an MBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

U.S. citizenship is required. Recipients shall presume that minority individuals include Black Americans, Hispanic Americans, Native Americans, Asian Pacific Americans, or other groups whose members are found to be disadvantaged by the Small Business Act or by the Secretary of Commerce under section 5 of Executive order 11625. The reporting contact at EPA can provide additional information.

A ***woman business enterprise*** **(WBE)** is a business concern that is, (1) at least 51 percent owned by one or more women, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more women and (2) whose daily business operations are managed and directed by one or more of the women owners. In order to qualify and participate as a WBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

Business firms which are 51 percent owned by minorities or women, but are in fact not managed and operated by minorities or females do not qualify for meeting MBE/WBE procurement goals. U.S. Citizenship is required.

Good Faith Efforts

A recipient is required to make the following good faith efforts whenever procuring construction, equipment, services, and supplies under an EPA financial assistance agreement. These good faith efforts for utilizing MBEs and WBEs must be documented. Such documentation is subject to EPA review upon request:

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the services and assistance of the SBA and the Minority Business Development Agency of the Department of Commerce.

6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs (a) through (e) of this section.

C. Instructions for Part I:

1A. Specify Federal fiscal year this report covers. The Federal fiscal year runs from October 1st through September 30th (**e.g. November 29, 2014 falls within Federal fiscal year 2015**)

1B. Specify report type. Check the annual reporting box. Also indicate if the project is completed.

1C. Indicate if this is a revision to a previous year and provide a brief description of the revision you are making.

2A-B. Please refer to your financial assistance agreement for the mailing address of the EPA financial assistance office for your agreement.

The "EPA DBE Reporting Contact" is the DBE Coordinator for the EPA Region from which your financial assistance agreement was originated. For a list of DBE Coordinators please refer to the EPA OSBP website at http://epa.gov/osbp/dbe_cord.

3A-B. Identify the agency, state authority, university or other organization which is the recipient of the Federal financial assistance and the person to contact concerning this report.

4A. Provide the Assistance Agreement number assigned by EPA. A separate report must be submitted for each Assistance Agreement.

***For SRF recipients**: In box 4a list numbers for ALL OPEN Assistance Agreements being reported on this form.

4B. Refer back to Assistance Agreement document for this information.

5A. Provide the total amount of the Assistance Agreement which includes Federal funds plus recipient matching funds and funds from other sources.

***For SRF recipients only**: SRF recipients will not enter an amount in 5a. SRF recipients should check the "N/A" box.

5B. Self-explanatory.

5C. Provide the total dollar amount of **ALL** procurements awarded this reporting period by the recipient, sub-recipients, and SRF loan recipients, **including** MBE/WBE expenditures, not just the portion which exceeds $150,000. For example: Actual dollars for procurement from the procuring office; actual contracts let from the contracts office; actual goods, services, supplies, etc., from other sources including the central purchasing/ procurement centers).

***NOTE**: To prevent double counting on line 5C, if any amount on 5E is for a subcontract and the prime contract has already been included on Line 5C in a prior reporting period, then report the amount going to MBE or WBE subcontractor on line 5E, but exclude the amount from Line 5C. To include the amount on 5C again would result in double counting because the prime contract, which includes the subcontract, would have already been reported.

***For SRF recipients only**: In 5c please enter the total annual procurement amount under all of your SRF Assistance Agreements. The figure reported in this section is **not** directly tied to an individual Assistance Agreement identification number. **(SRF state recipients report state procurements in this section)**

5D. State whether or not sub-awards and/or subcontracts have been issued under the financial assistance agreements by indicating “yes” or “no”.

5E. Where requested, also provide the total dollar amount of all MBE/WBE procurement awarded during this reporting period by the recipient, sub-recipients, SRF loan recipients, and prime contractors in the categories of construction, equipment, services and supplies. These amounts include Federal funds plus recipient matching funds and funds from other sources.

6. If there were no MBE/WBE accomplishments this reporting period, please briefly how certified MBEs/WBEs were notified of the opportunities to compete for the procurement dollars entered in Block 5C and why certified MBEs /WBEs were not awarded any procurements during this reporting period.

7. Name and title of official administrator or designated reporting official.

8. Signature, month, day, and year report submitted.

D. Instructions for Part II:

For each MBE/WBE procurement made under this financial assistance agreements during the reporting period, provide the following information:

1. Check whether this procurement was made by the recipient, sub-recipient/SRF loan recipient, or the prime contractor.

2. Check either the MBE or WBE column. If a firm is both an MBE and WBE, the recipient may choose to count the entire procurement towards EITHER its MBE or WBE accomplishments. The recipient may also divide the total amount of the procurement (using any ratio it so chooses) and count those divided amounts toward its MBE and WBE accomplishments. If the recipient chooses to divide the procurement amount and count portions toward its MBE and WBE accomplishments, please state the appropriate amounts under the MBE and WBE columns on the form. **The combined MBE and WBE amounts for that MBE/WBE contractor must not exceed the “Value of the Procurement” reported in column #3**

3. Dollar value of procurement.

4. Date of procurement, shown as month, day, year. Date of procurement is defined as the date the contract or procurement was awarded, **not** the date the contractor received payment under the awarded contract or procurement, unless payment occurred on the date of award. **(Where direct purchasing is the procurement method, the date of procurement is the date the purchase was made)**

5. Using codes at the bottom of the form, identify type of product or service acquired through this procurement (e.g., enter 1 if construction, 2 if supplies, etc.).

6. Name, address, and telephone number of MBE/WBE firm.

**This data is requested to comply with provisions mandated by: statute or regulations (40 CFR Parts 30, 31, and 33 and/or 2 CFR Parts 200 and 1500); OMB Circulars; or added by EPA to ensure sound and effective assistance management. Accurate, complete data are required to obtain funding, while no pledge of confidentiality is provided.

The public reporting and recording burden for this collection of information is estimated to average l hour per response annually. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclosure or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, OPPE Regulatory Information Division, U.S. Environmental Protection Agency (2136), 1200 Pennsylvania Avenue, NW, Washington, D.C. 20460. Include the OMB Control number in any correspondence. Do not send the completed form to this address.

XII – Changes to Approved DBE Compliance Form

NOTE: THIS FORM IS REQUIRED OF THE LOAN RECIPIENT (OWNER) (WITH THE PRIME CONTRACTOR'S INPUT) FOR DBE COMPLIANCE ONLY IF A SUBCONTRACTOR/SUPPLIER/VENDOR IS SOUGHT AND/OR PROCURED AFTER THE CONTRACT ATA (APPROVAL-TO-AWARD) HAS BEEN ISSUED. IT IS SIMILAR TO THE DBE COMPLIANCE FORM (PAGE SGC-8) IN THAT IT IS THE COVER/SUMMARY FORM USED TO DOCUMENT THE ADDITIONAL DBE SOLICITATION AND/OR REVISE THE ORIGINAL DBE APPROVAL STATUS.

Loan Recipient: Water Works, Gas and Sewer Board of the City of Piedmont

Loan (Project) Number: CS010899-01

CERTIFICATIONS:

I certify that the information submitted on and with this form is true and accurate and that this company has met and will continue to meet the conditions of this construction contract regarding DBE solicitation and utilization. I further certify that criteria used in selecting subcontractors and suppliers were applied equally to all potential participants and that EPA Forms 6100-2 and 6100-3 were distributed to all DBE subcontractors.

_____ Date_____

(Prime Contractor Signature)

_____

(Printed Name and Title)

I certify that I have reviewed the information submitted on and with this form and that it meets the requirements of the Loan Recipient's/Owner's State Revolving Fund loan contract. **(*Only ONE (1) signature required below.)**

_____ Date_____

(Signature of Loan Recipient (Owner))

OR*

_____ Date_____

(Loan Recipient's (Owner's) Representative's Signature, (**P.E.**))

Dave Bechtel, P. E.

(Printed Name and Title)

GENERAL INFORMATION: **(Please attach additional pages to address 1 through 5, as needed.)**

(1) If an approved subcontractor is terminated or replaced, please identify this company and briefly state the reason.

(2) For new or additional subcontractors, list name, trade, address, telephone number, contact person, dollar amount of subcontract and DBE status.

(3) Attach proof of certification by EPA, SBA, DOT (or by state, local, Tribal or private entities whose certification criteria match EPA's) for each subcontractor listed as a DBE, MBE or WBE.

(4) Attach documentation of solicitation effort for prospective DBE firms, such as fax confirmation sheets, copies of solicitation letters/emails, printouts of the online solicitations, printouts of online search results, affidavits of publication in newspapers, etc. The prime contractor is strongly encouraged to follow up each solicitation with, at least, one (1) logged phone call. Whenever possible, post solicitation for bids or proposals should be for a minimum of 30 calendar days before the bid or proposal closing date.

(5) Provide justification for not selecting a certified DBE subcontractor that submitted a low bid for any subcontract area.

_____

XIII – Certification Regarding Equal Employment Opportunity

The prime contractor is required to comply with Executive Order 112-46 of September 24, 1965 entitled "Equal Employment Opportunity" as amended by Executive Order 11375 of October 13, 1967.

The contract for the work under this proposal will obligate the prime contractor and its subcontractors not to discriminate in employment practices.

The prime contractor shall not maintain or provide for his/her employees the facilities, which are segregated on a basis of race, creed, color or national origin, whether such facilities are segregated by directive or on a de facto basis.

The prime contractor must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain his/her eligibility to receive the award of the contract.

The prime contractor must be prepared to comply in all respects with any contract provisions regarding non-discrimination stipulated in conjunction with labor standards.

PRIME CONTRACTOR'S CERTIFICATION:

Prime Contractor's Name: _____

Address: _____

_____

_____

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. Yes____ No____
2. Compliance Reports were required to be filed in connection with such contract or subcontract. Yes____ No____
3. Bidder has filed all compliance reports due under applicable contract requirements. Yes____ No____

If answer to item 3 is "No", please explain in detail on reverse side of this certification.

Certification - The information above is true and complete to the best of my knowledge and belief.

Signature of Prime Contractor: _____

Title: _____

Date: _____

XIV – Debarred Firms Certification

All prime construction contractors shall certify that Subcontracts have not and will not be awarded to any firm that is currently on the General Service Administration's Master List of Debarred, Suspended and Voluntarily Excluded Persons, in accordance with the provisions of ADEM Administrative Code 335-6-14-.35. Debarment action is taken against a firm for noncompliance with Federal Law.

All bidders shall complete this certification in duplicate and submit both copies to the Loan Recipient (Owner) with the bid proposal. The Loan Recipient (Owner) shall transmit one copy to the SRF Section within 14 days after the bid opening.

Project Name/Loan Name*: Wastewater Lagoon Upgrades
(*not **Contract** Name)

SRF Project No.: CS010899-01

The undersigned hereby certifies that the firm of _____

_____ has not and will not award a subcontract, in connection with any contract awarded to it as the result of this bid, to any firm that is currently on the General Service Administration's Master List of Debarred, Suspended, and Voluntarily Excluded Persons.

Signature of Prime Contractor: _____

Title: _____

Date: _____

XV – Davis-Bacon and Related Acts

Labor Standards Provisions for Federally Assisted Contracts

Wage Rate Requirements Under FY 2013 Continuing Appropriation

I. Requirements under the Consolidated and Further Continuing Appropriations Act. 2013 (P.L. 113-6) For Subrecipients That Are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient may contact Cynthia Y. Edwards at Edwards.Cynthiay@epa.gov or at 404-562-9340 of EPA, Region 4 Grants and SRF Management Section, for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at http://www.dol.gov/whd/

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract Subcontract Provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2010 appropriation , the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding.

The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at https://www.dol.gov/agencies/whd/forms/wh347 or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA , the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program.

If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements.

The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment.

A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages.

In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages.

The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing hat the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the subrecipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information
indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract . Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at https://www.dol.gov/agencies/whd/contact/local-offices.

(Insert applicable wage rate determination here.)

Wage Rates are county specific for *Heavy Construction* and can be found at:
https://sam.gov/content/wage-determinations

XVI – American Iron and Steel Requirement

Section 4.13 Compliance with 2014 Appropriations Act. (a) The Loan Recipient agrees to comply with all federal requirements applicable to the Authority Loan (including those imposed by P.L. 113-76, Consolidated Appropriations Act (the "2014 Appropriations Act") and related SRF Policy Guidelines) which the Loan Recipient understands includes, among other things, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel") unless (i) the Loan Recipient has requested and obtained a waiver from the U.S. Environmental Protection Agency pertaining to the Project or (ii) the Authority has otherwise advised the Loan Recipient in writing that the Buy American Requirement is not applicable to the Project. .

(b) The Loan Recipient also agrees to comply with all recordkeeping and reporting requirements under the Clean Water Act (codified generally under 33 U.S.C. §1251 et seq.) (the "Clean Water Act"), including any reports required by a federal agency or the Authority such as performance indicators of program deliverables, information on costs and Project progress. The Loan Recipient understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities, and (ii) failure to comply with the Clean Water Act and this Agreement may be an Event of Default hereunder that results in a repayment of the Authority Loan in advance of the maturity of the Evidence of Indebtedness and/or other remedial actions.

The Loan Recipient agrees to cause all contractors and subcontractors to comply with (through the inclusion of appropriate terms and conditions in all contracts, subcontracts and lower tiered transactions, such terms and conditions to be in substantially the form set forth in connection with the development and construction of the project

The Contractor acknowledges to and for the benefit of the Water Works, Gas and Sewer Board of the City of Piedmont, Alabama ("Purchaser"), and the Alabama Water Pollution Control Authority or the Drinking Water Finance Authority (the "State Authority") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State Authority that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State Authority or any damages owed to the State Authority by the Purchaser). While the Contractor has no direct contractual privity with the State Authority, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State Authority.

CW ARPA SIGN DETAIL (Reference: ADEM CW ARPA Agreement)

O. The recipient must construct a project sign that meets the following requirements:

(a) Sign is to be constructed of ½" MDO plywood or similar material, 4' x 8'.

(b) Paint with two (2) coats of enamel paint (or equivalent) prior to lettering.

(c) Background color white, lettering black.

(d) Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.

(e) Sign shall be attached to 4" x 4" x 8' treated posts.

(f) Sign shall be placed in prominent location near the project area, easily readable from existing street or roadway.

(g) Sign shall be maintained in good condition until completion of project.

(h) Sign shall follow the format below and include the following information only:

ADEM
Alabama Department of Environmental Management

STATE OF ALABAMA
Honorable Kay Ivey, Governor

ALABAMA AMERICAN RESCUE PLAN ACT (ARPA)
WASTEWATER INFRASTRUCTURE PROJECT

WATER WORKS, GAS AND SEWER BOARD OF THE CITY OF PIEDMONT

WASTEWATER LAGOON UPGRADES

$(Project/Contract Amount) ARPA Funds
$(Project/Contract Amount) STATE REVOLVING FUNDS (If Applicable)

(CONTRACTOR NAME)• CONTRACTOR
UTILITY ENGINEERING CONSULTANTY, LLC • CONSULTfNG ENGINEER
ALABAMA DEPARTMENT OF ENVIRONMENTAL
MANAGEMENT U.S. ENVIRONMENTAL PROTECTION AGENCY

EPA

DW ARPA SIGN DETAIL (Reference: ADEM DW ARPA Agreement)

O. The recipient must construct a project sign that meets the following requirements:

(a) Sign is to be constructed of ½" MDO plywood or similar material, 4' x 8'.

(b) Paint with two (2) coats of enamel paint (or equivalent) prior to lettering.

(c) Background color white, lettering black.

(d) Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.

(e) Sign shall be attached to 4" x 4" x 8' treated posts.

(f) Sign shall be placed in prominent location near the project area, easily readable from existing street or roadway.

(g) Sign shall be maintained in good condition until completion of project.

(h) Sign shall follow the format below and include the following information only:

ADEM
Alabama Department of Environmental Management

STATE OF ALABAMA
Honorable Kay Ivey, Governor

ALABAMA GREAT SEAL

ALABAMA AMERICAN RESCUE PLAN ACT (ARPA)
DRINKING WATER INFRASTRUCTURE PROJECT

WATER WORKS, GAS AND SEWER BOARD OF THE CITY OF PIEDMONT

WASTEWATER LAGOON UPGRADES

$(Project/Contract Amount) ARPA Funds

(CONTRACTOR NAME)• CONTRACTOR
UTILITY ENGINEERING CONSULTANTS, LLC • CONSULTING ENGINEER

ALABAMA DEPARTMENT OF ENVIRONMENTAL
MANAGEMENT U.S. ENVIRONMENTAL PROTECTION AGENCY

EPA

XIX – Construction Contract Requirements

This checklist is to be completed by the Loan Recipient (Owner)/Engineer when submitting plans and specifications to the SRF Section for review. It affirms to the SRF reviewer that the Loan Recipient (Owner)/Engineer has addressed these items (in boilerplate form) within the specifications manual.

Contract Page No.	Satisfied Yes/No	
_____	_____	Bid Advertisement (including date, time, and location of bid opening).
_____	_____	Bid Bond.
_____	_____	Performance Bond (100%).
_____	_____	Payment Bond (Not less than 50%).
_____	_____	Contract Length.
_____	_____	Liquidated Damages.
_____	_____	Liability Insurance (including workman's comp, public liability, and builder's risk, if applicable).
_____	_____	Method of Award (i.e. lowest, responsive, responsible bidder).
_____	_____	Air testing of gravity sewers (if applicable).

Within 14 days after the bid opening, the Loan Recipient (Owner)/Engineer is to prepare the Project Review and Cost Summary (per the **PR&CS Checklist, page SGC-39**) and submit it to the SRF Section of ADEM. Upon completion of review, a ***written*** ATA (Approval-to-Award) will be issued.

NOTE:

The Loan Recipient (Owner) assumes all financial risk, if the construction contract is awarded prior to the issuance of an ATA letter by the SRF Section.

XX – Project Review and Cost Summary

ADEM Alabama Department of Environmental Management	SRF Project Review and Cost Summary	Form Revised **07-2021**

This form is to be completed and submitted (with supporting documentation) to the SRF Section within 14 days after bid opening. Following satisfactory review, an ATA (Approval-to-Award) letter will be issued. After the ATA is issued/ award of the contract, a pre-construction conference should be scheduled (**with the SRF Project Manager in attendance**). *A complete, bound set of the executed contract documents manual should be forwarded to the SRF Section for review and written approval following the pre-construction conference.*

Loan Recipient: Water Works, Gas and Sewer Board of the City of Piedmont Project Number: CS010899-01

Project Name: Wastewater Lagoon Upgrades

Contract Number: _____ Contract Name: _____

1. Date of plans and specifications concurrence letter from ADEM-SRF Section: _____

   Date of construction permit issuance from ADEM-DW Branch: _____

2. Attach copies of the following documents:

___ a. Bid advertisement with certification by publisher and date(s) of publication.

___ b. Certified bid tabulation.

___ c. Proposal of the selected bidder.

___ d. Bid bond.

___ e. Engineer's letter to the loan recipient recommending award of the contract. If the award is made to other than the low bidder, provide justification.

___ f. Site certificates for the project, if not previously submitted with the SRF loan application.

___ g. DBE Documentation from **the loan recipient (owner) and the prime contractor**. Utilization, solicitation and documentation requirements (with a list of required documents) are discussed in detail in Parts III - V (pages SGC-3 - SGC-23) of the ADEM *SRF Supplemental General Conditions* for SRF Assisted Public Drinking Water and Wastewater Facilities Construction Contracts.

___ h. Copy of the wage determination used in bidding.

___ i. Any addenda that have been issued after ADEM review of the plans and specifications.

Comments:

_____

_____

"General Decision Number: AL20240105 01/05/2024

Superseded General Decision Number: AL20230105

State: Alabama

Construction Type: Heavy

County: Calhoun County in Alabama.

HEAVY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2024

SUAL2015-033 08/02/2017

	Rates	Fringes
CARPENTER, Includes Form Work	$ 20.26	8.59
CEMENT MASON/CONCRETE FINISHER, Includes Water Sewer Lines	$ 13.71 **	0.00
ELECTRICIAN	$ 19.98	5.53
LABORER: Common or General, Includes Water Sewer Lines	$ 12.39 **	0.00
LABORER: Pipelayer, Includes Water Sewer Lines	$ 13.91 **	2.04
OPERATOR: Backhoe/Excavator/Trackhoe, Includes Water Sewer Lines	$ 18.99	3.63
TRUCK DRIVER: Dump Truck, Includes Water Sewer Lines	$ 12.25 **	2.58

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($17.20) or 13658 ($12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current

negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISION"

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Contract Description: Piedmont Wastewater Lagoon Upgrades - CWSRF Project No. CS010899-01.

B. Lagoon Aerators

C. Lagoon Baffle Curtains

D. Ultraviolet Disinfection Modifications

E. Work by Owner

F. Contractor use of site and premises

G. Work Sequence

H. Owner occupancy

1.2 WORK BY OWNER

The Owner will continue to operate the existing facility.

1.3 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow:
   1. Owner occupancy.
   2. Work by Others and Work by Owner.

B. Construction Operations: Limited to areas noted on Drawings.

C. Utility Outages and Shutdown: At the Owner's convenience.

1.4 FUTURE WORK

Project is designed for future expansions.

1.5 WORK SEQUENCE

Construct work in phases during the construction period, coordinate construction schedule with Owner and Engineer.

1.6 OWNER OCCUPANCY

A. The Owner will occupy portions of the site during the entire period of construction to conduct normal operations of the existing plant.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate this requirement.

1.7 LOCATION

The location of the work as shown on the project location map is in the the City of Piedmont, Alabama.

1.8 WORK TO BE PERFORMED

The work to be performed under this contract consists of furnishing all plant, labor, tools, materials and equipment; and constructing complete, ready for use, a Water Resource Recovery Facility with all necessary structures, special piping connections, appurtenances, surface restoration work, and all miscellaneous and incidental work necessary for the satisfactory prosecution and completion of the contract. All work performed shall be in accordance with the Invitation for Bids, Instructions to Bidders, Supplementary Conditions, General Conditions, Contract and Surety Forms, and Plans and Specifications.

1.9 LICENSES AND PERMITS

A. The Contractor's attention has been called to the necessity for compliance with all federal, state and local laws and ordinances regarding licenses and permits as referred to in the Contract Documents as follows: Instructions to Bidders, Page IB-9; General Conditions, Article 6.14 and Article 6.15, Page GC-10.

B. The Contractor is reminded that it is mandatory that all licensing requirements be met. Prior to the beginning of any work, including the placement of a construction trailer on or near the project site, all necessary permits must be obtained.

C. All work performed for the City of Piedmont Lagoon Upgrades owned or funded projects shall require the use of licensed personnel for the respective trades i.e., plumbers, electricians, gas fitters, etc.

1.10 PROTECTION OF THE OWNER, AGENTS OF THE OWNER, WORKMEN AND THE PUBLIC

The Contractor and the superintendent are requested to carefully read the Articles of the General Conditions relating to protection of the Owner, agents of the Owner, workmen, and the public, such as Insurance; Indemnity; Licenses and Permits: Compliance with Laws, Ordinances and Regulations; Safety; Warning Signs and Barricades; Public Convenience; Sanitary Provisions; etc. This request is made to stress the importance of safe prosecution of the work, and does not imply that the Contractor and his Superintendent should not be completely familiar with all Articles of the General Conditions and all other provisions of the Contract Documents. Under the terms and conditions of this Contract, the Engineer shall not be required to act as Safety Engineer or Safety Supervisor since such responsibility remains solely with the Contractor, who, in the prosecution of his work, is bound by the requirements of "Safety and Health Regulations for Construction Occupational Safety and Health Administration, U.S. Government Department of Labor", and of other authorities having jurisdiction. It is recommended that the Contractor seek the advice of the Safety Inspector for his Insurance Carrier in regard to job safety, and that he observe all precautions and safety provisions as outlined in the "Manual of Accident Prevention in Construction", as published by the Associated General Contractors of America, to the extent that such provisions are not inconsistent with applicable laws or regulations.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

SECTION 01041

PROJECT COORDINATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Coordination by the Project Coordinator.

B. Construction mobilization.

C. Schedules.

D. Submittals.

E. Coordination drawings.

F. Closeout procedures.

1.2 RELATED SECTIONS

Section 01700 - Contract Closeout: Contract Closeout Procedures.

1.3 PROJECT COORDINATOR

Project Coordinator: Engineer and/or Owner Representative.

1.4 CONSTRUCTION MOBILIZATION

A. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.

B. During construction, coordinate use of site and facilities through the Project Coordinator.

C. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

D. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.

E. Coordinate field engineering and layout work under instructions of the Coordinator.

1.5 SCHEDULES

A. Submit preliminary progress schedule in accordance with Section 01300.

B. After review, revise and resubmit schedule to comply with revised Project schedule.

C. During progress of work revise and resubmit with Applications for Payment.

1.6 SUBMITTALS

A. Submit preliminary shop drawings, product data and samples in accordance with Section 01300 for review and compliance with Contract Documents, for field dimensions and clearances, for relation to available space, and for relation to work of separate contracts. Revise and resubmit as required.

B. Submit requests for interpretation of Contract Documents, and obtain instructions through the Engineer.

C. Deliver closeout submittals for review and preliminary inspection reports, for transmittal to Engineer.

1.7 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Engineer.

1.8 CLOSEOUT PROCEDURES

A. Notify Project Coordinator when Work is considered ready for Substantial Completion. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.

B. Comply with Project Coordinator's instructions to correct items of work listed in executed Certificates of Substantial Completion and for access to Owner occupied areas.

C. Notify Project Coordinator when Work is considered finally complete. Accompany Project Coordinator on preliminary final inspection.

D. Comply with Project Coordinator's instructions for completion of items of Work determined by Engineer's final inspection.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Quality assurance.

1.2 RELATED SECTIONS

General Conditions: Reference standards.

1.3 QUALITY ASSURANCE

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids.

C. Obtain copies of standards when required by the Contract Documents.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect/Engineer before proceeding.

F. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Architect/Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed products list.

D. Shop drawings.

E. Product data.

F. Samples.

G. Manufacturers' instructions.

H. Manufacturers' certificates.

I. Construction photographs.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Manufacturers' field services and reports.

B. Section 01700 - Contract Closeout: Contract warranty and manufacturer's certificates closeout submittals.

1.3 SUBMITTAL PROCEDURES

A. Transmit each submittal with Engineer accepted form.

B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number, and specification Section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the work and Contract Documents.

E. Schedule submittals to expedite the Project, and deliver to Engineer at business address. Coordinate submission of related items.

F. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed work.

G. Provide space for Contractor and Engineer review stamps.

H. Revise and resubmit submittals as required, identify all changes made since previous submittal.

I. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

J. Submit the number of opaque reproductions which Contractor requires, **plus 4 copies** which will be retained by Engineer.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule in duplicate **within 20 days** after date of Owner-Contractor Agreement established in Notice to Proceed for Engineer review.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.

D. Submit a horizontal bar chart with separate line for each section of work, identifying first work day of each week.

E. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

F. Indicate estimated percentage of completion for each item of work at each submission.

G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and under Allowances.

1.5 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Owner-Contractor Agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.6 SHOP DRAWINGS

A. Submit the number of opaque reproductions which Contractor requires, plus 6 copies which will be retained by Engineer.

B. After review distribute in accordance with Article on Procedures above and for Record Documents described in Section 01700 - Contract Closeout.

1.7 PRODUCT DATA

A. Submit the number of copies which the Contractor requires, plus 4 copies which will be retained by the Engineer.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

C. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01700 - Contract Closeout.

1.8 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

B. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Owner's selection.

C. Include identification on each sample, with full Project information.

D. Submit the number or samples specified in individual specification Sections; two of which will be retained by Engineer.

E. Reviewed samples which may be used in the work are indicated in individual specification Sections.

1.9 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.10 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification sections, submit manufacturers' certificate to Engineer for review, in quantities specified for product data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

1.11 CONTRACTOR PERMITS AND LICENSES

Copies of all permits and/or licenses required for this work must be retained by the Engineer.

SECTION 01550

ACCESS ROADS AND PARKING AREAS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Access roads.

B. Parking.

C. Existing pavements and parking areas.

D. Permanent pavements and parking facilities.

E. Maintenance.

F. Removal, repair.

1.2 RELATED SECTIONS

A. Section 01010 - Summary of Work.

B. Section 01500 - Construction Facilities and Temporary Controls: Temporary construction.

C. Section 02211 - Rough Grading.

D. Individual Sections: Specifications for earthwork and paving bases.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary Construction: Contractors option.

B. Earthwork, Paving Base, Topping and Concrete Which Will Become Permanent Construction: As specified.

PART 3 - EXECUTION

3.1 PREPARATION

Clear areas, provide surface and storm drainage of premises and adjacent areas.

3.2 ACCESS ROADS

A. Construct temporary all-weather access roads from public thoroughfares to serve construction area, of a width and load bearing capacity to provide unimpeded traffic for construction purposes.

B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

C. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.

D. Location approved by Engineer.

E. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants and control valves free of obstructions.

3.3 PARKING

A. Provide temporary parking areas to accommodate use of construction personnel, personal vehicles in existing plant site to be kept to a minimum.

B. When site space is not adequate, provide additional off-site parking.

C. Locate as approved by Engineer.

3.4 EXISTING PAVEMENTS AND PARKING AREAS

A. Existing on-site streets and driveways may be used for construction traffic. Tracked vehicles not allowed.

B. Existing parking facilities shall not be used by construction personnel.

C. Do not allow heavy vehicles or construction equipment in parking areas.

3.5 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. Prior to Substantial Completion base for permanent roads and parking areas may be used for construction traffic.

B. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.6 MAINTENANCE

A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.

B. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.7 REMOVAL, REPAIR

A. Remove temporary materials and construction at Substantial Completion.

B. Remove underground work and compacted materials to a depth of 2 feet; fill and grade site as specified.

C. Repair existing facilities damaged by use, to specified condition.

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions.

1.2 RELATED SECTIONS

A. Document - Instructions to Bidders: Product options and substitution procedures.

B. Section 01400 - Quality Control: Product quality monitoring.

1.3 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Provide interchangeable components of the same manufacturer, for similar components.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place on sloped supports, above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.6 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request twenty-one (21) days before bids are received for substitution for any manufacturer not named.

D. Products specified by Name in Proposal Form as an "a" item: The "a" item shall be used as base bid price in Proposal Form." Where more than one “a” item is named, the Contractor shall circle only the one they intend to furnish.

1.7 SUBSTITUTIONS

A. Instructions to Bidders specify time restrictions for submitting requests for Substitutions for major equipment during the bidding period to requirements specified in this Section.

B. Substitutions shall not be allowed for items listed as no substitutions allowed in the individual specification section.

C. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

D. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

E. A request constitutes a representation that the Bidder:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the Substitution as for the specified product.
   3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse Owner for review and redesign services associated with re-approval by authorities.

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

G. Substitution Submittal Procedure:
   1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
   3. The Engineer will notify Contractor, in writing, of decision to accept or reject request.

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Adjusting.

D. Project record documents.

E. Operation and maintenance data.

F. Warranties.

G. Spare parts and maintenance materials.

1.2 RELATED SECTIONS

A. Section 01500 - Construction Facilities and Temporary Controls: Progress cleaning.

B. Section 01730 - Operation and Maintenance Data.

C. Section 01740 - Warranties and Bonds.

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Engineer's inspection

B. Provide submittals to Engineer and Owner that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

D. Owner will occupy all of the site as specified in Section 01010.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

H. Cut grass at Plant site a minimum of one time after project completion.

1.5 ADJUSTING

Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the work:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and Modifications.

E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface locations.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract Drawings.
   6. Measured grade and alignment of any buried pipe installed.

F. Submit documents to Engineer with claim for final Application for Payment.

1.7 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Format and content of manuals.

B. Instruction of Owner's personnel.

C. Schedule of submittals.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals: Submittals procedures Shop drawings, product data, and samples.

B. Section 01400 - Quality Control: Manufacturer's instructions.

C. Section 01700 - Contract Closeout: Contract Closeout Procedures.

D. Section 01740 - Warranties and Bonds.

E. Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.3 QUALITY ASSURANCE

Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.4 FORMAT

A. Prepare data in the form of an instructional manual.

B. Binders: Commercial quality, 8-1/2 x 11 three-ring binders with hardback, cleanable, plastic covers; three inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; list title of Project and separate building; identify subject matter of contents.

D. Arrange content by process flow under section numbers and sequence of Table of Contents of this Project Manual.

E. Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.5 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Engineer, subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

E. Type Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01400.

F. Warranties and Bonds: As specified in Section 01740.

1.6 MANUAL FOR MATERIALS AND FINISHES

A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional Requirements: As specified in individual product specification Sections.

E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.7 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications.

C. Include color coded wiring diagrams as installed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Additional Requirements: As specified in individual product specification Sections.

O. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.8 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.

B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.

C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

1.9 SUBMITTALS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of work. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes in final form 15 days prior to final inspection. Copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.

D. Submit six copies of revised volumes of data in final form within ten days after final inspection.

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation and submittal.

B. Time and schedule of submittals.

1.2 RELATED SECTIONS

A. Document - Invitation to Bid: - Instructions to Bidders: Bid Bonds.

B. Document - General Conditions: Performance Bond and Labor and Material Payment Bonds, Warranty, and Correction of work.

C. Section 01700 - Contract Closeout: Contract closeout procedures.

D. Section 01730 - Operation and Maintenance Data.

E. Individual Specifications Sections: Warranties required for specific products or work.

1.3 FORM OF SUBMITTALS

A. Bind in commercial quality, 8-1/2 x 11 inch three-ring side binders with hardback, cleanable, plastic covers.

B. Label cover of each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible principal.

C. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.

D. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.4 PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item or work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

1.5 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

B. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.

C. For items of work when acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

SECTION 02060

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition of designated structure and removal of materials from site.

B. Demolition and removal of foundation and slab-on-grade.

C. Disconnecting and removal of identified utilities.

D. Refer to items as indicated.

1.2 RELATED SECTIONS

A. Section 01500 - Construction Facilities and Temporary Controls: Barriers, fences and landscape protection. Dust control.

B. Section 01600 - Material and Equipment.

C. Section 01700 - Contract Closeout: Project record documents.

D. Section 02110 - Site Clearing: Clearing outside periphery of structures.

E. Section 02223 - Backfilling: Backfill materials.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of barricades, fences and temporary work.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual locations of capped utilities, subsurface obstructions, and piping.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control and disposal.

B. Obtain required permits from authorities.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Do not close or obstruct roadways, sidewalks or hydrants without permits.

E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

1.6 SEQUENCING

Sequence work under the provisions of Section 01010.

1.7 SCHEDULING

A. Schedule work under the provisions of Section 01300.

B. Schedule work to coincide with site excavation work and/or trenching of pipe installation.

C. Describe demolition removal procedures of abandoned storage shed next to Sedimentation Basin #2 and schedule work with Engineer and Owner.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

Fill Material: Type D fill, specified in Section 02223.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide, erect, and maintain temporary barriers and security devices at locations indicated.

B. Protect existing landscaping materials, appurtenances, structures and piping which are not to be demolished.

C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.

D. Mark location of utilities.

3.2 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with other construction progress.

B. Cease operations immediately if adjacent structures (i.e. existing sewer or gas lines) appear to be in danger. Notify Engineer. Do not resume operations until directed.

C. Conduct operations with minimum interference to public or private accesses. Maintain egress and access at all times.

D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

E. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.

3.3 DEMOLITION

A. Disconnect and cap designated utilities within demolition areas.

B. Remove foundation walls and footings to a minimum of two feet below finished grade beyond area of new construction.

C. Remove concrete slabs on grade.

D. Empty buried tanks located within demolition area. Remove buried tanks, components, and piping from site.

E. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Section 01600.

F. Backfill areas excavated caused as a result of demolition in accordance with Section 02223.

G. Rough grade and compact areas affected by demolition to maintain site grades and contours.

H. Remove demolished materials from site.

I. Do not burn or bury materials on site. Leave site in clean condition.

J. Demolition of abandoned structures shall consist of breaking up bottom of all structures that normally contain process flows. Structures shall be broken up and removed to a minimum of two (2) feet below grade. All material will be allowed to be buried and backfilled with earth. All metal components, excluding rebar, shall be removed before backfilling.)

SECTION 02202

ROCK REMOVAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of discovered rock during excavation.

B. Explosives to assist rock removal.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Inspection of bearing surfaces.

B. Section 02211 - Rough Grading.

C. Section 02222 - Excavation: Building excavation.

D. Section 02223 - Backfilling: Backfill materials.

E. Section 02225 - Trenching: Trenching and backfilling for utilities.

1.3 REFERENCES

NFPA 495 - Code for Explosive Materials.

1.4 DEFINITIONS

Rock: Solid mineral material with a volume in excess of ⅓ cu yd or solid material that cannot be removed with a backhoe without drilling or blasting.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate the proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock removal method.

1.6 QUALIFICATIONS

A. Seismic Survey Firm: Company specializing in seismic surveys with five years documented experience.

B. Explosives Firm: Company specializing in explosives for disintegration of rock, with five years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for explosive disintegration of rock and to NFPA 495 for handling explosive materials.

B. Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.

1.8 SCHEDULING

A. Schedule work under the provisions of Section 01300.

B. Schedule work to avoid disruption to occupied buildings nearby.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Explosives: Type recommended by explosive firm following seismic survey and required by authorities having jurisdiction.

B. Delay Device: Type recommended by explosive firm.

C. Blast Mat Materials: Type recommended by explosives firm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01400.

B. Verify site conditions and note subsurface irregularities affecting work of this Section.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Conduct survey and document conditions of buildings near locations of rock removal and prior to blasting, photograph and video existing conditions identifying existing irregularities.

3.3 ROCK REMOVAL - EXPLOSIVE METHOD

A. If rock is uncovered requiring the explosives method for rock disintegration, execute as follows.

B. Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations.

C. Obtain a seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

D. Provide seismographic monitoring during progress of blasting operations.

E. Disintegrate rock and remove from excavation.

F. Remove rock at excavation bottom to form level bearing.

G. Remove shaled layers to provide a sound and unshattered base for footings and foundations.

H. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter as a minimum.

I. Remove excavated material from site.

J. Correct unauthorized rock removal or overbreak in accordance with directions of Engineer.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock.

3.5 PRE-BLAST SURVEY AND BLASTING TECHNIQUES

A. The Contractor is reminded that he has sole and complete responsibility for the conditions on, in, or near the job site, including safety of all persons and property during performance of the Work.

B. The required duty of the Engineer to conduct construction review of the Contractor's performance does not, and is not intended to, include review of the adequacy of the Contractor's safety measures in, on, or near the construction site.

C. The observation of safety provisions of applicable laws and local building and construction codes shall be the responsibility of the Contractor.

D. During the performance of the Work it will be necessary for the Contractor to remove rock from the pipe trench by the use of blasting techniques.

E. Persons responsible for blasting shall be present and supervise all blasting design, loading and shot firing at all times.

F. The contractor shall be required to perform preblast surveys on structures/buildings within one thousand (1,000) feet of blasting operations.

G. The limit for each charge will be set to limit the effects to; air concussion or air blast of .03 psi maximum (140 dB); Particle velocities shall be a maximum of 1.0 in/sec. measured from locations directed by the Engineer.

3.6 PAYMENT FOR ROCK REMOVAL AND DISPOSAL

Rock is an unclassified material and payment for rock blasting, removal, and disposal is included in the lump sum price bid to construct complete the proposed facilities.

SECTION 02207

AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Aggregate materials.

1.2 RELATED SECTIONS

A. Section 01025 - Measurement and Payment: Requirements applicable to unit prices for the work of this Section.

B. Section 01400 - Quality Control: Testing aggregate fill materials.

C. Section 02211 - Rough Grading.

D. Section 02222 - Excavation.

E. Section 02223 - Backfilling.

F. Section 02225 - Trenching.

G. Section 02231 - Aggregate Base Course.

H. Section 02275 - Riprap.

I. Section 02667 - Site Water Lines.

J. Section 02687 - Site Gas Lines.

K. Section 02722 - Site Storm Sewerage Systems.

L. Section 02732 - Site Sanitary Sewerage Systems.

M. Section 02923 - Landscape Grading.

1.3 REFERENCES

A. AASHTO - M147 - Materials for Aggregate and Soil-Aggregate.

B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

C. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

D. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12 inch Drop.

E. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

G. ASTM D2487 - Classification of Soils for Engineering Purposes.

H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

I. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

J. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

K. State of Alabama Highway Department - Standard Specifications for Highway Construction.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Materials Source: Submit name of imported materials suppliers. Provide materials from same source throughout the work. Change of source requires Engineer approval.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

A. Coarse Aggregate Type A1 (ALDOT #57): Pit run washed stone; free of shale, clay, friable material and debris; graded in accordance with ANSI/ASTM C136, within the following limits:

Sieve Size	Percent Passing
2 inches	100
1 inch	95 to 100
½ inch	25 to 60
No. 4	0 to 10
No. 8	0 to 5

B. Coarse Aggregate Type A2 (ALDOT #67): Pit run washed stone; free of clay, shale, friable material and debris; graded in accordance with ANSI/ASTM C136 within the following limits:

Sieve Size	Percent Passing
1 inch	100
¾ inch	90 to 100
⅜ inch	20 to 55
No. 4	0 to 10
No. 8	0 to 5

C. Coarse Aggregate Type 3 (ALDOT #8910): Pit run washed stone; free of shale, clay, friable material and debris; graded in accordance with ANSI/ASTM C136 within the following limits:

Sieve Size	Percent Passing
½ inch	100
⅜ inch	90 to 100
No. 4	60 to 85
No. 8	40 to 70

No. 50	10 to 25
No. 200	1 to 5

D. Fine Aggregate Type A4 (Sand ALDOT #100): Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ANSI/ASTM C136; within the following limits:

Sieve Size	**Percent Passing**
⅜ inch	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 90
No. 50	5 to 30
No. 100	0 to 10

2.2 SOURCE QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Tests and analysis of aggregate material will be performed in accordance with ANSI/ASTM D698.

C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 STOCKPILING

A. Stockpile materials on site at locations indicated designated by Architect/Engineer.

B. Stockpile in sufficient quantities to meet project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

B. If a borrow area is indicated, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

SECTION 02211

ROUGH GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of topsoil and subsoil.

B. Cutting, grading , filling and rough contouring the site.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control : Testing fill compaction.

B. Section 02060 - Building Demolition.

C. Section 02110 - Site Clearing.

D. Section 02202 - Rock Removal.

E. Section 02222 - Excavation: Building excavation.

F. Section 02223 - Backfilling: General building area backfilling.

G. Section 02225 - Trenching: Trenching and backfilling for utilities.

H. Section 02921 - Landscape Grading: Finish grading with topsoil to contours.

1.3 REFERENCES

A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12 inch Drop.

B. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

C. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

1.4 SUBMITTALS

Submit under provisions of Section 01300.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual locations of utilities remaining, by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Excavated material, graded, free of roots, rocks larger than 1 inch, subsoil, debris, and large weeds.

B. Subsoil: Excavated material, graded, free of lumps larger than 6 inches, rocks larger than 3 inches, and debris.

C. Granular Fill: Type A3 specified in Section 02207.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

B. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.

C. Notify utility company to remove and relocate utilities.

D. Protect above and below grade utilities which are to remain.

E. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

F. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re- landscaped, or re-graded.

B. Stockpile in area designated on site. Remove excess topsoil not being reused, from site.

C. Do not excavate wet topsoil.

D. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, re- landscaped, or re-graded.

B. Stockpile in area designated on site.

C. Remove from site.

D. Do not excavate wet subsoil.

E. Stockpile subsoil to depth not exceeding 8 feet. Cover to protect from erosion.

F. When excavation through roots is necessary, perform work by hand and cut roots with sharp axe.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Granular Fill: Place and compact materials in continuous layers not exceeding 8 inches compacted depth, compacted to 98 percent.

C. Subsoil and Topsoil Fill: Place and compact material in continuous layers not exceeding 8 inches compacted depth, compacted to 95 percent of the Proctor value.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise.

F. Make grade changes gradual. Blend slope into level areas.

G. Remove surplus fill materials from site.

3.6 TOLERANCES

Top Surface of Subgrade: Plus or minus 1/10 foot.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D1557 and with Section 01400.

C. Compaction testing will be performed in accordance with ANSI/ASTM D1556 ANSI/ASTM D1557 and with Section 01400.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

E. Frequency of Tests: As required by the Engineer.

SECTION 02222

EXCAVATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation for building foundations.

B. Excavation for slabs-on-grade, paving, landscaping.

C. Excavation for site structures.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Inspection of bearing surfaces.

B. Section 01500 - Construction Facilities and Temporary Controls: Dewatering excavations and water control.

C. Section 02202 - Rock removal: Removal of Rock during excavation.

D. Section 02211 - Rough Grading: Topsoil and subsoil removal from site surface.

E. Section 02223 - Backfilling.

F. Section 02225 - Trenching: Excavation for utility trenches.

1.3 FIELD MEASUREMENTS

Verify that survey benchmark and intended elevations for the Work are as indicated.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.

C. Notify utility company to remove and relocate utilities.

D. Protect above and below grade utilities which are to remain.

E. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

F. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

3.2 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

B. Excavate subsoil required to accommodate building foundations, slabs-on-grade, paving, site structures, and construction operations.

C. Machine slope banks.

D. Excavation cut not to interfere with normal 45 degree bearing splay of foundation.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Hand trim excavation. Remove loose matter.

G. Remove lumped subsoil, boulders, and rock up to ⅓ cu yd measured by volume. Larger material will be removed under Section 02202.

H. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

I. Correct unauthorized excavation at no extra cost to Owner.

J. Correct areas over-excavated by error in accordance with Section 02222.

K. Stockpile excavated material in area designated on site and remove excess material not being reused, from site Remove excavated material from site.

3.3 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01400.

B. Provide for visual inspection of bearing surfaces.

3.4 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

B. Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

SECTION 02223

BACKFILLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building perimeter and site structure backfilling to subgrade elevations.

B. Site filling and backfilling.

C. Fill under slabs-on-grade and paving.

D. Consolidation and compaction.

E. Fill for over-excavation.

F. Sheet vapor retardant and cover over crawl space and fill.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Testing Fill compaction.

B. Section 02222 - Excavation.

C. Section 02225 - Trenching: Backfilling of utility trenches.

D. Section 03300 - Cast-in-Place Concrete: Concrete materials.

1.3 REFERENCES

A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12 inch Drop.

C. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

1.4 SUBMITTALS

Submit under provisions of Section 01300.

1.5 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
   1. Unconsolidated material in the crust of the earth derived by weathering and erosion includes:
      a. materials of both inorganic and organic origin;
      b. boulders less than ⅓ cubic yard in volume, gravel, sand, silt, and clay;
      c. materials which can be excavated with backhoe, trenching machine, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.

C. Rock
   1. A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes:
      a. limestone, sandstone, dolomite, granite, marble, and lava;
      b. boulders ⅓ cubic yard or more in volume;
      c. 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;
      d. materials which cannot be excavated with a backhoe, trenching machines, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.

D. Undercutting
   Excavation of rock and unsuitable earth below the bottom of a foundation, structure, or pipe to be constructed or installed.

E. Subgrade
   Undisturbed bottom of an excavation.

F. Pipe Foundation Backfill.
   Crushed limestone or crushed dolomite placed as directed by the Engineer to stabilize an unsuitable subgrade below the pipe bedding. The gradation shall be determined by the Engineer and could include rock removed from the pipe trench.

G. Pipe Bedding
   1. Crushed limestone or crushed dolomite meeting minimum standards for gradation as set forth by the State of Alabama Department of Transportation (ALDOT) for number 57 stone.
   2. Crushed limestone or crushed dolomite placed from level six inches minimum below the bell of pipe to the bell of pipe, as shown in the pipe installation detail in the Drawings.

H. Pipe Haunching
   1. Crushed limestone or crushed dolomite meeting minimum standards for gradation as set forth by the State of Alabama Department of Transportation (ALDOT) for number 57 stone.
   2. Crushed limestone or crushed dolomite from the bottom of bell of pipe to the centerline of the pipe.

I. Pipe Initial Backfill
   1. Crushed limestone or crushed dolomite meeting minimum standards for gradation as set forth by the State of Alabama Department of Transportation (ALDOT) for number 57 stone.
   2. Crushed limestone or dolomite placed from top of pipe haunching to one foot (1') above the top of the pipe.

J. Pipe Final Backfill
   1. Pipe Trenches Cut in Natural Soil
      a. Earth placed in a pipe trench from the top of pipe zone (or top of initial backfill) to finished grade.

2. Pipe Trenches Cut in Pavement
   a. Pipe initial backfill material placed in trench from top of pipe zone (top of initial backfill) to sub-base of pavement.
3. Pipe Trenches Cut Under Structures
   a. Pipe initial backfill material placed in trench from top of pipe zone (top of initial backfill to sub-base of structure.

K. Topsoil
Earth containing sufficient organic materials to support the growth of grass.

L. Structure Foundation Bedding
Crushed limestone or crushed dolomite meeting minimum standards for gradation as set forth by the State of Alabama Department of Transportation (ALDOT) for number 57 stone.

M. Structure Foundation backfill
1. Crushed limestone or crushed dolomite placed as directed by the Engineer to stabilize an unsuitable subgrade below structure foundations. The gradation shall be determined by the Engineer.
2. Six (6) inches of foundation backfill required on all structures.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Type A : Pit run, washed natural stone; free of shale, clay, friable material, sand, debris; graded in accordance with ANSI/ASTM C136 meeting the requirement of coarse aggregate type A1 (ALDOT #57), Section 02207.2.1.

B. Type B: Pit run; washed, free of clay, shale, organic matter; graded in accordance with ANSI/ASTM C136, meeting the requirements of coarse aggregate type A3 (ALDOT #8910) , Section 02207.2.1:

C. Type C - Sand: Natural river or bank sand; washed: free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C136, meeting the requirements of fine aggregate type A4 (ALDOT #100), Section 02207.2.1:

D. Type D - Select Fill: Material excavated from site and approved by Engineer.

E. Subsoil: Reused, free of gravel larger than 3 inch size, and debris.

F. Concrete: Structural concrete conforming to Section 03300 with a compressive strength of 3500 psi.

2.2 ACCESSORIES

A. Geotextile Fabric: Amoco 2006 or equivalent.

B. Vapor Retardant: 30 mil thick, polyethylene.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify fill materials to be reused are acceptable.

B. Verify foundation perimeter drainage installation has been inspected.

C. Verify underground tanks are anchored to their own foundation to avoid floatation after backfilling.

3.2 PREPARATION

A. Generally, compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type B fill and compact to density equal to or greater than requirements for subsequent backfill material.

C. Prior to placement of aggregate base course material at paved areas, compact subsoil to 98 percent of its maximum dry density in accordance with ANSI/ASTM D698.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Granular Fill: Place and compact materials in continuous layers not exceeding 8 inches compacted depth.

D. Soil Fill: Place and compact material in continuous layers not exceeding 12 inches compacted depth.

E. Employ a placement method that does not disturb or damage foundation waterproofing and protective cover.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.

H. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise.

I. Make grade changes gradual. Blend slope into level areas.

J. Remove surplus backfill materials from site.

K. Leave fill material stockpile areas completely free of excess fill materials.

3.4 TOLERANCES

Top Surface of Backfilling : Plus or minus one inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and with Section 01400.

C. Compaction testing will be performed in accordance with ANSI/ASTM D1556.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

E. Frequency of Tests: As required by the Engineer.

F. Proof roll compacted fill surfaces under slabs-on-grade and paving.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500

B. Recompact fills subjected to vehicular traffic.

3.7 SCHEDULE

A. Interior Slab-On-Grade:
Type A fill, 6 inches thick.

B. Fill Under Grass Areas:
1. Subsoil fill, to 6 inches below finish grade, compacted to 95 percent.
2. Topsoil fill, final 6".

C. Fill Under Landscaped Areas:
1. Subsoil fill, to 12 inches below finish grade, compacted to 95 percent.
2. Topsoil fill, final 6".

D. Fill for French Drains:
Type B fill, to 12 inches below finish grade, compacted to 90 percent.

E. Fill Under Asphalt Paving:
Type B fill, to 12 inches below finish paving elevation, compacted to 98 percent.

F. Fill to Correct Over-excavation:
Lean concrete to minimum compressive strength of 3500 psi.

SECTION 02225

TRENCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavate trenches for utilities.

B. Compacted bedding under fill over utilities to subgrade elevations.

C. Backfilling and compaction.

1.2 RELATED SECTIONS

A. Section 01400- Quality Control: Testing fill compaction.

B. Section 01500 - Construction Facilities and Temporary Controls: Water control in excavations.

C. Section 02202 - Rock removal: Removal of rock during excavation.

D. Section 02211 - Rough Grading: Topsoil and subsoil removal from site surface.

E. Section 02923 - Landscape Grading: Filling of topsoil over backfilled trenches to finish grade elevation.

F. Section 02222 - Excavation: General building excavation.

G. Section 02223 - Backfilling: General backfilling.

H. Section 03300 - Cast-in-Place Concrete: Concrete materials.

1.3 REFERENCES

A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12 inch Drop.

C. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 inch Drop.

1.4 FIELD MEASUREMENTS

Verify that survey benchmark and intended elevations for the Work are as shown on Drawings.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

Types A, B, C, D Subsoil and Concrete materials as specified in Section 02223.

2.2 BED MATERIALS

A. Type 1 Material: As specified for Type A1 in Section 02207.

B. Type 2 Material: As specified for Type A2 in Section 02207.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify fill materials to be reused, are acceptable.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type 2 fill and compact to density equal to or greater than requirements for subsequent backfill material.

3.3 EXCAVATION

A. Excavate subsoil required for storms sewer sanitary sewer water gas and process piping to main lines.

B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.

D. Hand trim excavation. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock up to ⅓ cu yd, measured by volume. Larger material will be removed under Section 02202.

F. Correct unauthorized excavation at no cost to Owner.

G. Correct areas over-excavated by error in accordance with Section 02222.

H. Stockpile excavated material in area designated on site and remove excess material not being used, from site.

3.4 BEDDING

Support pipe and conduit during placement and compaction of bedding fill.

3.5 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Granular Fill: Place and compact materials in continuous layers not exceeding 6 inches compacted depth.

D. Soil Fill: Place and compact material in continuous layers not exceeding 8 inches compacted depth.

E. Employ a placement method that does not disturb or damage foundation perimeter drainage, conduit, duct in trench, and pipe.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Leave fill material stockpile areas completely free of excess fill materials.

3.6 TOLERANCES

A. Top Surface of Backfilling: Under Paved Areas: Plus or minus one inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus one inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and with Section 01400.

C. Compaction testing will be performed in accordance with ANSI/ASTM D698 and with Section 01400.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.8 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

B. Recompact fills subjected to vehicular traffic.

SECTION 02607

MANHOLES AND COVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Modular precast concrete manhole sections with tongue-and-groove joints, covers, anchorage and accessories.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

Section 05500 - Miscellaneous Metals: Placement of fabricated steel items.

1.3 RELATED SECTIONS

A. Section 02222 - Excavating: Excavating for manholes and base pads.

B. Section 02223 - Backfilling: Backfilling after manhole installation.

C. Section 03300 - Cast-In-Place Concrete.

D. Section 04100 - Mortar and Masonry Grout: Mortar and grout.

E. Section 15430 - Plumbing Specialties: Manhole accessories.

F. Section 16118 - Ductbank: Manhole accessories.

1.4 REFERENCES

A. ANSI/ASTM C55 - Concrete Building Brick.

B. ASTM A48 - Gray Iron Castings.

C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

E. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate manholes locations, elevations, piping, conduit, and device sizes and elevations of penetrations.

C. Product Data: Provide manhole covers, component construction, features, configuration, dimensions and concrete mix design.

1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hansen Pipe & Products

B. Substitutions: Under provisions of Section 01600.

2.2 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923.

B. Mortar and Grout: As specified in Section 04100.

C. Reinforcement: Reinforcing steel shall conform to ASTM A615, Grade 40 deformed bars or ASTM A616, Grade 40 deformed bars.

2.3 COMPONENTS

A. Manhole Lid and Frame: ASTM A48, Class 30B Cast iron construction, machined flat bearing surface, removable, boltable lid, closed lid design; total weight of not less than 400 pounds; sealing gasket; lid molded with identifying name; Model V-2480 manufactured by Vulcan Foundry or equivalent.

B. Manhole Steps: Formed integral with manhole sections.

C. Base Pad: Pipe bedding specified in Section 02223, leveled top surface.

D. Strap Anchors: Bent steel shape, 3 x 16 inch size x ½ inch bitumastic coal tar epoxy finish.

E. Concrete: Precast manholes shall be wet cast utilizing 4,000 psi concrete containing cement Type II with a C_3A content of 5.5% or less. Monolithic manholes shall use 4,500 psi concrete containing Type II cement with a C_3A content of 5.5% or less.

F. Interior Coating: Coal tar epoxy as manufactured by Koppers Company, Bitumastic No. 300-M; or equal. Final dry mils thickness shall be a minimum of 12 mils.

G. Concentric Cone: Each cone shall have a manhole backstep to help with entry into manhole.

H. Manholes shall be constructed to the sizes, shapes, and dimensions as detailed in Section 6.00, titled "STANDARD DRAWINGS", and at the locations shown on the plans. They shall be constructed of precast concrete sections. The depth of the manhole will vary with the location but in all cases it shall be such as will place the cover (or lid) at the finished grade of the pavement or ground surface or as otherwise indicated on the plans. In undeveloped or rural area, manholes shall be furnished to a height of two (2) feet above ground. The invert shall be placed at the elevation shown on the plans. Eccentric cone sections will not be allowed; only concentric cones shall be used, as detailed in Section 6.00, titled "STANDARD DRAWINGS."

I. The design of manhole base sections shall be approved by the Engineer prior to manufacture. Openings in manhole walls for incoming and outgoing sewers shall be precast and after installation sealed with an approved non-shrinking grout. These manholes shall be installed on a choked and compacted stone bedding.

J. Flexible manhole sleeves ("boots") may be approved by the Engineer as an alternate method of sealing the space between the manhole wall and the pipe. Flexible manhole sleeves may be allowed on all pipe 18" and smaller. The flexible sleeve shall be similar to Kor-N-Seal or equal and conform to ASTM Specification C923 and shall be made from ethylene propylene rubber (EPDM). Manhole sleeves shall be secured to pipe by stainless steel clamp and bolt assembly conforming to ASTM Specifications C923 and ASTM A167.

K. Precast concrete manholes for sewers 48 inches in diameter and larger shall be as specified above, except that they shall be installed on a saddle constructed on the barrel of the sewer. Precast concrete manholes for sewers 30, 36 and 42 inches shall be saddle-type or precast base types as specified in the Plans. General details of the precast manhole bases and the saddles for various pipe sizes are given in the Drawings. Reinforcing steel in the saddle shall be welded to the reinforcing steel of the pipe. The design of these saddles shall be approved by the Engineer prior to manufacture.

L. All joints for precast manhole stacks shall be tongue and groove with gaskets meeting the approval of the Engineer.

M. Where the difference in the invert elevation of 2 or more sewers, 18 inches in diameter or smaller, intersecting in one (1) manhole is 2 feet or more, a Memphis Tee Manhole (drop manhole) shall be constructed in the manner shown in Section 6.00. They shall be similar in construction to the standard manhole, except that a drop connection of a pipe and fittings of the proper size and material shall be constructed outside the manhole and supported by Class B concrete as indicated on the plans. The manhole and the drop connection shall be placed on 12 inch reinforced concrete base. The drop connection piping assembly shall be bolted to the barrel of the manhole riser using four 5/8 inch diameter stainless steel (316) bolts with suitable washers to prevent failure caused by pulling the bolt head through the manhole wall.

N. Base sections shall be precast with the vertical walls of sufficient height to allow entry of the required pipes as called for on the plans. Manhole inverts shall be constructed of cement mortar and shall have the same cross-section as the invert of the sewers which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit.

O. All water standing in the trench shall be removed before placing of concrete is started, and the foundation maintained in a dry condition.

P. Precast manholes shall be constructed using 16" risers or multiples thereof.

Q. The top elevation of manhole frames must be adjusted to grade in areas such as streets, alleys, and parking lots or where indicated on plans. A maximum adjustment of 16 inches will be allowed using brick and mortar. Adjustments greater than 16 inches must be made by changing precast riser sections.

2.4 CONFIGURATION

A. Shaft Construction: Concentric with concentric cone top section; lipped male/female dry joints; sleeve to receive pipe conduit and device sections.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: 48", 60", 72", 84" or 96".

D. Design Depth: 48" to 96" as approved by Engineer.

E. Clear Lid Opening: 26 inches diameter.

F. Pipe and Conduit Entry: Provide openings as required.

G. Steps: 18 inches wide, 16 inches on center vertically steel reinforced copolymer polypropylene, set into manhole wall or aluminum ladder as shown on the drawings.

H. Inserts: Manhole lift system as manufactured by Press-Seal Corporation.

2.5 MISCELLANEOUS CASTINGS

A. Valley gutter inlet shall be Neenah Model R-3382 or equivalent.

B. Curb inlet shall be Neenah Model R-3305 or equivalent.

C. Yard inlet shall be Neenah Model R-3409 or equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.2 PREPARATION

Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.3 INSTALLATION OF MANHOLE AND OTHER STRUCTURES

A. Precast concrete manhole sections shall conform to ASTM Designation C478, except as modified herein:
   1. The joint design of the precast sections consist of a bell or groove on one end of the unit of pipe and a spigot or tongue on the adjacent end of the joining section.
   2. The joint shall consist of a round rubber gasket confined in a groove in the spigot end of the precast manhole section and shall conform to Sections 6.1, 6.1.7., and 9 of ASTM Designation C443, latest revision.

B. Openings in manhole sections for pipe connections shall be cut to the point of manufacture and shall be circular or horseshoe shaped with grooved or roughened surfaces to improve mortar bond. Any additional holes cut in the field shall be accomplished as specified in this Section.

C. Manhole bases shall be cast-in-place concrete, reinforced as shown on the Standard Detail Sheet of monolithic base and first section combination. Manhole bases shall be cast or placed on a minimum of 6 inches of compacted crushed stone.

D. Manhole channels or inverts shall be preformed and poured with Class "B" concrete to the spring line of the connecting pipe. The finished invert shall be semi-circular shaped smooth channel directing the flow to the downstream pipe.

E. Precast manhole sections, when used, shall have the exterior surfaces of each section thoroughly coated with a coal tar epoxy type coating as manufactured by Koppers Company, Bitumastic Nol 300-M; Port Coatings, Taramastic 100; or equal. Monolithic manholes and other concrete structures shall be coated in the field with a coat tar epoxy type coating. Coating shall be 8 mil minimum dry film thickness. Each joint after being fully mortared shall be coated with a coat tar epoxy type coating upon reaching its final set.

F. Connecting pipe shall be connected into manholes by means of a resilient connector between reinforced concrete manhole structures and pipe in accordance with ASTM C923. A waterstop gasket embedded in the manhole barrel similar or equal to Press Wedge II would be acceptable.

G. All PVC pipe entering a manhole shall have manhole waterstop gasket as supplied by the manufacturer firmly clamped around the pipe. If flexible entry type manhole system is used, the waterstop gasket is not required.

H. Manhole frames and lids shall weigh not less than 400 pounds and be of good quality cast iron, conforming to ASTM Designation A481 and as shown in the Contract Documents. Unless specifically designated otherwise, manhole castings shall be the non-locking type. All manhole frames shall be cast or drilled with three holes equally spaced around base of frame and shall be securely anchored to cone section with three ⅜ inch bolts, nuts and washers. The joint between the casting frame and cone section shall be fully mortared or gasketed and coated with a coal tar epoxy coating upon reaching its final set to become a watertight joint.

SECTION 02829

ELECTRIC GATE OPERATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electric Gate Operators:
   1. Commercial High Traffic DC Swing Gate Operator (LiftMaster Model CSW24U).

B. Monitored Photo Eyes
   1. Monitored Retro-Reflective Photo Eyes (LiftMaster Model LMRRU)
   2. Monitored Through-Beam Photo Eyes (LiftMaster Model LMTBU)

1.2 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Concrete mounting pads.

B. Section 11150 - Parking control equipment.

C. Division 16 - Requirements for electrical connections.

1.3 REFERENCES

A. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 - Industrial Control and Systems: Enclosures.

B. Underwriters Laboratories (UL): UL 325 - Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.

C. Underwriters Laboratories (UL): UL 991 - Standard for Tests for Safety-Related Controls Employing Solid-State Devices.

D. International Organization for Standardization: ISO 9001 - Quality Management Systems.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Equipment list, system description, electrical wiring diagrams for installation, and manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, edge conditions, and accessories.
   1. Operation, installation, and maintenance manuals including wiring diagrams.
   2. Risers, layouts, and special wiring diagrams showing any changes to standard drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials and products in strict compliance with manufacturer's instructions and industry standards.

B. Store products indoors in manufacturer's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect from damage.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 Certified Manufacturer.

B. Installer Qualifications: Installation performed by factory authorized contractor specifically trained in gate operation systems of the type found within this section.
   1. Provide documentation of maintenance and repair service availability for emergency conditions.
   2. Provide quarterly maintenance for one year following Substantial Completion of the Project.

1.7 WARRANTY

A. Manufacturer's Standard Limited Warranty:
   1. Warranty Period: 5 years for commercial applications, 7 years for residential applications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: LiftMaster; 845 Larch Avenue; Elmhurst, IL 60126-1196. ASD. Toll-Free: 800.282.6225. Email: specs@LiftMaster.com. Web: LiftMaster.com.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 GATE OPERATORS

A. Gate Operators: LiftMaster CSW24U Commercial High Traffic DC Swing Gate Operator.
   1. LiftMaster CSW24U Swing Gate Operator.
   2. Compliance: UL Listed. Compliant to the UL 325, UL 991 and CSA C22.2 No. 247 standards.
      a. This model is intended for use in Class I, II, III and IV vehicular swing gate applications.
      b. To be UL 325 compliant, two independent safety entrapment protection devices must be installed at each entrapment zone (the inherent reversing system in this gate operator counts as one device). Devices such as monitored photo eyes or edge sensors are required to be installed with this operator.
      c. Only LiftMaster monitored photo eyes or edge sensors may be used with this operator to meet the UL 325 Standard.
   3. Monitored Safety Inputs: 3 inputs per board (main board and expansion board) totaling 6 inputs with any combination of up to:
      a. Main Board:
         1) 1 Monitored Close Photo Eye input
         2) 1 Monitored Open Photo Eye input
         3) 1 Monitored Open Safety Edge or Open Photo Eye input
      b. Expansion Board
         1) 2 Monitored Safety Edge or Phot Eye inputs (selectable for Open or Close).
         2) 1 Monitored Photo Eye input (selectable for Open or Close).

c. 8 Monitored edges available when Transceiver is added.

4. Electrical Power Requirements:
   a. 115V AC, single phase
   b. 230V AC, single phase.
5. Motor: 24V DC, with soft start/stop operation.
   a. Duty cycle: Continuous duty.
6. Capacity: 12 foot (3658 mm) gate at 1,200 pounds (554 kg) or 18-foot (5486 mm) gate at 600 pounds (272 kg).
7. Recommended Cycles per Day: Continuous duty.
8. Gate Travel Speed: 90-degree opening in 13 to 15 seconds.
9. Warranty: 5 years for commercial applications, 7 years for single-home applications.
10. Wormgear Reduction: 2 commercial oil bath gearboxes with 900:1 wormgear reduction running in synthetic oil bath. Hardened output shafts designed for high cycle applications with frequent loop reversals.
11. Battery Backup: Power Management system draws 14.8 mA when gate is idle with remote controls programmed. Provides 146 cycles on Battery Backup with two 7 Ah batteries or 876 cycles with two 33 Ah batteries.
12. Standby Time: Provides up to 24 days of standby power in the event of a power loss with two 7 Ah batteries or 105 days with two 33 Ah batteries (excluding accessories).
13. Solar Capable: See daily solar cycle chart.
14. Accessory Electrical Power Requirements: 24V DC 500 mA output, switched and unswitched power.
15. Chassis: Constructed with ¼ inch (6mm) gold zinc-plated steel for rust prevention.
16. Cover: High-density, UV-resistant polycarbonate two-piece cover.
17. Internet Connectivity: MyQ Technology
    a. 902 to 928 MHz
    b. 50-channel FHSS (Frequency Hopping Spread Spectrum).
    c. LiftMaster 828LM Internet Gateway enables monitoring and control of gate operators via internet-enabled smartphone, tablet or computer.
    d. Provides two-way communication between gate operator and MyQ accessories to enable remote open, close and monitoring of gate.
18. Receiver:
    a. Security+ 2.0 3-channel on-board receiver, holds up to 50 remote controls (unlimited with use of 811LM/813LM), HomeLink compatible
    b. Transmits 310 MHz, 315 MHz, 390 MHz.
19. Inherent Reversing Sensor: Detects obstructions or increased loads. Reverses gate when closing or stops/reverses the gate when opening.
20. Electronic Limits: Maintains accurate limit position throughout travel, even after using the manual release handle.
21. Dual-gate operation capabilities to allow 2 separate gate operators to operate in unison at a single entrance.
22. Wireless Dual-Gate Operation:
    a. Built-in wireless communication will operate primary and secondary operator without having to run a communication wire.
    b. Support for Through-beam photo eye in the wireless dual-gate setup. Can attach emitter and receiver to each operator, eliminating the communication wire between them.
23. Soft Stop & Start during mid-travel reversal extends operator life under high-cycle, heavy gate use.
24. Bi-Part Delay: Selectable feature for dual-gate applications. Firmware monitors speed and position of each gate and adjusts speed as necessary to ensure primary gate closes last, avoiding potential damage to the gate.
25. Synchronized Close: Selectable feature for dual-gate applications with curved driveways. Monitors the speed and position of each gate and adjusts speed as necessary to ensure both the gates close at the same time.
26. LED Diagnostic Display: Simplifies installation and troubleshooting.

27. Colored Terminal Blocks: Provides easy identification of safety and fire department inputs.

28. Programmable Auxiliary Relays: 2 programmable relays with 6 settings each
    a. Pre-warning or gate-in-motion sounder.
    b. Switch on/off devices at open or Close Limits or while gate is in motion..
    c. Tamper detection if gate is pushed off Close Limit.
    d. Cycle quantity feedback.
    e. Red/Green light to control gate traffic.
29. Quick Close, Anti-Tailgate: Quickly secures property, preventing unauthorized access.
30. Sequenced Access Management: Capable of sequentially controlling the operator in tandem with barrier gate.
31. Plug-in Loop Detector Inputs: Programmed inputs for shadow, interrupt and exit.
32. Alarm Reset Button: Instantly resets the built-in safety alarm siren.
33. Fire Department Compliant: Selectable settings allow gate to auto open on power failure or battery depletion.
34. Surge Suppression: Industrial strength on high and low voltage outputs. Protects against lightning strikes at a 50-foot (15240 mm) radius.
35. Emergency Release: Simple-to-use release handle allows gate to be operated manually and maintain limit position once re-engaged.
36. Operating Temperature Range:
    a. Without Heater: -4 degrees F to 140 degrees F.
    b. With Optional Heater: -40 degrees F to 140 degrees F.
37. MyQ Enabled Accessories:
    a. LiftMaster 828LM Internet Gateway: Allows remote monitoring from Internet-enabled computer or smartphone.
    b. LiftMaster 829LM Garage and Gate Monitor: Allows remote monitoring and operation.
    c. LiftMaster 823LM Remote Light Switch: Controls light remotely.
    d. LiftMaster 825LM Remote Light Control: Allows remote monitoring and operation.
38. Accessories: Safety Monitoring Devices:
    a. Monitored Photo Eyes and Wireless Edge Kits
        1) LiftMaster LMRRU Reflective Photo Eyes
        2) LiftMaster LMTBU Thru-Beam Photo Eyes
        3) LiftMaster LMWEKITU Wireless Edge Kith with Transmitter and Receiver.
    b. Wired Monitored Edges (all require use of LMWEKITU)
        1) LiftMaster S50 Small Profile Monitored Edge
        2) LiftMaster L50 Large Profile Monitored Edge
        3) LiftMaster WS4 Wrap-Around 4 foot (1219 mm) square monitored edge
        4) LiftMaster WS5 Wrap-Around 5 foot (1524 mm) square monitored edge
        5) LiftMaster WS6 Wrap-Around 6 foot (1829 mm) square monitored edge
        6) LiftMaster WR4 Wrap-Around 4 foot (1219 mm) square monitored edge
        7) LiftMaster WR5 Wrap-Around 5 foot (1524 mm) square monitored edge
        8) LiftMaster WR6 Wrap-Around 6 foot (1829 mm) square monitored edge
39. Accessories: Provide the optional accessories listed below.
    a. LiftMaster LOOPDETLM Plug-in Loop Detector
    b. LiftMaster KPW250 – Wireless Commercial Keypad
    c. LiftMaster 892LT 2-Button Security+ 2.0 Learning Remote Control
    d. LiftMaster 811LM 1-Button Encrypted DIP Remote Control
    e. LiftMaster IPAC – Internet Protocol Access Control Entry System
    f. LiftMaster EL2000SS Stainless Steel Commercial and Gated Community Telephone Entry System.
    g. LiftMaster PPWR Passport Receiver with Security+ 2.0 Technology
    h. LiftMaster PPK1 Passport 1-Button Mini Remote (10 required)
    i. LiftMaster KPR2000 Single Access Remote Control Keypad and Proximity Reader
    j. LiftMaster MG1300 Maglock. 1,300 pound (590 kg) holding force

k. LiftMaster MPEL: Mounting plate for post mount
l. LiftMaster HTR Heater Kit

B. LiftMaster LMRRU Monitored Retro-Reflective Photo Eye.
1. LiftMaster LMRRU Monitored Retro Reflective Photo Eye: Photo eye assembly, with 6 foot cable, photo eye bracket, photo eye hood, square reflector, reflector hood, reflector bracket, mounting hardware.
2. Compliance:
a. Meets UL 325 requirements for gates as secondary entrapment protection.
b. Enclosure: NEMA 4X waterproof and corrosion-resistant enclosure.
3. Installation Design:
a. Single-sided, does not require trenching.
b. Alignment: LED indicator with visible feedback and adjustable photo eye assembly.
4. Photo Eye Beam: Polarized beam technology sends and receives beam through 2 polarized filters to avoid interference from shiny objects.
5. Sensing Distance: 50 feet.
6. Operating Temperature Range: -40 degrees F to 149 degrees F.
7. Power: LiftMaster 2-wire photo eye interface.
8. Operating Current: Greater than or equal to 40 mA.
9. Output Versions: Monitored 2-wire.
10. Response time: 35 milliseconds.
11. Wake-up Delay: 500 milliseconds.
12. Connection: 6 foot (1829 mm) cable, fine stranded with crimp terminals wire size 18 gauge.

C. LiftMaster LMTBU Monitored Through Beam Photo Eye.
1. LiftMaster LMTBU Monitored Through Beam Photo Eye: Photo eye emitter, photo eye receiver each with 6 foot (1829 mm) cable, 2X photo eye bracket, 2X photo eye hood, mounting hardware.
2. Compliance:
a. Meets UL 325 requirements for gates as secondary entrapment protection.
b. Enclosure: NEMA 4X waterproof and corrosion-resistant enclosure.
3. Installation Design:
a. Dual-sided, if used in dual gate applications. Operator wireless communication can be used to avoid trenching.
b. Alignment: LED indicator with visible feedback and adjustable photo eye assembly.
4. Photo Eye Beam: Polarized beam technology sends and receives beam through 2 polarized filters to avoid interference from shiny objects.
5. Sensing Distance: 90 feet.
6. Operating Temperature Range: -40 degrees F to 149 degrees F .
7. Power: LiftMaster 2-wire photo eye interface.
8. Operating Current: Greater than or equal to 40 mA.
9. Output Versions: Monitored 2-wire.
10. Response time: 35 milliseconds.
11. Wake-up Delay: 500 milliseconds.
12. Connection: 6 foot (1829 mm) cable, fine stranded with crimp terminals wire size 18 gauge.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Inspect and prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

Install in accordance with manufacturer's instructions. Test for proper operation and adjust until satisfactory results are obtained.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

SECTION 02923

LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

Final grade topsoil for finish landscaping.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Testing fill compaction.

B. Section 02211 - Rough Grading: Site contouring.

C. Section 02223 - Backfilling: Backfilling at building areas.

D. Section 02225 - Trenching: Backfilling trenches.

E. Section 02510 - Asphaltic Concrete paving.

F. Section 02936 - Seeding: Finish ground cover.

PART 2 - PRODUCTS

2.1 MATERIAL

Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify building and trench backfilling has been inspected.

B. Verify substrate base has been contoured and compacted.

3.2 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of ½ inch in size. Remove subsoil contaminated with petroleum products.

C. Scarify subgrade to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment is used for hauling and spreading topsoil and has compacted subsoil.

3.3 PLACING TOPSOIL

A. Place topsoil in areas where seeding, to a nominal depth of 6 inches. Place topsoil during dry weather.

B. Fine grade topsoil eliminating rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks and foreign material while spreading.

D. Manually spread topsoil close to trees, plants and building to prevent damage.

E. Roll placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.4 TOLERANCES

Top of Topsoil: Plus or minus ½ inch.

3.5 PROTECTION

A. Protect landscaping and other features remaining as final work.

B. Protect existing structures, fences, sidewalks, utilities, paving and curbs.

SECTION 02936

SEEDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Seeding, Hydroseeding, mulching and fertilizer.

D. Maintenance.

1.2 RELATED SECTIONS

A. Section 02223 - Backfilling: Rough grading of site.

B. Section 02225 - Trenching: Rough grading over cut.

C. Section 02923 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.

1.3 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

B. Alabama Department of Transportation Standard Specifications.

1.4 DEFINITIONS

Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 MAINTENANCE DATA

A. Submit under provisions of Section 01700.

B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; and types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.7 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilized in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 MAINTENANCE SERVICE

Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition for two cuttings.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

REQUIRED POUNDS PER ACRE OF PURE LIVE SEED				
Date of Planting	Jan. 1 to Feb. 29	Mar. 1 to August 15	Aug. 16 to Nov. 15	Nov. 16 to Dec. 31
Annual Ryegrass	15			15
Hulled Bermuda Grass		18		
Unhulled Bermuda Grass	35	12	18	35
Tall Fescue	35	35	35	35
Weeping Lovegrass		2		
Hulled Sericea Lespedeza		38	38	
Unhulled Sericea Lespedeza	38			38
Reseeding Crimson Clover			29	
Required Permanent Plant	**Mixed**			

2.2 SOIL MATERIALS

Topsoil: Excavated from site and free of weeds, or if none is available at site topsoil must meet Section 02923.

2.3 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Manufactured fertilizer shall be 8% nitrogen, 8% phosphorus, and 8% potash with 50% of the elements derived from organic sources.

C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

D. Erosion Fabric: Woven jute fabric, open mesh construction smolder-resistant treated. Fabric shall be Belton Anti-Wash/Geojute.

E. Metal Staples: Softwood lumber, chisel pointed.

F. String: Inorganic fiber.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that prepared soil base is ready to receive the work of this Section.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 6 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install edging at periphery of seeded areas in straight lines to consistent depth.

3.4 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions at 1500 lbs per acre.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.5 SEEDING

A. Apply seed at a rate of 2 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Planting Season: As per Alabama Department of Transportation Specifications.

D. Do not sow immediately following rain, or when ground is too dry, or during windy periods.

E. Roll seeded area with roller not exceeding 112 lbs.

F. Immediately following seeding and compacting apply mulch to a thickness of ⅛ inches.

G. Apply water with a fine spray immediately after each area has been mulched. Saturate to depth of 4 inches of soil.

H. Provide jute mat in areas where directed by Engineer.

3.6 HYDROSEEDING

A. Apply seeded slurry with a hydraulic seeder at a rate of 5 lbs per 1000 sq ft evenly in two intersecting directions.

B. Do not hydroseed area in excess of that which can be mulched on same day.

C. Immediately following seeding, apply mulch to a thickness of ⅛ inches. Maintain clear of shrubs and trees.

D. Asphalt adhesive shall be used in mulching operations on the areas to be grassed.

E. Asphalt adhesive shall be applied per Alabama Department of Transportation Section 860.03.7.

F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.7 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery. Set string height to 6 inches. Space stakes at 48 inches.

B. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36 inch intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.8 MAINTENANCE

A. Mow grass at regular intervals to maintain at a maximum height of 2 ½ inches. Do not cut more than ⅓ of grass blade at any one mowing.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas which show bare spots.

H. Protect seeded areas with warning signs during maintenance period.

3.9 PAYMENT

A. Basis of Measurement: Per acre of disturbed area within the Pump Station Proper.

B. Basis of Payment: Furnish and install seed, topsoil mulch fertilizer, jute-mat, water, preparation of soil. Payment will be made on a cost per acre. Restoration area around the Pump Station project area and along new access road boundaries.

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03300 - Cast-In-Place Concrete: Supply of concrete accessories for placement by this Section.

B. Section 04300 - Unit Masonry: Supply of masonry accessories for placement by this Section.

C. Section 05500 - Miscellaneous Metals: Supply of metal fabrications for placement by this Section.

D. Division 15 - Mechanical: Supply of mechanical items for placement by this Section.

E. Division 16 - Electrical: Supply of electrical items for placement by this Section.

1.3 RELATED SECTIONS

A. Section 03200 - Concrete Reinforcement.

B. Section 03300 - Cast-in-Place Concrete.

1.4 REFERENCES

A. ACI 347 - Recommended Practice For Concrete Formwork.

B. ANSI/ASME A17.1 - Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks.

C. PS-1 - Construction and Industrial Plywood.

1.5 DESIGN REQUIREMENTS

Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

1.6 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

C. Product Data: Provide data on void form materials and installation requirements.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with ACI Codes.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located in the State of Alabama.

1.9 REGULATORY REQUIREMENTS

Conform to applicable code for design, fabrication, erection and removal of formwork.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Deliver void forms and installation instructions in manufacturer's packaging.

C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.11 COORDINATION

A. Coordinate this Section with other Sections of work which require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect/Engineer before proceeding.

PART 2 - PRODUCTS

2.1 WOOD FORM MATERIALS

Form Materials: At the discretion of the Contractor.

2.2 MANUFACTURERS - PREFABRICATED FORMS

A. At the discretion of the Contractor.

B. Substitutions: Under provisions of Section 01600.

2.3 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

C. Pan Type: Steel of size and profile required.

D. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes required.

E. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than one inch.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture.

C. Corners: Chamfered, wood strip type; ¾ inch size; maximum possible lengths.

D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

E. Flashing Reglets: Galvanized steel, gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

G. Waterstops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 9 inches wide in contraction and expansion joints, or 6 inches wide in pumpwell, clearwell and slabs, maximum possible lengths, ribbed profile preformed corner sections, heat welded jointing.

H. Waterstops: Steel waterstops 6" wide shall be saw cut into place when connecting new construction to existing structures or use Greenstreak Model 60951 waterstop.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.2 EARTH FORMS

Earth forms are not permitted.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

F. Provide chamfer strips on external corners of beams and columns.

G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

H. Remove all wood; organic and deleterious materials from forms before pouring concrete. There shall not be any wood; organic or deleterious materials left in hardened concrete.

I. Bevel strips shall be placed at all points where angles occur in walls and at all tops (exposed edges) of exposed wells.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Position recessed reglets for brick veneer masonry anchors to spacing and intervals specified in Section 04300.

E. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install waterstops continuous without displacing reinforcement. Heat seal joints watertight.

G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

E. All forms shall be thoroughly cleaned and washed immediately before beginning a pour.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

B. Camber slabs and beams ¼ inch per 10 feet in accordance with ACI 301.

3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than 8 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Do not remove forms or bracing until a minimum of 72 hours, from the completion of the pour, has passed.

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 RELATED SECTIONS

A. Section 03100 - Concrete Formwork.

B. Section 03300 - Cast-in-Place Concrete.

C. Section 03346 - Concrete Floor Finishing: Reinforcement for concrete floor toppings.

D. Section 04200 - Unit Masonry: Reinforcement for masonry.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements For Reinforced Concrete.

C. ACI SP-66 - American Concrete Institute - Detailing Manual.

D. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.

E. ANSI/ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

G. ANSI/ASTM A496 - Deformed Steel Wire Fabric for Concrete Reinforcement.

H. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

I. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.

J. ANSI/AWS D12.1 - Reinforcing Steel Welding Code.

K. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

L. ASTM A616 - Rail Steel Deformed and Plain Bars for Concrete Reinforcement.

M. ASTM A617 - Axle Steel Deformed and Plain Bars for Concrete Reinforcement.

N. ASTM A704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

O. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

P. ASTM A767 - Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.

Q. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.

R. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.

S. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.

T. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with CRSI Manual of Practice.

B. Maintain one copy of each document on site.

C. Submit certified copies of mill test report of reinforcement materials analysis.

D. Provide Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

1.6 COORDINATION

Coordinate with placement of formwork, formed openings and other work.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain.

B. Reinforcing Steel Mat: ASTM A615, 60 ksi yield grade; steel bars or rods, plain finish.

C. Stirrup Steel: ANSI/ASTM A82, plain.

D. Welded Steel Wire Fabric: ASTM A497 Welded Deformed Type; in flat sheets or rolls; plain finish.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.

B. Weld reinforcement in accordance with ANSI/AWS D12.1.

C. Galvanized Epoxy Coated Reinforcement: Clean surfaces, weld and reprotect welded joint in accordance with manufacturer's instructions.

D. Locate reinforcing splices not indicated on Drawings, at point of minimum stress. Review location of splices with Engineer.

E. Bends shall be made around a pin having a diameter not less than six (6) times the bar diameter except for bars larger than one (1) inch, in which case the bends shall be made around a pin of eight (8) bar diameters.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as follows:

Item	Coverage
Beams	2 inch
Supported Slabs and Joists	2 inch
Column Ties	2 inch
Walls (exposed to weather or backfill)	3 inch
Footings and Concrete Formed Against Earth	3 inch
Slabs on Fill	3 inch

E. Length of splices or laps shall be as shown on the Drawings, but in no case shall the length of lap be less than thirty-two (32) bar diameters.

3.2 FIELD QUALITY CONTROL

Field inspection will be performed under provisions of Section 01400.

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete, building frame members, floors, shear walls, foundation walls, supported slabs and footings.

B. Floors and slabs on grade.

C. Control, and expansion and contraction joint devices associated with concrete work, including joint sealants.

D. Equipment pads, light pole base, and thrust blocks.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

Section 03100 - Concrete Formwork:
Placement of joint device in formwork.

1.3 RELATED SECTIONS

A. Section 03100 - Concrete Formwork: Formwork and accessories.

B. Section 03200 - Concrete Reinforcement.

C. Section 05800 - Expansion Control.

D. Section 07900 - Joint Sealers.

E. Section 15050 - Plant and Plumbing Piping: Mechanical items for casting into concrete.

F. Section 16130 - Electrical Boxes: Electrical items for casting into concrete.

1.4 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 302 - Guide for Concrete Floor and Slab Construction.

C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

D. ACI 305R - Hot Weather Concreting.

E. ACI 306R - Cold Weather Concreting.

F. ACI 308 - Standard Practice for Curing Concrete.

G. ACI 3 Building Code Requirements for Reinforced Concrete.

H. ANSI/ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).

I. ANSI/ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.

J. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

K. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

L. ASTM C33 - Concrete Aggregates.

M. ASTM C94 - Ready-Mixed Concrete.

N. ASTM C150 - Portland Cement.

O. ASTM C330 - Light Weight Aggregates For Structural Concrete.

P. ASTM C494 - Chemicals Admixtures for Concrete.

Q. ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on joint devices, attachment accessories, admixtures and mix design.

C. Samples: Submit two inch long samples of expansion/contraction joint control joint and waterstop.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual locations of embedded utilities and components which are concealed from view.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of document on site.

C. Acquire cement and aggregate from same source for all work.

D. Conform to ACI 305R when concreting during hot weather.

E. Conform to ACI 306R when concreting during cold weather.

1.8 FIELD SAMPLES

A. Provide under provisions of Section 01400. Coordinate with Section 03100.

B. Construct and erect a field sample for architectural concrete surfaces receiving special treatment or finish as result of formwork.

1.9 COORDINATION

A. Coordinate work under provisions of Section 01400.

B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type II-V with C_3A content of less than 5.5%.

B. Cement: ASTM C150, Type I - Lab/Control Building Only.

C. Fine Aggregate: ASTM C33, natural quartz sand; sand made from crushing stone shall not be acceptable.

Sieve Size	Percent Passing
⅜ "	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10

D. Coarse Aggregate: ASTM C33, hard, durable, dense particles of stone or gravel.

Sieve Size	Percent Passing
1 ½ "	100
1 "	95-100
½ "	25-60
#4	0-10
#8	0-5

E. Fine Aggregates: ASTM C33.

F. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

A. Chemical: ASTM C494, Type A - Water Reducing or Type D - Water Reducing and Retarding admixture containing no chlorides; manufactured by W.R. Grace WRDA-64 or equivalent.

B. Fly Ash: ASTM C618; Type F with a loss on ignition of 6% maximum. Maximum allowable alkalies as Na_2 shall be 1.5%.

2.3 ACCESSORIES

A. Bonding Agent: Acrylic manufactured by Thoro Systems or Sonneborne.

B. Vapor Barrier: 6 mil thick clear polyethylene film, type recommended for below grade application.

C. Non-Shrink Grout: Premixed compound consisting of non- metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 48 hours and 8,900 psi in 28 days; Sika Grout 212 manufactured by Sika or equivalent.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: ASTM D1751, ASTM D994; Asphalt impregnated fiberboard or felt, ¼ inch thick; tongue and groove profile. This filler shall be used on sidewalls, curb and gutters, valley gutters and concrete paving slabs.

B. Joint Filler Type B: ASTM D1752, Type 1; Premolded sponge rubber, fully compressible with recovery rate of minimum 95 percent.

C. Ceramar is an acceptable alternative. If used, this filler shall be used on all structures.

D. Sealant and Primer: A type, as specified in Section 07900.

2.5 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94, Alternative No. 1.

B. Select proportions for normal weight concrete in accordance with ACI 301 2.

C. Provide concrete mix Type 'A' to the following criteria:
   1. Compressive Strength (7 days): 3300 psi
   2. Compressive Strength (28 days): 4500 psi
   3. Slump: 3 to 4 inches
   4. Water/Cement Ratio: 0.43

D. Provide concrete mix Type 'B' to the following criteria:
   1. Compressive Strength (7 days): 1800 psi
   2. Compressive Strength (28 days): 2500 psi
   3. Slump: 3 to 4 inches
   4. Minimum water to cement ratio: 0.59

E. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.

F. Use set retarding admixtures during hot weather only when approved by Engineer.

G. An approved fly ash may be used as a partial cement replacement in Class A or Class B concrete in an amount not to exceed one-half (½) cubic foot provided all applicable requirements for these classes of concrete are met and proposed mix designs are checked by Engineer.

H. Class A shall contain 517 pounds of cement with 100 pounds of Type F fly ash minimum or 564 pounds of cement minimum without any fly ash.

2.6 EPOXY ADHESIVE AND GROUT

A. Epoxy adhesive and grout shall be epoxy-resin systems meeting the requirements of ASTM C 881 and the additional requirements herein.

B. The proper type, grade, and class (ASTM C 881) shall be chosen to suit the job requirements as follows:
   1. Type
      I - For bonding hardened concrete and other materials to hardened concrete and setting anchor bolts and reinforcing bars in hardened concrete.
      II - For bonding freshly mixed concrete to hardened concrete.
      III - For bonding skid resistant materials to hardened concrete and as a binder in epoxy mortars or epoxy concrete.
   2. Grade
      a. - For crack injection and spray application, light viscosity.
      b. - For brush application, medium viscosity.
      c. - For trowel or caulking gun application, non-sagging heavy viscosity for filling voids and gaps.
   3. Class
      A - For use below 40° F.
      B - For use between 40° F and 60° F.
      C - For use above 60° F.
   4. Color
      All epoxy adhesives and grouts shall be concrete grey or clear if they will be visible on the final concrete surface.

C. The epoxy material shall consist of a two-component system conforming to the following requirements:
   1. Properties of mixed components shall meet the following requirements:
      Solids content
      100% by weight
      Pot Life 30 min. (min.) at 75° F
      Contact time 2 hours @ 75° F
      Tank free time 4 hours min. @ 75° F
   2. Properties of cured material shall meet the following requirements.
      Neat Binder
      Tensile Strength
      3,200 psi min. @ 14 days
      ASTM D-638 7° F cure
      Tensile Elongation
      1% min. @ 14 days,
      ASTM D-638 (Modified) 75° F cure
      Compressive Strength
      12,000 psi min. @ 14 days
      ASTM D-695 75° F
      Compressive Modulus 400,000 psi min. @ 28 days, 75° F
      Water Absorption 1% by weight, maximum 14 days 75° F cure 24 hours immersion
      Grout: One part Binder to three-and quarter parts aggregate by loose volume
      Compressive Strength 12,000 psi min. @ 28 days
      ASTM C-109 (Modified) days, 75° F cure (2" cubes)
      Compressive Modulus1,250,000 psi min. 28 days, 75° F cure (Modified)
   3. Aggregate shall meet the requirements of the resin manufacturer.
   4. Chemical acceptance for SPI Classification -2- ('A' Component).
      a. The cured system shall meet the requirements of the U.S. Department of Agriculture for use in food processing plants.

b. The cured system shall meet the requirements of U.S. Government regulations requiring water extractable of less than 0.5 MG per square inch of exposed surface for potable water containers. Tests for water extractables shall meet the requirements of the Environmental Control Administration of the U.S. Public Health Service.
The epoxy shall be "Ecuo Epoxy #615" by the Euclid Chemical Company or "Sikador Hi-Mod" by Sika Chemical Corporation.

2.7 GENERAL CONSTRUCTION GROUT

A. Non-shrink, expanding type.

B. Non-ferrous, non-staining non-bleeding.

C. Compressive strength at 28 days - 5000 psi.

D. Expensive mechanism shall not employ gas-generating or air-release systems.

E. Grout shall conform to ASTM C1107

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01400.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Subgrade and/or surface to be poured against shall be free of sawdust, debris, water, ice, snow, frozen material, extraneous oil, mortar or any other materials that may be deleterious to the concrete.

D. Clean rock surfaces by air-water cutting, a wet sandblasting or wire brush scrubbing. Wet rock surfaces immediately prior to placing concrete.

E. Earth surfaces shall be firm and damp.

F. Do not place Class A concrete on mud, dried earth, uncompacted fill, or frozen subgrade. Mud mats of Class B concrete or six inch minimum of crushed limestone material will be required.

G. Any flow of water into or through the forms shall be diverted through proper side drains into a sump or removed by other approved methods which will prevent washing the freshly deposited concrete.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 304.

B. Notify Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and conduit are not disturbed during concrete placement.

D. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by sealant applied between overlapping edges and ends.

E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.

F. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

G. Separate slabs on grade from vertical surfaces with 1 inch thick joint filler.

H. Extend joint filler from bottom of slab to within ½ inch of finished slab surface. Conform to Section 03300.2.4.D for finish joint sealer requirements.

I. Install joint devices in accordance with manufacturer's instructions.

J. Install joint device anchors. Maintain correct position to allow joint cover flush with floor and wall finish.

K. Apply sealants in joint devices in accordance with Section 07900.

L. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

M. Place concrete continuously between predetermined expansion, control, and construction joints.

N. Do not interrupt successive placement; do not permit cold joints to occur.

O. Place floor slabs in pattern indicated.

P. Saw cut joints within 24 hours after placing. Using 3/16 inch thick blade, cut into ¼ depth of slab thickness.

Q. Screed floors and slabs on grade to floor drains or slope as required.

R. When placing concrete with a tremie, the lower end of the tremie or spout shall be within five (5) feet of the concrete surface.

S. The concrete shall be placed in continuous horizontal layers such that thirty (30) minutes is the maximum elapsed time between placement of successive layers.

T. When placing concrete the discharged concrete shall be within five (5) feet of the concrete surface.

U. Discharge concrete from cement mixer within ninety (90) minutes after water has been added to the mix in the truck.

V. A maximum of one (1) gallon of water per cubic yard of concrete may be added, on the job site.

W. When water is added to concrete at the job site there shall be a minimum of 1½ minutes of mixing per each cubic yard remaining in the truck.

3.4 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed, concrete walls, columns, beams, joists and haunches with smooth rubbed finish as Scheduled in this Section.

B. Finish concrete floor surfaces in accordance with ACI 301.

C. Wood float surfaces which will receive quarry tile with full bed setting system.

D. Steel trowel surfaces which are scheduled to be exposed.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at ⅛ inch per foot nominal as indicated on Drawings.

F. All concrete surfaces of walls, columns, beams, and ceilings shall be rubbed while "green" with a carborundum stone to a smooth even surface.

G. All imperfections in the surface of the concrete (i.e. fins, rough surfaces, honeycomb, mismatched joint marks, pits, etc.), shall be corrected by use of cutting tools, by patching and by rubbing.

H. Rubbing shall be completed within five days after the removal of forms from surfaces.

I. All floors given a monolithic cement top finish shall be completely finished as per Section 03300.3.9 before the concrete has taken its initial set.

3.5 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 308.

D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 4 days.

E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

F. Slabs and floors shall be thoroughly wetted and tightly covered with polyethylene film and one (1) inch of sand or burlap bags for a minimum of twenty-one days as soon as they have reached sufficient hardness to allow foot traffic.

G. Finished concrete shall be protected during cold weather (i.e. if the temperature is below 35° F for a period of 4 hours during any consecutive 24 hours) by maintaining a temperature at 50° F minimum during the first 10 days following the pour.

3.6 CONCRETING IN HOT AND COLD WEATHER

A. Concrete, when placed in forms, shall have a temperature greater than 50° F and less than 90° F.

B. The temperatures of neither aggregates nor mixing water shall be greater than 100° F just prior to mixing with the cement.

C. Concrete shall not be poured when the temperature is below 35° F.

D. Concrete shall not be poured when the temperature is above 98° F.

E. When the temperature is between 35° F and 50° F, the Contractor shall take measures that may include insulation of the poured concrete structure, protective covers and heat sources capable of maintaining temperature of the poured structure at 50° F or above.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01400.

B. Provide free access to Work and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of Work. Adequate time must be given to the Engineer to evacuate the mix design.

D. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

E. Four concrete test cylinders will be taken for every 50 cu yds of each class of concrete placed.

F. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. One slump test will be taken for each set of test cylinders taken.

3.8 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections as directed.

3.9 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.10 FINISHING OF CONCRETE AND GROUT SURFACES

A. All concrete and grout surfaces shall be true and even, and shall be free from open or rough spaces, depressions, or projections.

B. Accurately screed exposed surfaces of concrete to grade and then float prior to final finishing. Do not use excessive floating or trowel while concrete is soft. Do not add dry cement or water to the surface of screeded concrete to expedite finishing.

C. After removal of forms, remove all bulges, fins, form marks, or other irregularities that may adversely affect the appearance or function of the concrete.

D. Clean and patch all cavities left by form ties or any other device. Use expansive grout for patching.

E. Finish concrete in accordance with the following schedule, unless specifically excepted.

Surface	Finish
All exposed vertical surfaces from 6 inches below grade for minor or major structures.	Smooth rubbed finish
Floor slabs of tanks and channel floors	Smooth floated finish
Floor slabs of tanks or channel floors which will receive leveling grout	Brushed finish
Interior building floors not receiving fluid applied resilient flooring	Steel trowel finish
Leveling grout for tank slabs and channel floors	Screeded with steel trowel finish
Exterior horizontal traveled sidewalks and driveways	Brushed finish
Exposed exterior curb and gutters and valley gutter surfaces except as listed above.	Smooth rubbed finish

F. Cement based or acrylic polymer compounds will not be considered as an alternative to rubbing. Preparation and application shall meet the requirements of cement based and acrylic polymer compound manufacturers.

3.11 TESTING

A. The Owner shall employ and pay for the services of an Independent Testing Laboratory to perform the following tests as specified below and as requested by the Engineer.

Perform tests in accordance with the following ASTM Specifications:

Tests	ASTM Specifications
Air Content	C173
Slump	C 143
Test Cylinders	C 31 or C 513
Core Samples	C 42
Fly Ash	C 311

B. Make test cylinders in sets of four, minimum. Field cure one cylinder. Break field cured cylinder at seven days. Laboratory cure the remaining three cylinders from each set of four. Break two laboratory cured cylinders at 28 days. The Engineer shall be responsible for handling and transportation of cylinders. Hold fourth cylinder for possible 56 day break.

C. Make one set of test cylinders for each 50 cubic yards, or fraction of 50 cubic yards, of concrete placed, or at other times requested by the Engineer.

D. Fly ash shall be sampled and tested as specified in ASTM C 311 prior to use as an admixture in concrete.

3.12 CLASS AND TYPES OF CONCRETE AND GROUT PLACEMENT

A. The class and type of concrete to be used shall be as follows in the table below.

	Location	Mix Design	Max Slump
1.	Slab Foundation Administration Building	Class A Type 1	Walls 6"/Slabs 4.5"
2.	Equipment Pads	Class A Type 1	4"
3.	Sidewalks	Class A Type 1	4"
4.	Pipe Encasement	Class B Type II	6"
5.	Pipe Braces	Class A Type 1	6"
6.	All Other Structures	Class A Type II-V	4.5"

B. The class and type of grout to be used shall be the following class and types:
1. Connection to existing structures
   a. Grout reinforced steel to existing structure - Epoxy adhesive and grout
   b. Non expansive anchors - Epoxy adhesive grout
   c. Anchor bolts dowels - Epoxy adhesive grout
2. Equipment installation - Machine grout
3. General grout for filling of cavities - Construction grout
4. Repairs to new or existing concrete placed, modified concrete, polymer modified concrete. Epoxy Grout.

C. All footings, foundation (excluding caissons) and slabs-on-grade shall have 6" #57 stone foundation bedding.

3.13 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment or as shown on the drawings.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel and/or concrete members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

SECTION 03370

CONCRETE CURING

PART 1 - GENERAL

1.1 SECTION INCLUDES

Initial and final curing of horizontal and vertical concrete surfaces.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete.

B. Section 03346 - Concrete Floor Finishing.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.

C. ACI 308 - Standard Practice for Curing Concrete.

D. ASTM C171 - Sheet Materials for Curing Concrete.

E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

F. ASTM D2103 - Polyethylene Film and Sheeting.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on curing compounds, compatibilities, and limitations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products under provisions of Section 01600.

B. Deliver curing materials in manufacturer's packaging including application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Membrane Curing Compound Type A: ASTM C309 Type 1 Class B acrylic dissipating resin type, translucent with fugitive dye.

B. Water: Potable, not detrimental to concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION - HORIZONTAL SURFACES

A. Cure floor surfaces in accordance with ACI 308.

B. Slabs — Option 1 ponding over 100% slab continuously for 4 days.
Option 2 membrane curing compound applied in accordance with manufacturer's instructions.

C. After floor slabs have been cured, they shall be protected from ongoing construction in accordance with Section 03300, 3.5.F.

3.3 EXECUTION - VERTICAL SURFACES

A. Cure surfaces in accordance with ACI 308.

B. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

3.4 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

B. Do not permit traffic over unprotected floor surface.

SECTION 03732

CONCRETE REPAIR

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation of concrete and application of repair materials.

B. Rehabilitation of concrete surfaces.

C. Repair of concrete internal reinforcement.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete.

B. Section 04500 - Masonry Restoration and Cleaning.

C. Section 03346 - Concrete Floor Finishing: Applied finish to repaired concrete surface.

1.3 REFERENCES

A. ANSI/ASTM C404 - Aggregates for Masonry Grouts.

B. ANSI/ASTM C882 - Bond Strength of Epoxy-Resin Systems Used with Concrete.

C. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.

D. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.

E. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

F. ASTM A616 - Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.

G. ASTM A617 - Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.

H. ASTM C33 - Concrete Aggregates.

I. ASTM C150 - Portland Cement.

J. ASTM D638 - Tensile Properties of Plastics.

K. ASTM D695 - Compressive Properties of Rigid Plastics.

L. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Submit product data indicating product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

D. Submit manufacturer's certificate under provisions of Section 01400 that specified products meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01700.

B. Accurately record actual locations of structural reinforcement repairs and type of repair.

1.6 QUALITY ASSURANCE

A. Materials Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

B. Applicator: Company specializing in concrete repair approved by materials manufacturer.

C. Welding: ANSI/AWS D1.4.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01600.

B. Store and protect products under provisions of Section 01600.

C. Comply with instructions for storage, shelf life limitations, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Master Builders

B. Sonneborn

C. Thoro Systems

D. Substitutions: Under provisions of Section 01600.

2.2 PATCHING MATERIALS

A. Epoxy Resin: Two-part epoxy adhesive containing 100 percent solids, meeting the following minimum characteristics:

Characteristic	Test Method	Results
Bond Strength	ANSI/ASTM C882	2,700 psi
Tensile Strength	ASTM D638	6,600 psi

Elongation	ASTM D638	2 percent at 7 days at 70 degrees F
Flexural Strength	ASTM D790	8,000 psi
Compressive Strength	ASTM D695	6,500 psi

B. Bonding Agent: Polyvinyl, acetate emulsion, dispersed in water while mixing, non-coagulant in mix, water resistant when cured.

C. Portland Cement: ASTM C150, Type II-V; gray color.

D. Sand: ASTM C33; uniformly graded, clean.

E. Water: Clean and potable.

F. Cleaning Agent: Commercial muriatic acid.

2.3 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade billet-steel deformed bars, finish.

B. Stirrup Steel: ASTM A82.

2.4 MIXING EPOXY MORTARS

A. Mix epoxy mortars in accordance with manufacturer's instructions for purpose intended.

B. Mix components in clean equipment or containers. Conform to pot life and workability limits.

2.5 MIXING CEMENTITIOUS MATERIALS

A. Mix cementitious mortar in accordance with manufacturer's instructions for purpose intended.

B. Include bonding agent as additive to mix.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts existing surfaces.

3.2 PREPARATION

A. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination; wire brush using acid. Rinse surface and allow to dry.

B. Flush out cracks and voids with muriatic acid to remove laitance and dirt. Chemically neutralize by rinsing with water.

C. Provide temporary entry ports spaced to accomplish movement of fluids between ports, no deeper than the depth of the crack to be filled. Limit port size diameter to be no greater than the thickness of the crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.

D. For areas patched with epoxy mortar, remove broken and soft concrete 1/4 inch deep. Remove corrosion from steel. Clean surfaces mechanically; wash with acid and rinse with water.

E. Sandblast clean the exposed reinforcement steel surfaces. Mechanically cut away damaged portions of bar.

3.3 REPAIR WORK

A. Repair exposed structural, shrinkage, and settlement cracks of concrete by the epoxy injection paste method.

B. Repair spalling. Fill voids flush with surface.

C. Repair reinforcement by welding new bar reinforcement to existing reinforcement. Strength of welded splices and reinforcement to exceed original stress values.

3.4 INJECTION - EPOXY RESIN ADHESIVE

A. Inject adhesive into prepared ports under pressure using equipment appropriate for particular application.

B. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.

C. Remove temporary seal and excessive adhesive.

D. Clean surfaces adjacent to repair and blend finish.

3.5 APPLICATION - EPOXY MORTAR

A. Trowel apply mortar mix to an average thickness of 2 inches. Tamp into place filling voids at spalled areas.

B. For patching honeycomb, trowel mortar onto surface, working into honeycomb to bring surface flush with surrounding area. Finish trowel surface to match surrounding area.

C. Cover exposed steel reinforcement with epoxy mortar; feather edges to flush surface.

3.6 APPLICATION - CEMENTITIOUS MORTAR

A. Apply spray coating of bonding agent to damp concrete surfaces. Provide full surface coverage.

B. Apply cementitious mortar by steel trowel to an average thickness of 2 inches. Tamp into place filling voids at spalled areas. Work mix into honeycomb.

C. Damp cure cementitious mortar for four days.

3.7 FIELD QUALITY CONTROL

Field inspection and testing will be performed under provisions of Section 01400.

SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members, support members, suspension cables, sag rods, struts, and bolts.

B. Baseplates, shear stud connectors, expansion joint plates, and belts.

C. Grouting under baseplates.

1.2 RELATED SECTIONS

A. Section 03300 - Concrete: Precast concrete anchorage devices for attachment to structural steel.

B. Section 05210 - Steel Joists.

C. Section 05500 - Metal Fabrications: Non-framing fabrications affecting structural steel work.

D. Section 09900 - Painting: Finish painting..

1.3 REFERENCES

A. ASTM A36 - Structural Steel.

B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

C. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.

D. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.

E. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.

G. ASTM A325 - High Strength Bolts for Structural Steel Joints.

H. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.

I. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

K. ASTM A502 - Steel Structural Rivets.

L. ASTM A572 - High Strength Low Alloy Columbium-Vanadium Steel of Structural Quality.

M. AWS A2.0 - Standard Welding Symbols.

N. AWS D1.1 - Structural Welding Code.

O. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

P. AISC - Specification for Architectural Exposed Structural Steel.

Q. SSPC - Steel Structures Painting Council.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, and locations of structural members openings attachments fasteners.
   2. Connections.
   3. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Submit under provisions of Section 01400 certifying that products meet or exceed specified requirements.

D. Mill Test Reports: Submit under provisions of Section 01400 Manufacturer's Certificates, indicating structural strength, destructive and non-destructive test analysis.

E. Welders' Certificates: Submit under provisions of Section 01400 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months.

1.5 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Perform Work in accordance with AISC - Specification for Architectural Exposed Structural Steel.

C. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Fabricator: Company specializing in performing the work of this Section with minimum 5 years experience.

B. Erector: Company specializing in performing the work of this Section with minimum 3 years experience.

C. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Alabama.

1.7 FIELD MEASUREMENTS

Verify that field measurements are as shown on shop drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Members: ASTM A36 or ASTM A572, Grade 50.

B. Structural Tubing: ASTM A500, Grade B.

C. Pipe: ASTM A53, Grade B.

D. Bolts, Nuts, and Washers: ASTM A325.

E. Anchor Bolts: ASTM A307.

F. Welding Materials: AWS D1.1; type required for materials being welded.

G. Sliding Bearing Plates: Teflon coated.

H. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

I. Shop and Touch-Up Primer: As specified in Section 09900.

2.2 FABRICATION

Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.3 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP-2.

B. Shop prime structural steel members. Do not prime surfaces that will be field welded.

2.4 SOURCE QUALITY CONTROL AND TESTS

Testing of components will be performed under provisions of Section 01400.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.2 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

B. Field weld components and shear studs indicated on Drawings.

C. Do not field cut or alter structural members without approval of Architect/Engineer.

D. After erection, prime welds, abrasions, and surfaces not shop primed galvanized, except surfaces to be in contact with concrete.

E. Grout under baseplates in accordance with Section 03300.

3.3 ERECTION TOLERANCES

A. Maximum Variation From Plumb: ¼ inch per story, non-cumulative.

B. Maximum Offset From True Alignment: ¼ inch.

3.4 FIELD QUALITY CONTROL

Field inspection will be performed under provisions of Section 01400.

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Shop fabricated ferrous metal and non-ferrous metal items, galvanized and prime painted.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

Section 03300 - Cast-In-Place Concrete: Placement of metal fabrications in concrete.

1.3 RELATED SECTIONS

A. Section 05120 - Structural Steel: Structural steel column anchor bolts.

B. Section 05120 -Structural Steel: Bearing plates angles and anchor bolts for metal deck bearing, including anchorage.

C. Section 05520 - Handrails and Railings.

D. Section 09900 - Painting: Paint finish.

1.4 REFERENCES

A. ASTM A36 - Structural Steel.

B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

C. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.

D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.

F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.

G. ASTM A325 - High Strength Bolts for Structural Steel Joints.

H. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.

I. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

K. ASTM B177 - Chromium Electroplating on Steel for Engineering Use.

L. AWS A2.0 - Standard Welding Symbols.

M. AWS D1.1 - Structural Welding Code.

N. SSPC - Steel Structures Painting Council.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.6 QUALIFICATIONS

A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Alabama.

B. Welders' Certificates: Submit under provisions of Section 01300, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.7 FIELD MEASUREMENTS

Verify that field measurements are as indicated on shop drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sections: ASTM A36.

B. Steel Tubing: ASTM A501.

C. Plates: ASTM A283.

D. Pipe: ASTM A53, Grade B Schedule 40

E. Fasteners: Stainless Steel

F. Bolts, Nuts, and Washers: ASTM A325

G. Welding Materials: AWS D1.1; type required for materials being welded

H. Shop and Touch-Up Primer: As specified in Section 09900

I. Anchor Bolts: ASTM A193, B8LN

J. Aluminum Plates and Shapes: ASTM 6061-T6 of 6063-T6

K. Aluminum Bolts: 2024-T4 alloy

L. Stainless Steel Shapes and Plates: Type 304

2.2 FABRICATION

A. Fit and shop assemble in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

G. Structural steel shall be fabricated in accordance with the AISC Code.

H. Structural aluminum shall be fabricated in accordance with the Aluminum Association Specification.

I. All welding shall be in accordance with AWS D1.1.

J. Galvanizing shall be applied in conformance with the Recommended Practice for Providing High Quality Zinc Coatings (Hot-Dip) on Assembled Products (ASTM Specification A385).

K. Galvanized items shall not be cut, welded, or drilled after the zinc coating is applied.

2.3 FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces where field welding is required.

C. Prime paint items in accordance with Section 09900.

D. Galvanize in accordance with ASTM A123, structural steel members. Provide minimum 1.25 oz/sq ft galvanized coating.

2.4 DESIGN

A. Structural steel design shall be in conformance with ALSC "Specifications for the Design and Erection of Structural Steel for Buildings".

B. Structural aluminum shall be in accordance with the Aluminum Association's "Specifications for Aluminum Structures".

C. Anchors
   1. Concrete inserts for anchoring equipment shall be considered for approval upon written request from the Contractor. Anchors shall be installed in accordance with the manufacturer's recommendations.

2. Stud shall be removable. Anchor body shall be cast from high strength malleable iron with a threaded hub in bottom to receive anchor bolt. Anchor bolt length and stud length to be compatible with the equipment to be anchored.
3. Anchors shall be 304 or 316 S.S.

D. Chemical or Expansion Bolts
1. Chemical or expansion bolts, where shown on the drawings, shall be stainless steel of the size shown and of a sufficient length to develop the full capacity of the bolt within the safe allowable limits of the bolt and the material into which the bolt is to be anchored.
2. Chemical or expansion bolts shall not be substituted for specified anchor bolts without approval of the Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete with setting templates, to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on Drawings. shop drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed galvanized, except surfaces to be in contact with concrete.

3.4 ERECTION TOLERANCES

A. Maximum Variation From Plumb: ¼ inch per story, non-cumulative.

B. Maximum Offset From True Alignment: ¼ inch.

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

Surface preparation and field application of paints and coatings.

1.2 RELATED SECTIONS

A. Section 15190 - Mechanical Identification.

B. Section 16195 - Electrical Identification.

1.3 REFERENCES

A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D2016 - Test Method for Moisture Content of Wood.

C. AWWA (American Water Works Association) - D102 - Painting Steel Water Storage Tanks.

D. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.

E. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 DEFINITIONS

Conform to ASTM D16 for interpretation of terms used in this Section.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on all finishing products.

C. Samples: Submit two samples, 2 x 2 inches in size illustrating range of colors and textures available for each surface finishing product scheduled.

D. Samples: Submit two samples, 2 x 2 inches in size illustrating selected colors and textures for each color selected.

E. Manufacturer's Instructions: Indicate special surface preparation procedures, substrate conditions requiring special attention.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience approved by manufacturer.

B. Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience waste coating.

1.7 REGULATORY REQUIREMENTS

Conform to applicable code for flame and smoke rating requirements for finishes.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Section 01700.

B. Provide 2 gallons of each color, type, and surface texture to Owner.

C. Label each container with color, type, texture, room locations, and building in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Paint
   1. **Tnemec Company, Inc.)**
   2. Or Equal

B. Manufacturers - Primer Sealers
   1. **Tnemec Company, Inc.)**
   2. Or Equal

C. Manufacturers - Block Filler
   1. **Tnemec Company, Inc.)**
   2. Or Equal

D. Manufacturers - Field Catalyzed Coatings
   1. **Tnemec Company, Inc.)**
   2. Or Equal

2.2 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler

2.3 FINISHES

Refer to schedule at end of section for surface finish schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01039.

B. Verify that surfaces & substrate conditions are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces as recommended by the coatings manufacturer. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: As recommended by manufacturer.
   2. Masonry, Concrete, and Concrete Unit Masonry: As recommended by manufacturer.
   3. Interior Wood: As recommended by manufacturer.
   4. Exterior Wood: As recommended by manufacturer.
   5. Concrete Floors: 3 lbs per 1,000 square feet (ASTM F 1869) or as directed by the manufacturer.

3.2 PREPARATION

A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that

exhibit loose surface defects.

C. Seal with shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Uniformly profile surfaces by abrasive blasting, sanding or other suitable means which will provide a 1.0 mil anchor profile.

F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

G. Concrete Floors: Allow new concrete surfaces to cure a minimum of 28 days. Verify dryness by testing for moisture with the "plastic film tape down test (ASTM D 4263)". Should moisture be detected perform "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride (Reference ASTM F 1869). Moisture content not to exceed that as recommended by the manufacturer. Abrasive blast or mechanically abrade all surfaces to remove sealers, hardeners, coatings, as well as any other foreign matter (reference SSPC-SP 13 ICRI CSP 1 -9).

H. Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Scarify the surface to provide a uniform 1.0 mil anchor pattern.

I. Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.

J. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

K. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Abrasive blast to remove all contamination, passivation and to provide a uniform profile of at least 1.0 mil.

L. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

M. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

N. Shop Primed Steel Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Abrasive blast in accordance with SSPC-SP 10 Near White Blast Cleaning. Surface Profile shall be as specified for the coating system to be applied. All surface shall be coated prior to the formation of rust and no later than eight hours after surface preparation. Areas damaged during erection or field installation shall be repaired by abrasive blasting in accordance with SSPC-SP 10 Near White Blast Cleaning and spot priming with the primer specified in the appropriate Section.

O. Field Primed Steel Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Abrasive blast in accordance with SSPC-SP 10 Near White Blast Cleaning. Surface Profile shall be as specified for the coating system to be applied. All surface shall be coated prior to the formation of rust and no later than eight hours after surface preparation.

P. Interior Wood Items Scheduled to Receive Paint Finish: Sand to a smooth finish. Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

Q. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

R. Exterior Wood Scheduled to Receive Paint Finish: Sand to a smooth finish. Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied.

S. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied.

T. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

U. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand wood and metal lightly between coats to achieve required finish.

F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

G. Allow applied coat to dry before next coat is applied.

H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface

I.

J. Prime concealed surfaces of interior and exterior woodwork with primer paint.

K. Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Section 15190 and Section 16195 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.

B. Paint shop primed equipment. Paint shop prefinished items occurring at interior areas.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports except where items are refinished.

E. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers and grilles to match face panels.

F. Paint exposed conduit and electrical equipment occurring in finished areas.

G. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

H. Color code equipment, piping, conduit, and exposed duct work in accordance with owner's existing paint scheme. Color band and identify with flow arrows, names and numbering.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 FIELD QUALITY CONTROL

Field inspection and testing will be performed under provisions of Section 01400.

3.6 CLEANING

A. Clean work under provisions of 01700.

B. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.7 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

A. Metal Fabrications - Section 05500: Exposed surfaces of lintels, elevator pit ladders.

B. Metal Stairs - Section 05510: Exposed surfaces of stringers, exposed vertical risers.

3.8 PAINTING SCHEDULE

A. STEEL

1. Immersion, Potable or Non-Potable Water:

Surface Prep.		Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast Near-White (SP10)	**Primer**	Series 91 H20 Hydro-Zinc **or** Equal	1 Coat, 2.5 – 3.5 mils
	Stripe	Series N140-1255 Pota-Pox Plus **or** Equal	1 Coat, 2.0 – 4.0 mils
	Intermediate	Series 21-1255 Epoxoline	1 Coat, 4.0 – 6.0 mil
	Finish	Series 21-WH16 Epoxoline Epoxoline **or** Equal	1 Coat, 10.0 to 12.0 mils

2. Immersion – Domestic Sewage:

Surface Prep.		Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast Near White (SP 10)	**Primer**	Series 1 Omnithane **or** Equal	1 Coat, 2.5 to 3.5 mils
	Stripe	Series 66 Epoxoline (Brush Applied) **or** Equal	1 Coat, 2.0 – 4.0 mils
	Intermediate	Series 66 Epoxoline **or** Equal	1 Coat, 4.0 – 6.0 mils
	Finish	Series 142 Epoxoline **or** Equal	1Coat, 10 to 12 mils

3. Exterior, Non-immersion – Mildly Corrosive Atmosphere

Surface Prep.		Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (SP10)	**Primer**	Series 91 H20 Hydro-Zinc	1 Coat, 2.5 to 3.5 mils
	Intermediate	Series 66 Epoxoline	1 Coat, 3.0 to 5.0 mils
	Finish	Series 1094 Endura-Shield	1 Coat, 3.0 to 5.0 mils

4. Interior, Non-immersion:

Surface Prep.		Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (SP10)	**Primer**	Series 91 H20 Hydro-Zinc	1 Coat 2.5 to 3.5mils
	Intermediate	Series 66 Epoxoline	1 Coat, 3.0 – 5.0
	Finish	Series 1094 Endura-Shield	1 Coat, 3.0 to 5.0 mils

5. Immersion, Domestic Sewage – High levels of Hydrogen Sulfide:

Surface Prep.		Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (SP10)	**Primer**	Series 66 Epoxoline	1 Coat, 4.0 to 6.0 mils
	Stripe Coat	Series 66 Epoxoline (applied by brush)	1 Coat, 2.0 to 4.0 mils
	Finish	Series 435 Perma-Glaze	1 Coat, 20.0 to 30.0 mils

6. Miscellaneous Casting, Including Manhole Rings & Covers:

Surface Prep.		Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (SP10)	**Prime & Finish**	Series 46H-413 Tneme – Tar	2 Coats, 10.0 to 12.0 mils per coat

7. Metal Anchorage for Buried Piping:

Surface Prep.		Paint Material	Min. Coats, Cover
Clean & Dry or Power Tool (-SP3)	**Prime & Finish**	Series 46-465 Tnemecol	1 Coat, 8.0 to 12.0 mils per coat

8. Factory Primed:

Surface Prep.		Paint Material	Min. Coats, Cover
Clean & Dry	**Primer**	Series 135 Chembuild	1 Coat, 3.0 to 5.0 mils
	Finish	See topcoat exposure	See Exposure

B. STEEL PIPE

1. Exterior Pipe (Non-immersion):

Surface Prep.		Paint Material	Min. Coats, Cover
Clean & Dry	**Primer**	Series 91 H20 Hydro-Zinc`	1 Coat, 2.5 to 3.5 mils
	Stripe	Series 66 Epoxoline (Brush Applied)	1 Coat, 2.0 -4.0 mils
	Intermediate	Series 66 Epoxoline	1 Coat, 3.0 – 5.0 mils
	Finish	Series 1094 Endura-Shield	1 Coat, 3.0 to 5.0 mils

2. Immersion, Potable or Non-Potable Water:*

Surface Prep.		Paint Material	Min. Coats, Cover

Abrasive or Centrifugal Wheel Blast Near-White (-SP10)	**Primer**	Series 91 H20 Hydro-Zinc	1 Coat, 2.5 to 3.5 mils
	Stripe	Series N140-1255 Pota-Pox Plus (Brush Applied)	1 Coat, 2.0 – 4.0 mils
	Intermediate	Series 21-1255 Epoxoline	1 Coat, 4.0 – 6.0 mils
	Finish	Series 21-WH16 Epoxoline*	1 Coat, 10.0 to 12.0 mils

* Use Series 142 Epoxoline for Non-Potable Water at same DFT

C. GALVANIZED STEEL PIPE & MISCELLANEOUS FABRICATIONS

1. Interior Mild to Moderate Atmosphere:

Surface Prep.		Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by abrasive blasting to remove contaminants and to provide uniform 1.0 mils profile	**Primer**	Series 66 Epoxoline	1 Coat, 2.0 to 3.0 mils
	Finish	Series 1094 Endura-Shield	1 Coat, 2.0 – 3.0 mils

2. Exterior Mild to Moderate Atmosphere (Non-immersion):

Surface Prep.		Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by abrasive blasting to remove contaminants and to provide uniform 1.0 mils profile	**Primer**	Series 66 Epoxoline	1 Coat, 2.0 to 3.0 mils
	Finish	Series 1094 Endura-Shield	1 Coat, 2.0 to 3.0 mils

3. Immersion, Potable or Non-Potable Water:

Surface Prep.		Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by abrasive blasting to remove contaminants and to provide uniform 1.0 mils profile	**Primer**	Series 21 Epoxoline	1 Coat, 4.0 to 6.0 mils
	Finish	Series 21 Epoxoline	1 Coat, 4.0 to 6.0 mils

* Use Series 66 Epoxoline for wastewater

4. Galvanized Metal Repair:

Surface Prep.		Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by Mechanical Cleaning (-SP11)	**Primer & Finish**	Series 90-97 Tneme-Zinc	1 Coat, 2.5 to 3.5 mils

D. CHAIN LINE FENCES

Surface Prep.		Paint Material	Min. Coats, Cover
Clean & Dry	**Finish**	Series 43-36 Aluminum	1 Coat, 2.0 to 3.0 mils

E. CONCRETE, DENSE MASONRY

1. Immersion - Domestic Sewage:

Surface Prep.		Paint Material	Min. Coats, Cover
SSPC-SP 13 (ICRI CSP 5)	**Surfacer**	Series N218 MortarClad	1/16" minimum. Fill all voids and seal surface
	Finish	Series 436 Perma-Shield PL	1 Coat, 80.0 to 100.0 mils

2. Immersion - Water:

Surface Prep.		Paint Material	Min. Coats, Cover
SSPC-SP 13 (ICRI CSP 5)	**Primer**	Series N218 MortarClad	1/16" minimum. Fill all voids and seal surface
	Finish	Series 22 Epoxoline	1 Coat, 30.0 to 40.0 mils

3. Chemical Resistant Secondary Containment:

Surface Prep.		Paint Material	Min. Coats, Cover
SSPC-SP 13 (ICRI CSP 5)	**Base Coat**	Series 239SC (MCK) (embed fiberglass matt while material is still wet and rib roll)	1 Coat, 60 – 80 square feet per gallon
	Saturante	Series 239SC (RCK)Chembloc	1 Coat, 10.0 to 12.0 mils
	Finish	Series 239SC (RCK)Chembloc	1 Coat, 10.0 to 12.0 mils

4. Chemical-Resistant Wall, Heavy Duty-CMU:

Surface Prep.		Paint Material	Min. Coats, Cover
Per manufacturer's instructions	**Primer**	Series 130 Envirofill Masonry Filler (Sprayed or rolled then squeegee)	1 Coat, 60 to 80 sq. Ft./gal
	Finish	Series 282 Tneme-Glaze	2 Coats, 8.0 to 12.0 mils per coat

5. Exterior - Non-immersion:

Surface Prep.		Paint Material	Min. Coats, Cover
Dry & Clean / Rubbed finish free of bugholes and imperfections	**Primer**	Series 156 Enviro-Crete	1 Coat, 4.0 to 6.0 mils
	Finish	Series 156 Enviro-Crete	1 Coat, 4.0 to 6.0 mil

* Series 156 is a Flat, Smooth Finish; Series 157 a Flat, textured Finish

6. Exterior CMU

Surface Prep.		Paint Material	Min. Coats, Cover
Dry & Clean	**Block Filler**	Series 130 Envirofill	1 Coat, 60 to 80 square feet per gallon
	Finish	Series 156 Enviro-Crete	2 Coats, 4.0 to 6.0 mils per coat

F. CONCRETE FLOORS

1. Decorative

Surface Prep.		Paint Material	Min. Coats, Cover
Blastrac or Brush Blast (ICRI CSP 4 – 5)	**Base Coat**	Series 241 Ultra-Tread MTV (Broadcast to refusal with selected quartz)	1/16" Nominal
	1st Coat	Series 222 – Deco Tread (Broadcast to refusal with selected quartz)	20 mils
	Grout Coat	Series 222 Deco-Tread	8.0 to 10.0 mils
	Finish	Series 248 Everthane	2.0 to 3.0 mils

2. Pipe Gallery, Mechanical Rooms and Hallway

Surface Prep.		Paint Material	Min. Coats, Cover
Mechanically abrade (ICRI CSP 2 – 3)	**Primer**	Series 237 Power-Tread	6.0 - 8.0 mils
	Intermediate	Series 237 Power-Tread	6.0 – 8.0 mils
	Finish	Series 248 Everthane	2.0 -3.0 mils

G. CONCRETE STRUCTURES:

1. Below Grade:

Surface Prep.		Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bugholes	**1st Coat**	Xypex Concentrate	1/16"
	2nd Coat	Xypex Mega-Mix I	1/8" minimum

H. PLASTER & WALLBOARD (GYPSUM BOARD)

Surface Prep.		Paint Material	Min. Coats, Cover
Dry & Clean	**Primer**	51 PVA Sealer	1 Coat, 1.0-2.0 mils
	Finish	Series 1026 Enduratone	2 Coats, 2.0-3.0 mils per coat

I. WOOD

1. Interior or Exterior:

Surface Prep.		Paint Material	Min. Coats, Cover
Dry & Clean	**Primer**	Series 10-99 W Tnemec Primer	1 Coat, 2.0 to 3.5 mils
	Finish	Series 1029 Enduratone	2 Coats, 2.0 to 3.0 per coat

J. INSULATED PIPE

1. Interior:

Surface Prep.		Paint Material	Min. Coats, Cover
Clean & Dry	**Primer & Finish**	Series 1026 Enduratone	2 Coats, 2.0 to 3.0 mils per coat

K. PVC PIPE

1. Interior and Exterior Fiberglass, PVC:

Surface Prep.		Paint Material	Min. Coats, Cover
Roughen by sanding or Brush Blasting	**Prime**	Series 66 Hi-Build Epoxoline	1 coat, 2.0 to 3.0 mils
	Finish	Series 1095 Endura-Shield	1 Coat, 2.0 to 3.0 mils

L. **DUCTILE & CAST IRON**

1. Interior-(O.D.):

Surface Prep.		Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by Abrasive blasting per NAPF Exterior Standard	**Primer**	Series N140-1211 Pota-Pox Plus	1 Coat, 6.0 to 8.0 mils
	Intermediate	Series 66 Epoxoline	1 Coat, 3.0 – 5.0 mils
	Finish	Series 1094 Endura-Shield	1 Coat, 3.0 – 5.0 mils

2. Exterior Exposed-(O.D.):

Surface Prep.		Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by Abrasive blasting per NAPF Exterior Standard	**Primer**	Series N140-1211 Pota-Pox Plus	1 Coat, 6.0 to 8.0 mils
	Intermediate	Series 66 Epoxoline	1 Coat, 3.0 – 5.0 mils
	Finish	Series 1094 Endura-Shield	1 Coat, 3.0 – 5.0 mils

3.9 COLOR CODE FOR PROCESSING EQUIPMENT

A. Prior to beginning of work verify color for new equipment with Owner.

B. Systems - OSHA - Where Applicable on this Project.

Application	Generic Color	Color Identification
Water		

Application	Generic Color	Color Identification
Raw Water	olive green	110GN Clover
Flocculated or Filtered	aqua	10GN Aqua Sky
Finished or Potable Water	dark blue	11SFSafety Blue
Waste Water		
Backwash Waste	light brown	68BR Twine
Sewage Plant Effluent (N/A)	clay**	21BR Earthenware
Sludge	dark brown	84BR Weathered Bark
Sewer (Sanitary or Other)	dark gray	34GR Deep Space
Chemical	**Generic Color**	**Color Identification**
Alum or Primary Coagulant	orange	04SF Safety Orange
Caustic	green	09SF Safety Green band 06SF Safety Red band
Chlorine (Gas & Solution)	yellow with red band	02SF Safety Yellow
Fluoride	light blue with red band	25BL Fontainebleau with 06SF Safety Red Band
Potassium Permanganate	violet	14SF Safety Purple
Soda Ash	light green with orange band	37GN Irish Spring with 04SF Safety Orange band
Sulfuric Acid	yellow with red band	02SF Safety Yellow with 06SF Safety Red band
Sulfur Dioxide	light green with yellow band	37GN Irish Spring with 02SF Safety Yellow Band
Other		
Compressed Air	dark green	91GN Balsam
Gas	yellow	02SF Safety Yellow
Other Lines	light gray	32GR Light Gray
Hoists/Trolleys	yellow**	02FS Safety Yellow
Fire Protection	red**	06SF Safety Red

*These colors are in accordance with the Recommended Standards for Water Works.

SECTION 11501

ULTRAVIOLET DISINFECTION EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. GLASCO UV will furnish all materials, equipment and appurtenances required to provide one (1) flow through FEP tube, single-bank tube reactor ultraviolet (UV) wastewater disinfection system. The reactor is designed to disinfect 3.10 MGD.

B. The UV system integrates fluoropolymer tubes and low-pressure high output lamps. Unlike "traditional" systems, this system does not have UV lamps "in" the water, does not use quartz sleeves, and does not integrate a cleaning system.

C. Ultraviolet (UV) disinfection system will be complete and operational with controls and accessories as shown and as specified. The UV equipment will be capable of treating the wastewater with the characteristics outlined to meet the permitted discharge limitations.

D. The reactor is a two (2) bank system that will treat the 3.10 MGD peak flow and provide the requisite dosage.

E. The system is designed for intermittent flows.

F. The following publications and references have been applied:

1. U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA)
2. US EPA (1986) Design Manual EPA/625/1-86/021
3. American National Standards Institute (ANSI)
4. American Society for Quality Control (ASQC)
5. American Society of Mechanical Engineers (ASME)
6. American Society for Testing Material (ASTM)
7. American Water Works Association (AWWA)
8. NEMA 250 (2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
9. NEMA C82.4 (2002) Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type)
10. NEMA ICS 1 (2000; R 2005; R 2008) Standard for Industrial Control and Systems General Requirements
11. NFPA 70 (2007; AMD 1 2008) National Electrical Code - 2008 Edition

1.2 SYSTEM DESCRIPTION

1. Design Criteria:
   a. Peak hydraulic flow: 3.10 MGD
   b. Redundancy: None
   c. Minimum flow: 0 MGD
   d. Total Suspended Solids: 30 mg/l
   e. Biological Oxygen Demand: 30 mg/l
   f. Max head loss: <7.5”
   g. UV Transmittance at 254 nm: 65%
   h. Effluent temperature range: 41 to 86°F
   i. Mean particle size: 30 microns
   j. Minimum UV dose: > 30 mJ/cm2
   k. Effluent standard to be achieved <200 per 100 ml fecal coliform based on a 30-day geometric mean of daily samples and sampling location immediately downstream of the UV reactor.

1.3 PERFORMANCE REQUIREMENTS

The UV disinfection system will produce an effluent conforming to the discharge requirements at maximum flow of <200/100 ml fecal coliform, based as a 30-day Geometric Mean. Grab samples shall be taken in accordance with the US EPA approved laboratory methods.

1. The UV system is designed to deliver a minimum UV dose of 30mJ/cm2 during peak flows, with effluent having UV Transmission of 65% or greater at end of lamp life (EOLL).

1.4 UNIT DIMENISIONS

Max Length: 10’- 5”
Max Width: 3’- 5”
Max Height 7’- 0”

The reactor will be constructed of stainless steel. Each bank will house fifty (50) tubes and seventy-two (72) lamps. The system will be supplied with a 18” flange pattern for inlet and outlet piping connections.

The BCC/SCC will be remote and will be constructed of stainless steel.

1.5 SUBMITTALS

A. The following has been submitted for review:
   1. GLASCO UV has attached mechanical and electrical drawings.

B. Submittals include:
   1. General layout and arrangement drawings
   2. Power wiring single line diagrams
   3. Ballast Control Center wiring diagrams
   4. Cut Sheets on Components

C. Operation and Maintenance manuals

   1. O&M Manual for the NONCON Series will be provided. O&M Manuals will contain the following additional information.
   2. Parts list.
   3. Assembly instructions.

4. Performance guarantee.
5. Maintenance recommendations.
6. Startup procedures.
7. List of spare parts.
8. Wiring diagrams
9. Software integration.
10. Trouble shooting.
11. Dimensional drawings have been attached as exhibits to this submittal.
12. Electrical wiring diagrams for system installation have been provided with noted recommendations.

1.6 DELIVERY STORAGE AND HANDLING

A. General Requirements: In addition to requirements for materials handling and storage as stated in the General Conditions of the Contract; the following applies:

B. Delivery: When transporting materials, equipment, and electrical/electronic components both on site and from Contractor's storage to the site, do so in accordance with recommendations of the Manufacturer.

C. Unloading: When unloading materials, equipment and electrical/electronic components provide any special apparatus as may be required by manufacturers. Handle materials, equipment, and electrical/electronic components in accordance with manufacturer's written instructions.

D. Storage: Store materials, equipment and electrical/electronic components, both on and off site, in accordance with manufacturer's written instructions. Additionally, provide manufacturer's certificates of proper materials, equipment, or machinery storage for the following listed items. Prior to issuance of such certificates, a manufacturer's representative shall visit the site of storage and examine materials, equipment, and electrical/electronic components in actual storage conditions.

1.7 OPERATIONS AND MAINTENANCE MANUALS

A draft O&M manual has been included in this submittal.

1.8 COORDINATION

Glasco UV will coordinate with contractors and integrators to ensure that the system is integrated and operational.

1.9 GURANTEE

A. UV System Equipment: In addition to the guaranteed requirements stated in the General Conditions and Supplementary Conditions, the following conditions apply to the UV system:
   1. Full replacement of all defective lamps that fail within the first 9,000 hours of proper operation.
   2. Full replacement of all defective components, materials, and workmanship for a period of 12 months from the date of substantial completion, not to exceed 18 months from date of shipment.
   3. Full replacement of all defective electronic ballasts that fail within the first 5

years from delivery under proper operation.

4. The manufacturer shall warrant all electronic and control circuits for 2 years from date of shipment.

1.10 SPARE PARTS

A. The following spare parts will be provided and will be stored in sturdy label containers.
   1. Four (4) UV lamps
   2. Two (2) Ballasts
   3. One (1) Cleaning brush
   4. Two (2) Operator safety kit
   5. Three (3) Operation Manuals

PART 2 - PRODUCTS

2.1 EQUIPMENT NAME

A. GLASCO UV will provide one (1) complete NONCON-5000-6-12X50 system designed for 3.10 MGD.

2.2 MATERIALS

A. UV systems are designed to be placed on slab.

B. UV system shall be anchored to the plant via stainless steel fasteners.

2.3 MANUFACTURED UNITS

A. General
   1. All module welded metal components in contact with effluent will be Type 304 stainless steel.
   2. All metal components will be Type 304 stainless steel and be capable of sustaining intermittent pedestrian traffic on the lamp racks.
   3. All wiring exposed or unexposed to UV light within the UV reactor or electrical ballast enclosure will be Teflon™ coated.
   4. All wires connecting the lamps to the ballasts will be enclosed inside the frame of lamp rack and not exposed to the effluent
   5. The effluent water shall be conveyed through the UV reactor through fluoropolymer tubes.
   6. All wetted components in the UV reactor will be: FEP, 304SS, PVC, ABS or other non- reactive, non-corrosive material.

B. Lamp Array Configuration:
   1. The lamp array configuration will be the uniform array with all lamps parallel to each other and to the flow.
   2. The system is designed to avoid any immersion of UV lamps in the Effluent.
   3. The UV lamps will be arranged around the outside of the FEP tubes in such a way that each water tube shall have no less than 6 lamps irradiating it.

C. Inlet/Discharge Flow Distribution:

1. Each Reactor will have an inlet and discharge transition tanks.
2. The UV system will have flange patterns on the inlet and outlet boxes.
3. The UV disinfection system will have flow inlet distribution that distributes wastewater through the FEP tubes.
4. The UV system will have a 304 Stainless steel channel and will be non-corrosive.

D. FEP Tube UV Reactor

1. Within the ultraviolet reactor, FEP UV transmitting tubes are arranged in a horizontal and vertical array. These FEP tubes are in a parallel mode and are attached at one end to the inlet flow distributor sheet and to the outlet flow distributor sheet with appropriate leak proof fittings. The FEP tubes will be adequately supported by integral mounting brackets.
2. In between and around the FEP tubes, lamp rack assemblies will be placed in such a fashion so as to provide uniform and adequate ultraviolet light intensity. The lamp racks slide in and out between and around a row of FEP tube array.
3. Within the FEP UV reactor, all UV sensitive materials will be protected from the UV light.
4. The flow path of the wastewater will be through UV transmitting FEP tubes in such a way that it is a minimum of 99% plug flow. The flow of wastewater will be in sufficient turbulent mode; therefore, the Reynold's number in each unit will be greater than 50,000 at peak daily flow. A turbulent flow will be in such a way that it will constantly scour the inner walls of the AFP tube and help prevent scaling or fouling.
5. The ultraviolet light reactor will be covered from five sides with stainless panels. The sixth side (top) will have access doors. The lamp racks will be accessible through these doors.
6. The air temperature inside the FEP UV reactor shall be maintained by means of heat exchanger. The control of the lamp temperature shall ensure optimum UV light emissions from the UV lamp. The heat exchanger shall ensure that no outside air or dust can get into the UV reactor and settle on the AFP tubes and UV lamps.
7. Cooling of the UV reactor shall utilize a liquid to air heat exchanger.
8. UV Reactor Thermal Control Mechanism:
    a. Cooling within the UV reactor shall utilize a series of liquid to air heat exchangers. A closed loop system will be utilized to feed the heat exchangers coils with liquid. The use of plant effluent as feed water to the heat exchangers will not be allowed.
    b. Glycol is the liquid that will be recirculated through the cooling loop. A fill reservoir will be provided to top off the coolant, and manufactures recommended intervals
    c. The cooling system will have an inline flow meter that will report to the system’s PLC on the functionality of the cooling loop.
    d. The UV manufacturer shall supply the heat exchangers and associated controls.
9. Each UV Reactor shall consist of 1 bank.

10. During the appropriate stage in the treatment process when the flow from the SBR decant has stopped, the FEP tubes will be capable of being empty, and the UV lamps will be able to be turned off. This will be controlled by the UV panel.

E. UV Lamps:

The Ultraviolet Disinfection System will have germicidal UV lamps. These lamps will be located on the lamp rack assemblies. The ultraviolet disinfection lamps will have the following characteristics:

1. A low pressure, high output non-amalgam mercury vapor lamp of the hot cathode type.
2. The filament shall be of the clamped design, significantly rugged to withstand shock and

vibration.

3. Each lamp will produce at least 90% emissions at the germicidal frequency of 253.4 (254nm) nanometers.
4. The power consumption will be a maximum of 155 input watts per lamp including ballast losses.
5. The rated UV output at 253.7 nanometers will be a nominal 50 UV254
6. The rated UV efficiency shall be a nominal 32% of actual lamp input wattage exclusive of ballast losses.
7. Watts at 100 hours of operation.
8. The minimum UV intensity from the lamps will be >400 microwatts/cm2 at 1 meter.
9. Pro-rated lamp life is 13,000 hours
10. Each lamp shall be single ended. Each lamp will have a nominal arc length of 1400 millimeters.
11. Each lamp has a minimum length of 1554 mm.
12. Each lamp will produce no measurable amount of ozone.
13. Each lamp envelope is made of quartz and is capable of transmitting at 90% of UV light at 254 nm.
14. UV lamp base will be either ceramic or metallic
15. Electrical connections will be at one end of the lamp and have 4 pins, dielectrically tested for 2,500 volts.
16. During periods in the process when there is no effluent flow going through the UV reactor(s) the UV lamps shall be turned off.
17. UV Lamps shall be available for purchase from non-related parties or OEM'sunder agreement from the original UV manufacturer
18. UV systems which use proprietary lamps shall not be considered.

F. UV Lamp Racks

1. The UV lamp racks will be placed between rows of the FEP tubes.
2. The lamp racks will slide in and out within a track that will be attached to the main frame of the UV reactor.
3. The use of cranes, hoists or other mechanical lifting devices is not required.
4. The lamp rack assemblies will be made from stainless steel.
5. Lamp rack assembly is capable of sustaining intermittent pedestrian traffic on the lamp racks with no damage or deformation.
6. There are no quartz sleeves, O rings, Seals or waterproof connections required for installing UV lamps onto the lamp rack assembly.
7. Electrical mounting sockets are attached to one end of the lamp rack.
8. The other end of the rack are slotted holes to slide lamps in and out during installation and removal of lamps.
9. Quick power disconnects will allow quick disconnect of the lamp rack assembly to the main power.
10. Lamp Racks are removable for service during plant operation without impacting Hydraulic flow or effective disinfection.
11. Removing a lamp rack or module does not result in the disruption of the hydraulic flow.
12. Ballast required for each lamp rack will be incorporated in the Ballast Control Center.
13. Systems utilizing module mounted ballasts shall not be accepted.
14. The ballast used to energize the UV lamps are high frequency electronic ballasts.
15. The electronic ballasts are rated at 120V-277V + 10% without discernible change of characteristics.
16. The electronics ballast have the following features:
    a. Power factor greater than or equal to 0.95.
    b. Electrical conversion efficiency greater than or equal to 90%.
    c. Ballast will have high frequency phase returns from the UV lamps.

d. The ballast operating frequency will be between 40 and 150 KHz.
e. The ballast will have a thermal overload protector when ballast skin temperature reaches 75°C.

G. System Control Center (SCC) / Ballast Control Center (BCC)

a. The NONCON reactor will have its own free standing modified NEMA 4X System Control Center / Ballast Control Center.
b. Each lamp will have a corresponding LED. LED shall be displayed through a window kit. A green LED indicates a functioning lamp, and an extinguished LED means lamp out or other problem such as damaged ballast.
c. The SCC will track operational hours as a way to remind when lamps require changing (13,000 hours).
d. The SCC will have a UV monitoring system that will measure and display UV output on a 0-100% basis.
e. The SCC will be provided with 20 feet of cable leading from the NONCON reactor.
f. 480V three phase, 4-wire power to be provided.
g. The UV System will have temperature control and internal heat management through the use of heat exchangers.
h. The UV system will be provided with a non-proprietary PLC by Allen Bradley. PLC will be an Allen Bradley 1400 with a Weintek Human Machine Interface.
    i. The System will be provided with a PLC and a touch screen HMI.
        a. LCD Display
        b. Touch screen keypad
        c. Status of operation through HMI
    ii. Lamp status
    iii. Lamp run time
    iv. UV output
    v. All controls and instrumentation will be housed in a remote NEMA 4xmodified stainless steel enclosure. The enclosure will contain:
        a. Electronic Data Center
        b. Contacts for remote alarms and controls to include:
    vi. Local start of UV
    vii. Lamp out indictors
    viii. Low UV alarm
    iv. Reactor on/off status
i. The SCC will provide the following
    i. On/OFF status of individual lamps and lamp racks
    ii. Error status of lamps and sensors
    iii. Number of operating hours for lamps
    iv. An advanced signal for lamp service or replacement
    v. UV intensity
    vi. Type and location of the alarm
    vii. The frequency of alarms shall be counted and stored
j. Alarms and historical operating data shall be stored in a removable storage device in comma delineated format.
k. Communication between the UV control panel (SCC) and the plant PLC shall be via CAT6 Ethernet cable.

H. UV Intensity Monitor:
a. One (1) UV module in each UV bank will be equipped with an ultraviolet intensity monitor system.
b. The intensity sensors will be placed around a representative FEP tube.

c. The UV sensors will sense 253.7 nm UV light and will provide a signal, which will be displayed on the system display panel.

I. ELECTRICAL

1. Each bank will have a three-way control for allowing OFF, Hand, or Automatic operation of the UV Reactor system.
2. In Hand, provide local control of the UV Reactor at the Local Display.
3. In Auto, provide automatic system as programmed in the UV system control center to turn lamps on and off based on flow signal from others if available.
4. Changing between Automatic and Hand operation shall be a smooth transfer without extinguishing lamps.
5. All incoming system and control power shall be brought into the Electrical Control Panel and routed to appropriate components.
6. Overall system status:
   a. Lamp Status
      1) Individual Lamp location (Stage, Lamp Rack, Position)
         a) Lamp On/Off status
         b) Lamp Life (in elapsed hours)
   b. Sensor Status
      1) Number of active sensors in UV system
      2) Type and Value of Sensor

J. CONTROL STRATEGY
1. At any given time, the UV reactor shall be designated as DUTY and shall be in AUTO position.
2. Remote Start: The UV system shall be turned on by the Main Plant's PLC/SCADA system by opening and closing dry contacts. The SBR's supervisory PLC shall be programmed to produce an output (dry contact), 5 minutes before the start of a decant cycle, this contact closure shall be used by the Main Plant's PLC/SCADA system to produce a remote start signal (contact closure) for the UV system. The main Plant's PLC/SCADA shall be programmed to OPEN the dry contact and the end of a decant cycle after effluent stops flowing through the UV reactor. The UV control system shall be programmed to keep the LEAD UV bank operational for 5 minutes after the remote start signal ceases.
3. Flow Pacing: The UV system shall employ a flow pacing technique with flow rate signals from the plant SCADA system.

K. LAYOUT AND COMPONENTS

1.	Number of reactors:	1
2.	Banks per reactor:	2
3.	Modules per bank:	3
4.	Lamps per module:	12
5.	Total lamps:	72
6.	FEP Tubes:	50
7.	Radar Level Sensor:	1
8.	Max Length:	10' 5"
9.	Max Height:	7'-0"
10.	Max Width:	3'-5"
11.	Connections:	18", 150# Flange Pattern

L. The UV systems shall accept 4-20 mA signals from the plant flow meters and other controls.

PART 3 – INSTALLATION, TESTING AND TRAINING

3.1 INSTALLATION

A. Equipment will be installed by Contractor in accordance the manufacturer's recommendations, drawings, and specifications to provide a complete installation.

B. Installation Responsibilities of the Contractor.

1. Provide UV manufacturer with at least 2 weeks notice prior to any changes in the installation date previously agreed upon by the Owner.
2. Sufficient space for moving into place and placement of all equipment supplied.
3. Equipment anchoring and grouting including anchor bolts.
4. All required permits.
5. Structural work such as concrete pads, mezzanines for elevating equipment items, discharge channel, building enclosure, and all piping.
6. Interconnecting electrical outside of the UV Skid limits.
7. Connection and sealing of all flange fittings and connections to the adjacent processes.
8. All electrical outside the skid limits and transformers/disconnect switches of the supplied equipment. Equipment electrical supply shall be detailed on the shop drawings.
9. Any hardware or software required to connect to the Owners SCADA control system.
10. Protecting the UV System from damage between the time of delivery and installation.
11. Analytical testing to prove performance shall be samples taken by the Owner and paid for by the Owner.
12. Equipment unloading, moving, and rigging into position.

3.2 ELECTRICAL CONNECTIONS AND CONTROLS

A. All wiring and conduits for electrical power, controls, and instrumentation will be provided by the Contractor.

3.3 OPERATOR TRAINING

A. Glasco UV will provide all the necessary start up and training. This will be as specified and any additional training at no charge.

SECTION 11600

LAGOON WASTEWATER
TREATMENT EQUIPMENT SYSTEM

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Description:

1. The equipment and materials covered by these specifications are intended to be standard equipment of proven reliability and as manufactured by reputable manufacturers having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the contract drawings and operated in accordance with the manufacturer's recommendations. The lagoon wastewater treatment equipment system shall consist of the following:
   a. Electric Horizontal-Rotor Floating Aeration Equipment
      1. There shall be furnished Five (5) 10-HP electric horizontal-rotor floating aerator(s) for operation as shown on the plans; Three (3) 10-HP Aerators in the first aerated cell and Two (2) 10-HP Aerators in the second aerated cell. Aerator(s) shall be the S&N AIROFLO 2200 Series Stainless Steel Floating Brush Rotor(s), as manufactured by S&N AIROFLO, Inc., 1011 Sycamore, Greenwood Industrial Park, Greenwood, Mississippi 38930. Each aerator shall consist of an electric motor, gear reducer, flotation devices, mainframe, cradle frame, adjusting linkage, anchoring system, control panels, and access systems.
   b. Floating Baffle Curtains
      1. S&N Airoflo, Inc., as the Aerator Manufacturer, shall furnish the baffle curtain materials anchor forms, all hardware, and incidentals required for installing, completing, and readying for operation, the floating baffle curtain indicated on the attachments and as specified herein, to include the concrete anchors and anchor posts. The Aerator Manufacturer will coordinate with OWNER and CONTRACTOR during construction and installation of the baffle curtains.

B. Unitary Responsibility:

1. In order to unify responsibility for proper operation of the complete lagoon wastewater treatment equipment system (the system), it is the intent of these Specifications that all system components are furnished by a single supplier (unitary source). Alternate manufacturers not offering a complete system design, including biological treatment design and a performance guarantee, shall not be considered. The system must be of standard catalog design, totally warranted by one manufacturer.

2. Under no circumstances will a lagoon wastewater treatment equipment system consisting of parts compiled and assembled by a manufacturer's representative, distributor, or other third-party source/manufacturer be accepted

3. It shall be the responsibility of the system supplier to fully integrate and ensure the functionality of a complete lagoon wastewater treatment equipment system.

C. Basis of Design:

1. The basis of design for these specifications is equipment manufactured by:

   a. S&N AIROFLO, Inc.
   1011 Sycamore
   Greenwood, MS 38930

   b. ENGINEER approved equal

2. Any equipment manufacturers wishing to supply equipment for the purposes of this project shall propose equipment that meets or exceeds the requirements set forth through these specifications, to include design documentation by a qualified water professional whose expertise includes the design of similar sized wastewater treatment equipment systems and is a registered professional engineer. The proposed equipment and relating treatment design must be approved by the ENGINEER.

1.2 REFERENCES

A. American Gear Manufacturers Association (AGMA)

B. National Electrical Manufacturers Association (NEMA)

C. American Society for Testing and Materials (ASTM)

D. American Welding Society (AWS)

G. American Society of Civil Engineers (ASCE)

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications – Aeration Equipment:

1. Consideration will be given only to the aerators of well-established and reliable manufacturers who are regularly engaged in such work and thoroughly experienced in the design and manufacture of aerators for the type of aeration basin geometry shown on the plans. The manufacturer shall have a basic aerator design that has thirty (30) years' experience. The manufacturer shall certify to not less than Ten (10) successful operating installations in the United States meeting the performance specifications as evidence of meeting the experience requirement.

B. Manufacturer's Qualifications – Baffle Curtains:

1. The manufacturer of the floating baffle curtain shall have at least ten years of experience in the construction of floating baffle curtains utilizing dielectric and / or hot wedge sealing fabrication methods. No sewn seams shall be permitted.

2. The manufacturer of the floating baffle curtains shall have manufactured a of no less than five-thousand linear feet of baffle curtains for tanks, ponds, and open water applications.

1.4 SUBMMITALS

A. Shop drawing submittals for aeration equipment shall include at least the following:

1. Certified shop drawings showing all details of construction, dimensions, anchor bolt location, and field connection.

2. Descriptive literature, bulletins, and catalogs of the equipment.

3. Installation, operation, and start-up procedures including lubrication requirements.

4. Complete motor data.

5. Total weight of the equipment including the weight of the single largest item.

6. A complete bill of materials for all equipment within the O&M manual along with maintenance schedules and procedures. No samples will be required.

7. A list of spare parts that are supplied with the equipment.

8. Aeration equipment manufacturer shall provide documentation of experience including, but not limited to, Thirty (30) years or more of aeration equipment manufacturing experience and installations treating municipal wastewater of equivalent nature. Aeration equipment manufacturer shall provide documentation of Ten (10) or more referenced aeration installations having been in continuous service for three (3) years or more.

9. Based on motor output power and field transfer conditions, manufacturer must provide a minimum of five (5) separate installations demonstrating the desired treatment having used an SAE at field conditions of 2.3 lb O_2/HP-hr in the design (See 1.4. Quality Assurance: ASCE Standard O_2 Transfer Rate of 3.0 lb 0_2/HP-hr)

B. Submittals for the baffle curtain system must first be approved by the ENGINEER and shall include the following:

1. Shop Drawings with construction details of each of the floating baffle curtains.

2. Floating baffle curtain manufacturer including contact name, address and telephone number.

3. Product data and physical properties of the floating baffle curtain material along with fabric manufacturer name, contact, address, and telephone number.

4. Product data with specifications covering all components used in the fabrication of the floating baffle curtain.

5. Installation instructions.

6. Operation and maintenance instructions.

C. Submit operations and maintenance manuals for the aeration equipment in compliance with the Contract Documents, 30 days prior to shipment. Manuals shall include:

1. Name, address, and telephone number of the nearest competent service representative who can furnish parts and technical service.

2. Pictorial illustrations of handling, installing, preventative maintenance, and major component replacement.

3. Operating, maintenance and troubleshooting information.

4. Complete maintenance parts list.

5. Complete connection, interconnecting and assembly diagrams.

6. Complete bill of materials.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, shipping, Handling and Unloading:

1. Aeration equipment shall be transported, unloaded, handled, and stored in accordance with the manufacturer's recommendations for the equipment.

2. Deliver materials to the Site to ensure uninterrupted progress of the Work. packaging of the floating baffle curtain shall be the responsibility of the floating baffle curtain manufacturer and so that the floating baffle curtains shall not be damaged during shipment.

B. Storage and protection:

1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

1.6 PERFORMANCE REQUIREMENTS

A. The aeration equipment, as installed, shall comply with the following:

1. Each aerator shall provide an oxygenation capacity of 720 lb O_2 per 24-hour period of continuous operation at standard conditions (10 hp x 3.0 lb O_2 HP-hr x 24 hr).

2. Each aerator shall develop an oxygen transfer efficiency of no less than 3.0 lb O_2/HP-hr based on motor output power at standard conditions.

3. The performance requirements for each aerator must be met at an amp loading no greater than 90% of full load amps.

B. The baffle curtains, as installed, shall comply with the following:

1. See Part 2 Products – Baffle Curtains

PART 2 - PRODUCTS

2.1 MOTORS

A. Each aerator shall be driven by single speed, Premium efficiency, minimum 1.25 SF (at full load amps, not to be confused with operational loads) horizontal shaft electric motor. The electric motor shall be an induction motor 10 HP, 3-phase, 1800 RPM, 60 Hertz, 230/460 Volt, TEFC, NEMA premium efficiency. Motor shall operate at 90% or less of its rated full load during normal operation. The aerator manufacturer shall provide certification that the nameplate data affixed to the aerator's electric motor is valid, specific data applicable to that particular motor. The motor shall carry a manufacturer's warranty from the date of installation.

2.2 GEAR REDUCERS

A. Each aerator shall have a new constant-duty AGMA class III gear reducer possessing a minimum 2.0 service factor based on manufacturer's recommended loading. The gear reducer shall connect directly to the rotor shaft by a twin tapered bushing. The gear reducer shall be connected inline to the electric motor and driven by a coupling with an elastomeric element. The coupling shall be attached to the motor and gear shafts by a taper lock bushing. Gear reducer shall be manufactured by Dodge and shall include a Dodge® Raptor elastomeric coupling

B. Each gear reducer shall be equipped with a Vented Breather modified to attach to the gear reducer to extend the life of the gear oil and reduce maintenance costs. As the thermals change in the cavity of the gear reducer, moisture vapor is trapped in the proprietary media to be released through the bottom of the breather housing. This prevents the accumulation of moisture in the cavity of the gear reducer reservoir. The Modified Vented Breather lowers and stabilizes the relative humidity inside the reservoir leading to a lower dew point. Lower dew point means no condensation, even when the machine is shut down. These Vent Breathers shall provide protection from moisture for a minimum of two years before replacement is required.

C. Each gear reducer shall be fitted by the aerator manufacturer with external seal guards to provide a labyrinth of protection to the gear reducer seals. Protection of the seal must include not only protection from splashed water but also protection form atmospheric moisture. The seal guards consist of a Teflon seal plate with an additional barrier of grease over the seal area for extra protection from atmospheric moisture. Each gear reducer shall be drilled and tapped to accept a UHMW hold down ring to stabilize the seal plate. Gear reducers without external seal guards shall not be acceptable.

D. Gear reducers shall be mounted in an open area. Location of gear reducers shall allow convenient access for maintenance and for free-flowing air to prevent heat buildup and the possible need for external cooling devices.

2.3 DRIVE ASSEMBLY, SHIELDS AND MOTOR COVER

A. The drive design employed shall be "Flex Drive" as approved by Dodge Engineering. Drive assemblies with "bolt on" or "locked mounted" gear reducers shall not be acceptable. A shaft mounted gear using a face mounted plate, is attached to the frame with heavy pins to allow tri-axial movement. The movement allowed by the pin and plate arrangement eliminates critical alignment issues, thus eliminating misalignment pressure on the bearings in the gear reducer. Further reduction of possible alignment issues is greatly reduced through the use of an elastomeric coupling between the motor and the gear.

B. The Extended Vertical Shield (EVS) on the drive end of the aeration equipment rotor consists of an 8' wide shield and a structural framework, attached to the main frame. The EVS is sized and designed to provide a clean dry area around the motor and gear reducer. The shield system construction shall incorporate protection of the seal and bearing area of the gear. The construction shall not allow wastewater to be transmitted along the rotor shaft by use of a floating rotor shaft seal.

2.4 HORIZONTAL ROTOR ASSEMBLY AND TAIL BEARING

A. The Rotor assembly shall consist of an 8-5/8" O.D. flanged torque tube with a 41 1/2" overall diameter. The flanges shall be indexed to fit the stub shaft hub. The rotor stub shafts shall consist of a fabricated hub stress relieved to 1200 degrees Fahrenheit and fitted with a 1045 carbon steel shaft. The shaft to hub fit shall be a heavy shrink fit, performed as the final step of the fabrication. A specific combination of rotor length and number of blades will provide the required HP to meet the performance requirements of the aerators called for in this specification.

B. All blades shall be C-shaped, reduced-impact blade design. The blades for a 41 1/2" diameter rotor shall be attached in banks of four blades of the same length, with the length of the blades in each bank alternating between 16-3/4" and 13-3/4". Rotor assembly shall be balanced to prevent vibration. Each bank of blades shall be welded to the torque tube using a specific off set to form a helix design to eliminate shock loadings. The vertical sides of the C-shaped rotor blade shall serve as gussets to reinforce the vertical strength of the blade and to relieve pressure on welded connections. Bolt-on blades are not acceptable.

C. Rotor and blades shall be constructed from A36 Low Carbon Steel and hot dipped galvanized to ASTM Specification #A123/A after final fabrication.

D. The Rotor shall be supported by a tail end stub shaft and a face mounting plate designed in conjunction with an elastomeric coupling to allow tri-axial movement of the gear to avoid undue misalignment pressure on the bearings in the gear reducer

E. Each unit shall possess a wastewater lubricated tail bearing, requiring no greasing or any other source of additional lubrication. The body of the bearing is constructed of UHMW polyethylene. The shrink fitted bronze bushing is designed to wear against the ultra-high molecular weight (UHMW) polyethylene. The inside of the bi-metallic bushing, also shrink fitted to the shaft is carbon steel and serves as a visual indicator of wear and as additional mass to extend the normal wear process and to protect the stub shaft. The manufacturer shall supply instructions for the replacement of the bi-metallic wear bushings. The bearing shall be constructed of UHMW polyethylene, with a minimum bearing surface width of 4".The top

side, of the outboard side, of the bearing is cut away for easy visual inspections. Mechanical bearings requiring greasing, either manual or automatic, will not be accepted.

2.5 FLOTATION DEVICES

A. Each unit shall contain Two (2) Stainless Steel flotation devices capable of floating and stabilizing the unit. Each float shall be fabricated from Type 304 stainless steel having a minimum thickness of 0.0625 inches. All seams shall be welded for strength. Floatation devices shall be internally reinforced and filled with high-density polyurethane foam and completely sealed from the environment. Flotation stability is mandatory. Prior to assembly, flotation devices shall be sealed and pressure tested at 3.0 psig.

2.6 MAIN FRAME

A. The horizontal beams of the main frame shall be constructed from 2" x 3" 304 stainless steel structural tubing. All frame connections shall be welded for strength. The main frame shall have lift brackets sufficient for handling purposes. Each end of the frame shall have a non-skid platform, welded in place for added structural integrity and to provide convenient platforms for inspections and maintenance. A splash guard shall be welded to the main frame and extend downward into the water to help protect the drive assembly from splash created by the rotor.

2.7 CRADLE FRAME

A. A cradle frame shall attach the Flotation devices to the main frame and provide adjustment points to allow adjustments to rotor blade operating depth and respective motor operating amperage. Cradle frames shall 304 stainless steel. The frame shall be connected to the anchoring system in a way that the forces resulting from wave action and other movement are not transferred to the Flotation system. Rubber pads shall also be provided for isolation of the floats from the cradles.

2.8 ADJUSTING LINKAGE

A. Each unit shall have adjusting linkage attached to each corner of the main frame. Adjusting linkage shall be capable of changing the operating depth of the horizontal-rotor blades, the horsepower requirements, and amp draw, and provide leveling of the aerator. Adjusting linkage shall be fabricated from 304 stainless steel rods with brass adjusting nuts to prevent seizing. Adjusting linkage shall not be connected directly to the anchoring system nor shall it mechanically depend on the anchoring system for it to be effective. These adjusting points shall adjust rotor submergence, thus operating the rotor at the performance levels for oxygen transfer and mixing, as prescribed by the specification. Floating rotors without these adjustments shall not be acceptable.

2.9 ANCHORING SYSTEM

A. The custom anchoring system shall secure the main frame of the aerator in the desired position and limit its lateral movement potential. It shall not restrict the unit's flotation and shall allow for continuous aerator operation with fluctuations in water surface elevation required by the specific application. This system will be supplied with a Levee Anchoring System (LAS); Thirty (30) feet in extension length. The 30' LAS will allow the unit to float level and operate at the various water levels required for the lagoon application.

2.10 AERATOR CONTROL PANEL

A. The Aerator Manufacturer shall furnish One (1) Aerator Control Panel for the 10 HP, 3 phase, 230 volts, supplied with the following for each aerator:

1. Thermal Magnetic Breakers for each rotor
2. Reduced Voltage Soft Motor Starters (RVSS) with ambient compensated overload relays for each rotor
3. 24 Hour Time Clocks for each rotor
4. Thermal Transformer circuit breaker
5. Transformers with primary and secondary fusing properly sized by the manufacturer
6. Oil-tight HOA Switches for each rotor
7. Control relays for each rotor
8. NEMA4 SS Enclosure

B. Aerator Manufacturer shall furnish each aerator with type SO electrical cable along with flexible conduit to a bank mounted disconnect adjacent to the motor end of the levee anchoring. Aerator manufacturer shall determine cable gauge size and length of cable required per unit. Contractor is to install an aerator control panel as shown on the plans. All electrical to be installed according to the National Electric Code with require main disconnect and electrical power metered drop from the existing service.

C. Materials of construction for the aforementioned control panels shall comply with all more stringent requirements which may exist in the electrical section of these specifications.

2.11 SPARE PARTS AND HANDLING TOOLS

A. Includes one (1) spare elastomeric element for the coupling on the rotor.

B. One (1) Lifting Bar to ensure the safe and proper handling of the aerators during unloading and installation.

2.12 BAFFLE CURTAIN SYSTEM

A. Description:

1. The baffle curtains shall consist of a fabric wall that is anchored at the bottom by a galvanized chain in a sealed pocket and is floated at the top by buoyant logs that are also in a sealed pocket. The floating baffle curtains shall be constructed in multiple sections resulting in the specified dimension of each curtain. Weight and ease of handling at the job site shall be taken into account when determining the lengths of the prefabricated floating baffle sections. The floating baffle curtains shall be delivered to the jobsite ready to install and the only fabrication required at the jobsite shall be the connection of the floating baffle sections. The floating baffle curtains shall be floated into position for installation.

B. Design Criteria:

1. A total of Four (4) floating baffle curtains are required:
   a. Both floating baffle curtains shall be Six (6) ft deep. The Three (3) curtains will be approximately 530 ft long and One (1) curtain 275 ft. long. Contractor to field verify curtain lengths. Floating baffle curtains shall have tapered ends to fit a 1 to1 slope, and the other ends vertical to terminate in the pond. Ballast chain and / or cable connections to the shore anchor posts shall be constructed to a sufficient length to allow for installation. Baffle curtains to separate lagoon into aeration chambers.
   b. OWNER and ENGINEER to verify with CONTRACTOR and MANUFACTURER that an average depth of six (6) feet exists within the lagoon treatment basin prior to installation of any treatment equipment.

C. Details of Construction:

1. Flotation:

   a. The flotation shall consist of 6-inch diameter (minimum) flotation logs made of closed cell polyfoam logs, having the buoyancy of at least 60 pounds per cubic foot.

   b. The flotation shall be completely enclosed inside the floating baffle curtain by means of a thermal seal. Each flotation log shall be sealed in its own chamber along the top of the floating baffle curtain.

D. Anchoring:

1. Bottom Ballast:

   a. The floating baffle curtain shall be anchored in position by a galvanized chain thermally sealed into a pocket along the bottom of the curtain.

   b. The chain shall be continuous from the berm through each floating baffle curtain section, connected to each other with a stainless steel rapid link. The ballast shall be 1/4” (minimum) galvanized proof coil chain.

2. Concrete Anchors:

   a. Concrete anchors shall be placed along the upstream side of the ballast chain at 18’ intervals beginning at the toe of the levee. The concrete anchors shall be attached to the ballast chain using a stainless-steel rapid link or marine grade rope. The connection shall be secured to the ballast chain through cutouts in the ballast chain pocket forming an opening exposing the ballast chain for attachment of the concrete anchors. The concrete anchors shall be made using a five-gallon bucket, filled with concrete with a 3/8” x 9-inch-long or greater galvanized eyebolt, flat washer and two nuts, inserted into the concrete at least 6” to 7” to form an attachment. The eyebolt shall be of a size to accept a 3/8” stainless steel rapid link thru the eye of the eyebolt.

3. Retrieval Rope:

    a. The concrete anchors shall be made retrievable by securing one end of a 3/8" diameter marine grade rope through the ballast chain and the other end of the rope secured to a stainless steel grommet paced in the flotation collar located at the top of the floating baffle curtain.

4. Shore Anchor Post:

    a. The shore anchors shall consist of a 4" diameter by 8' long 304 stainless steel schedule 20 pipe buried a minimum of six feet in concrete. Concrete should encase the post at a minimum diameter of 2'. The shore anchor post shall also be filled with concrete. The shore anchor posts shall be located on the levee side slope approximately 1' off the top of the levee.

E. Cable

1. Tension Cable:

    The cable shall be 1/4" diameter, stainless steel sealed in a pocket on the lower side of the flotation collar and shall be continuous from berm through each floating baffle curtain section, connected to each other with 3/8" stainless steel rapid links. The cable shall have the breaking strength of at least 12,000 lb.

F. Connections:

1. End Connection:
    a. The end connections shall consist of ¼" x 4" x 12" stainless steel predrilled plates that shall by attached to the floating baffle curtain with 3/8" diameter by 1-1/2" long stainless-steel bolts to "sandwich" the end of the floating baffle curtain between the end plates. The tension cable or connection chain shall connect the anchor posts to the stainless-steel predrilled plates at both top and bottom of the curtain. No grommets shall be used for the connections to the shore anchor posts.

2. Baffle Connection:

    a. The floating baffle curtain sections shall be joined with the use of 3/16" x 1-1/2" x 10" long stainless steel predrilled plates and 3/8" diameter by 1-1/2" long stainless-steel bolts. The plates shall be applied to the outside of each floating baffle curtain section, then bolted together to "sandwich" the joining sections together.

3. Miscellaneous Hardware:

    a. All hardware provided for the floating baffle curtains shall be type 304 stainless steel. The galvanized ballast chain shall be the only exception.

G. Baffle Curtain Material

1. The baffle material shall be a reinforced synthetic material. The material supplied under these specifications shall be a first quality product specifically designed and

manufactured for this application and demonstrated to be suitable and durable for the construction of floating baffle curtains.

2. Physical Specifications:

a.	Color:	Black
b.	Base Type:	Polyester
c.	Fabric weight:	7 oz/yd 2
d.	Finished Coated Weight:	30.0 +/- 2.0 oz/yd2
e.	Grab Tensile:	550/525 lbs/in
f.	Minimum Adhesion:	10 lbs/in
g.	Minimum Hydrostatic Resistance:	500 psi

3. The material shall be 6730 XR-5 as manufactured by the Seaman Corporation of Wooster, Ohio.

H. Manufacturers:

1. S&N Airoflo, Inc./Engineered Textile Products, Inc

PART 3 - EXECUTION

3.1 EXECUTION – AERATION AND NITRIFICATION EQUIPMENT

A. The floating aerators shall be installed by the contractor. The Manufacturer shall be responsible for providing proper installation instructions to assure proper alignment and tolerances.

B. Upon completion of installation, the manufacturer shall conduct installation certification, start-up, O&M review, and the initial inspection of the unit(s). It will be the on-site personnel's responsibility to conduct the 60 day inspection and return a completed inspection form (inspection form can be found in Part 2 of the O&M manual) to S&N Airoflo. The 60 day inspection and completed inspection form returned to S&N Airoflo is required in order to execute warranty.

C. S&N Airoflo™ warrants their equipment to be free from defects in material and workmanship for a period of one (1) year following operation start-up and acceptance. During this one (1) year period, S&N Airoflo™ will replace or repair (F.O.B., factory) any part (or parts) returned that have failed under normal use and service. The electric motor and gear reducer warranties shall be as stated by the manufacturers.

1. The S&N warranty period ends twelve (12) months after the start-up date or eighteen (18) months after delivery, whichever comes first.

2. Any damages resulting from acts of God, vandalism, animals, or high or low voltage will not be covered under warranty.

3.2 EXECUTION – BAFFLE CURTAINS

A. OWNER to verify dimensions of the lagoon and to determine exact location of the shore anchor posts prior to ordering floating baffle curtains.

B. The floating baffle curtains shall be installed into position as shown on the project plans. The floating baffle curtains shall be installed in accordance to manufacturer's shop drawings, instructions and recommendations.

A. MANUFACTURER to provide to ENGINEER Certification that the floating baffle curtains were installed in accordance with the Contract Documents.

C. Warranty

1. The baffle manufacturer shall warrant the floating baffle curtain against defects in workmanship and materials for a period of two years from the date of delivery.

2. The floating baffle curtain material shall be warranted by the manufacturer against weathering for a period of ten years, prorated.

SECTION 15050

PLANT AND PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Sanitary sewer piping system.

C. Domestic water piping system.

D. Storm water piping system.

E. Natural gas piping system.

F. Process piping system.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

Section 03300 - Concrete: Placement of pipe sleeves.

1.3 RELATED SECTIONS

A. Section 02222 - Excavating.

B. Section 02223 - Backfilling.

C. Section 02225 - Trenching.

D. Section 02675 - Disinfection of Water Distribution System.

E. Section 09900 - Painting.

F. Section 15140 - Supports and Anchors.

G. Section 15190 - Mechanical Identification.

H. Section 15440 - Plumbing Fixtures.

1.4 REFERENCES

A. ANSI B31.1 - Power Piping.

B. ANSI B31.2 - Fuel Gas Piping.

C. ANSI B31.4 - Liquid Petroleum Transportation Piping Systems.

D. ANSI B31.9 - Building Service Piping.

E. ASME - Boiler and Pressure Vessel Code.

F. ASME Sec. 9 - Welding and Brazing Qualifications.

G. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

H. ASME B16.3 - Malleable Iron Threaded Fittings.

I. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250.

J. ASME B16.18 - Cast Bronze Solder-Joint Pressure Fittings.

K. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.

L. ASME B16.23 - Cast Copper Alloy Solder-Joint Drainage Fittings - DWV.

M. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes.

N. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

O. ASME B16.32 - Cast Copper Alloy Solder-Joint Fittings for Sovent Drainage Systems.

P. ASTM A47 - Ferritic Malleable Iron Castings.

Q. ASTM A53 - Pipe, Steel, Black and Hot-Dipped
Zinc Coated, Welded and Seamless.

R. ASTM A74 - Cast Iron Soil Pipe and Fittings.

S. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

T. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

U. ASTM B32 - Solder Metal.

V. ASTM B42 - Seamless Copper Pipe.

W. ASTM B43 - Seamless Red Brass Pipe.

X. ASTM B75 - Seamless Copper Tube.

Y. ASTM B88 - Seamless Copper Water Tube.

Z. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube.

AA. ASTM B302 - Threadless Copper Pipe (TP).

BB. ASTM B306 - Copper Drainage Tube (DWV).

CC. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

DD. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

EE. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

FF. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

GG. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.

HH. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).

II. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

JJ. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.

KK. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

LL. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) Composite-Sewer Piping.

MM. ASTM D2683 - Socket-Type Polyethylene Fillings for Outside Diameter-Controlled Polyethylene Pipe.

NN. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

OO. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

PP. ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.

QQ. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

RR. ASTM D3033 - Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

SS. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

TT. ASTM D3309 - Polybutylene (PB) Plastic Hot Water Distribution System.

UU. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

VV. ASTM F493 - Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

WW. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Pipe.

XX. AWS A5.8 - Brazing Filler Metal.

YY. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

ZZ. AWWA C110 - Ductile - Iron and Gray - Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

AAA. AWWA C111- Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.

BBB. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

CCC. AWWA C651 - Disinfecting Water Mains.

DDD. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

EEE. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

FFF. CAN-3 B281 - Auminum Drain, Waste, and Vent Pipe and Components.

GGG. NCPWB - Procedure Specifications for Pipe Welding.

HHH. NFPA 54 - National Fuel Gas Code.

III. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Record actual locations of valves, cleanouts and bends.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01700.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.8 QUALITY ASSURANCE

A. Pipe: Manufacturer's name and pressure rating marked on pipe.

B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

C. Welders Certification: In accordance with NCPWB Standard Procedure Specifications.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section.

1.10 REGULATORY REQUIREMENTS

A. Perform work in accordance with Local Plumbing Code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from Local Authority indicating approval of installation of backflow prevention devices.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Accept piping on site in shipping containers with labeling in place. Inspect for damage.

C. Load and unload all pipe, fittings and appurtenances by hoists or skidding. Use slings, hooks and pipe tongs in such a manner to prevent damage to products. No inward projecting lifting device shall be allowed.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.12 ENVIRONMENTAL REQUIREMENTS

Do not install underground piping when bedding are wet or frozen.

1.13 EXTRA MATERIALS

Furnish under provisions of Section 01700.

PART 2 - PRODUCTS

2.1 GENERAL

All pipe, fittings, and appurtenances shall be as shown on the drawings and specified in this section. All pipe, fittings, and appurtenances shall be new and unused.

2.2 BURIED PRESSURE PIPE AND FITTINGS

A. Stainless Steel Pipe and Fittings
   1. Pipe
      a. Stainless steel pipe shall meet the requirements of ASTM A 778 and shall be TP 304L, "as welded" grade. Design and manufacture pipe in accordance with ANSI B31.3 for a working pressure of 15 psi, the depth of cover indicated on the Drawings, and a H-20 traffic loading.
      b. Stainless steel pipe shall have steel-pipe- equivalent outside diameter.
      c. Pipe joints shall be butt-welded.
   2. Fittings
      a. Fittings shall be stainless steel. Fitting wall thickness shall match pipe wall thickness. Fittings shall meet the requirements of ASTM A 774 and shall be 304L, "as welded" grade.
      b. All elbows shall be long radius.
      c. Fitting joints shall be butt-welded.
   3. Welding and Filler Rods

a. Welding rods for shielded metal arc process shall be AWS 5.4, E 308L
b. Filler rod for gas tungsten or gas metal arc process shall be AWS 5.9. ER 308L.

B. Polyvinyl Chloride Pipe and Fittings, Smaller than 4-inch
1. Pipe and Fittings
a. Pipe and fittings shall be manufactured from unplasticized, polyvinyl chloride which meets the requirements of ASTM D1784. Polyvinyl chloride shall be Class 12454-B.
b. Polyvinyl chloride pipe, smaller than 4-inch, shall meet requirements of ASTM D1785.
c. Polyvinyl chloride fittings, smaller than 4- inch, shall meet the requirements of ASTM D2466.
d. Pipe and fittings shall be Schedule 80. Pipe and fitting joints shall be socket solvent weld type.
e. Pipe and fittings shall be by the same manufacturer.
2. Welding Rod
Welding rods shall be same material as pipe and fittings.
3. Primer
Primer shall be stabilized tetrahydrofuran, or equal primer supplied by pipe and fitting manufacturer, for hot, windy conditions.
4. Solvent Joint Cement
Solvent joint cement shall meet the requirements of ASTM D2564. Cement containers shall be no larger than one pint and shall have a dauber secured to the container lid.

C. Copper Pipe and Fittings
1. Pipe
Copper pipe shall meet the requirements of ASTM B88. Type and temper shall be as follows:

Conveyed Material	**Pipe Type and Temper**
Water	Type K, hard drawn
Air	Type K, hard drawn

2. Fittings
Fittings shall be commercially pure wrought copper and shall meet the requirements of ASTM B75. Fitting dimensions shall meet the requirements of ANSI B16.22. Joints shall be socket type.
3. Solder
Solder shall be 95-5 wire solder and shall meet the requirements of ASTM B32 for Grade 95 TA. Do not use cored solder.
4. Tape Wrap
Tape wrap shall be 15 mil butyl rubber adhesive, polyethylene-backed tape as manufactured by Polyken Division of the Kendall Company, Royston Laboratories,Inc., or equal.
5. Heat Shrink Wrap
Heat shrink wrap shall be cross-linked polyolefin wrap or sleeve with a mastic sealant. Wrap or sleeves shall be Raychem WPC, TPS, flange steel, or equal. Wrap type shall be as recommended by the manufacturer for the specific joint.

2.3 EXPOSED PIPE AND FITTINGS

A. Steel Pipe and Fittings, 4-inch and Larger
1. Pipe and Fittings
a. Pipe and fittings shall meet the requirements of AWWA Standard C200. Design and manufacture pipe fittings for a 250 psi working pressure. Minimum thickness shall be as follows:

6-inch and smaller	Schedule 40
8-inch thru 12-inch	Schedule 20
14-inch and larger	Schedule 10

b. Pipe and fitting joints shall be butt weld joints or flange joints.
2. Coating

Coat the exterior surfaces of steel pipe and fittings as specified in Section 09900.

3. Flange Joints
   a. Flanges shall be steel and shall meet the requirements of AWWA Standard C-207. Flange shall be Class D.
   b. Gaskets shall meet the requirements of AWWA Standard C207. Gaskets shall be full face. Gaskets shall be neoprene.
   c. Nuts and bolts shall meet the requirements of AWWA Standard C-207. Nuts and bolts shall be cadmium plated.

B. Polyvinyl Chloride Pipe and Fittings
   1. Pipe and Fittings
      a. Pipe and fittings shall be manufactured from unplasticized, polyvinyl chloride which meets the requirements of ASTM D1784. Polyvinyl chloride shall be Class 12454-B.
      b. Polyvinyl chloride pipe shall meet the requirements of ASTM C1785.
      c. Pipe and fittings shall be Schedule 80. Pipe and fitting joints shall be socket solvent weld, threaded or flanged.
      d. Socket solvent weld fittings shall meet the requirements of ASTM D2467.
      e. Threaded fittings shall meet the requirements of ASTM D2464.
      f. Flanges shall be polyvinyl chloride. Flanges shall be 150 psi lbs., flat face, with ANSI Drilling.
      g. Pipe and fittings shall be by the same manufacturer.
   2. Welding Rod
      Welding rods shall be same material as pipe and fittings.
   3. Primer
      Primer shall be stabilized tetrahydrofuran, or equal primer supplied by pipe and fitting manufacturer, for hot, windy conditions.
   4. Solvent Joint Cement
      Solvent joint cement shall meet the requirements of ASTM D2564. Cement containers shall b no larger than one pint and shall have a dauber secured to the container lid.
   5. Threaded Joint Sealant
      Threaded joint sealant shall be ½ inch wide teflon tape in thickness recommended by manufacturer of threaded fittings.
   6. Gaskets
      a. Gaskets for flange joints shall be ethylenepropylene terpolymer rubber, 1/8 inch thick, and full face with a Durometer hardness of 80.
      b. Gaskets in polyvinyl chloride unions and strainers shall be viton.
   7. Bolts and Nuts
      a. Bolts and nuts used in water piping shall be as follows:
         1) bolts shall be semi-finished regular hex head cap screws, type 304 stainless steel, ASTM A193, Grade B8, NC threads;
         2) nuts shall be semi-finished regular hex head nuts, type 303 stainless steel, ASTM A194, Grade 3F, NC threads.
      b. Bolts and nuts used in chemical piping shall be monel metal, hex head, NC threads.

C. Copper Pipe and Fittings
   1. Pipe
      Cooper pipe shall meet the requirements of ASTM B88. Type and temper shall be as follows:

Conveyed Material	Type and Temper
Water	Type M, hard drawn
Air	Type K, hard drawn

   2. Fittings
      Fittings shall be commercially pure wrought copper and shall meet the requirements of ASTM B75. Fittings dimensions shall meet the requirements of ANSI B16.22. Joints shall be socket type.
   3. Solder and Flux

a. Solder shall be 95-5 solid wire solder and shall meet the requirements of ASTM B32, Grade 95 TA.
b. Flux shall be noncorrosive.

D. Stainless Steel Pipe and Fittings.

1. Pipe shall be manufactured from ASTM-A240 annealed and pickled sheets and plates in accordance with ASTM A778 in type (304L or 316L) stainless steel. Pipe shall be manufactured to nominal pipe sizes as listed in ANSI B36.19, Table 2, and shall have the following nominal wall thicknesses:

Nominal Pipe Size (IN.)	Actual O.D. (IN.)	Schedule/Gauge/Plate	Nominal Wall Thickness (IN.)
3	3.500	Sch. .5s	0.083"
4	4.500	Sch. .5s	0.083"
6	6.625	Sch. .5s	0.109"
8	8.625	Sch. .5s	0.109"
10	10.750	12 GA Sheet	0.109"
12	12.750	12 GA Sheet	0.109"
14	14.000	11 GA Sheet	0.125"
16	16.000	11 GA Sheet	0.125"
18	18.000	11 GA Sheet	0.125"
20	20.000	10 GA Sheet	0.140"
24	24.000	3/16 Plate	0.188"
30	30.000	3/16" Plate	0.188"
36	35.000	3/16" Plate	0.188"
42	42.000	1/4" Plate	0.250"
48	48.000	1/4" Plate	0.250"
54	54.000	5/16" Plate	0.312"
60	60.000	5/16" Plate	0.312"

2. Fittings shall be butt weld type manufactured in accordance with ASTM-A-774 of the same raw material and in the same thicknesses as the pipe. Long radius elbows up to 24" diameter shall be smooth flow; i.e. centerline to end of elbow equals 1.5 times the nominal pipe size. All short radius, special radius, and reducing elbows and long radius elbows greater than 24" diameter shall be of mitered construction with at least (5) miter sections for 90 degree bends, (3) mitered sections for 45 and 60 degree bends, and (2) mitered sections for 30 degree and smaller bends. Reducers shall be straight tapered, cone type, tees, crosses, laterals and wyes shall be shop fabricated from pipe.
3. Flanges
Flanged pipe ends shall be made up of type (304L or 316L) stainless steel slip-on type rolled angle face rings and primed or hot dipped galvanized) ductile iron back-up flanges drilled to ANSI 16.1

class 125 standard. The angle face ring thickness shall be equal to or greater than the wall of the pipe or fitting to which it is welded and it shall be continuously welded on both sides to the pipe or fitting. The angle leg shall not interfere with the flange bolt holes. The back-up flanges shall be supplied with the following nominal thicknesses.

Nominal Pipe Size Thickness (IN.)	Flange (IN.)
2 ½ - 3	½
4	9/16
6 - 10	5/8
12 - 16	3/4
18 - 20	7/8
24 - 30	1
36	1 1/8
42	1 1/4
48	1 3/8
54	1 3/8
60	1 ½

4. The piping will be shop prepared for pipe coupling where shown on the drawings or specified herein.
   a. Sleeve type couplings shall be of standard steel construction (specify gaskets, coating, etc). Pipe shall be plain end with external weld beads ground smooth to insure proper gasket seating. For pressure pipe lines, sleeve coupling joints will be restrained by the use of harness rods connecting across the joint to flange lugs on adjacent flange joints, stainless steel harness lugs shall be welded to the pipe to receive the harness rods. All sleeve couplings, flange lugs, harness rods and hardware will be provided by the Contractor.
   b. Arched band type couplings shall be stainless steel of equal or superior alloy and wall thickness as the pipe and will be Depend-O-Lok type as manufactured by Brico or equal. Couplings will be Fixed-FxF, Expansion - ExE, or Fixed by Expansion - FxE as noted on the drawings or as required. The pipe shall be plain end with external weld beads ground smooth and with S.S. restraining rings shop welded to the piping for fixed type couplings.
   c. Split type couplings shall be malleable iron or ductile iron. Gaskets shall be suitable for the service conditions. The pipe ends shall be roll grooved to the coupling manufacturers specifications. Where roll grooving is impractical, the pipe shall have heavy wall machine grooved pipe nipples or machined ring collars fully welded to the pipe or fittings. Nipples shall be taper bored to the I.D. of the adjoining pipe to allow full weld penetration. Collars shall be welded on both sides to the piping. Nipples and collars shall be of the same allow as the piping.
   d. Expansion couplings shall be flanged rubber arch type as specified in Section 15050. Pipe flanges shall be provided for these couplings where shown on the drawings.
5. Threaded pipe, gauge or instrument connections shall be made using stainless steel 150-pound threaded half couplings conforming to ASTM-A182 or ASTM-A-276, shop welded to the pipe at the locations shown on the drawings.
6. Joints
   a. Flanges shall be provided as a minimum at all flanged valves, meters, couplings, and other

equipment. Couplings will be provided as shown on the drawings.

b. Pipe and fitting spools shall be shop fabricated to the fullest extend possible in 40' - 0" maximum lengths with 7' - 6" maximum widths for efficient commercial transport to the project site. Spools with fittings may exceed 40' - 0" so long as length allows commercial transport. Smaller pipe spools shall be provided with joints as shown on the drawings for special handling, installation, and/or disassembly requirements.

c. All other joints required for shipping, handling and installation of the piping spools shall be (field welds, flange joints, sleeve couplings, band couplings, or split couplings.

E. Stainless Steel Pipe and Fittings, 3/4" through 3"

1. Pipe
   a. Stainless steel pipe shall meet the requirements of ASTM A312 and shall be TP 304, Schedule 40S, seamless.
   b. Pipe joints shall be screwed.
2. Fittings
   a. Stainless steel fittings shall meet the requirements of ASTM A183 and shall be Grade 304, 150 pound, rated 1,000 pound-CWP, forgings. Fittings shall be Schedule 40S. Fitting dimensions shall meet the requirements of ANSI B16.3.
   b. Fitting joints shall be screwed.
3. Thread Lubricant
   Thread lubricant shall be teflon tape.

F. Stainless Steel Pipe and Fittings, Smaller than ¾"

1. Pipe
   Stainless steel pipe shall be Type 304L and shall meet the requirements of ASTM A269. Minimum pipe thickness shall be Schedule 40S.
2. Fittings
   Fittings shall be 316 stainless steel with compression type ends. Fittings shall be Crawford "Swagelok". "Hobe Gyrolok", Parker Hannifin "CPI", or equal.

G. Steel Pipe and Fittings, Smaller than 4"

1. Pipe
   Steel pipe shall meet the requirements of ASTM A106, Grade B. Pipe shall be Schedule 80 and shall have screwed ends. Screwed ends shall meet the requirements of ANSI B16.11.
2. Fittings and couplings
   Fittings and couplings shall be forged steel and shall meet the requirements of ASTM A105, Grade II. Fittings shall be 3,000 pound. Fittings and couplings shall have screwed ends. Screwed ends shall meet the requirements of ANSI B16.11.
3. Unions
   Unions shall be ammonia type.
4. Tape
   Tape for joints shall be teflon type.

2.4 EXPANSION JOINT

The rubber expansion joints, where required, shall be Class 125 lb. flange, pressure rating of 250 psi and of the size as shown on the Drawings. The tube and cover shall be made of neoprene rubber. The joint shall include split retaining rings made of ductile iron, control rods and back-up rings and shall be as manufactured by Mercer Rubber Company, or equivalent.

PART 3 - EXECUTION

3.1 INSPECTION

A. General
1. The quality of all materials, the process of manufacture, and the finished products shall be subject to inspection and approval by the Engineer. Such inspections may be made at the place of manufacture or on the work after delivery, or at both places; and the products shall be subject to rejection at any time on account of failure to meet any of the specifications' requirements even though sample products have been accepted as satisfactory at the place of manufacture.
2. Prior to being installed, each pipe, fitting, valve, and hydrant shall be carefully inspected, and those not meeting the specifications shall be rejected and at once removed from the work.

B. Reinforced Concrete Pipe
1. The Engineer shall have the right to cut cores from such pieces of the concrete pipe as he desires for such inspection and tests as he may wish to apply.
2. Holes left by the removal of cores shall be filled in an approved manner by and at the expense of the manufacturer of the pipe.
3. The Engineer shall also have the right to take samples of concrete after it has been mixed, or as it is being placed in the forms or molds, and to make such inspection and tests thereof as he may wish.
4. Any pipe which has been damaged after delivery will be rejected and replaced solely at the Contractor's expense.

3.2 INSTALLATION OF BURIED PIPE

A. Laying Piping
1. The Contractor shall provide proper implements, tools, and facilities for the safe and expeditious prosecution of the work.
2. Every pipe, fitting, and valve shall be cleaned of all debris, dirt, and other foreign material before being laid and shall be kept clean until accepted in the completed work.
3. Lay and maintain pipe to the lines shown on the drawings, except as specified in this Article. Lay and maintain pipe to the grade shown on the drawings or to the minimum depth specified in this Article. Install fittings and valves, in the locations shown on the drawings.
4. Where the piping is to be constructed parallel to and close to existing buried utilities, the exact location of which is unknown, adjust the alignment of the piping to least interfere with these utilities, unless otherwise shown or specified.
5. Potable water piping shall be laid at least ten feet horizontally from any existing sanitary sewer or sewage force main. The distance shall be measured from edge of pipe to edge of pipe. Potable water piping crossing sanitary sewers or sewage force mains shall be laid to provide minimum vertical distance of 18 inches between the outside of the potable water piping and the outside of the sewer or force main. The 18 inch separation shall apply whether the potable water piping is over or under the sewer or force main. Lay potable water piping at crossings of sewers and force mains so a full length of pipe is centered on the sewer or force main whenever possible. No potable water piping shall pass through or come in contact with any part of a sanitary sewer manhole.
6. Lay pressure piping to a depth so not less than 4'-6" of cover is provided over all 10 inch and smaller pipe and 4'-0" of cover is provided over all 12 inch and larger pipe, unless otherwise shown. Cover shall be measured as the vertical distance from the top of the pipe to the finish grade elevation.
7. Do not lay pipe in water or when the trench or weather conditions are unsuitable for proper installation.
8. Lower pipe, fittings, and valves into the trench by hand, by means of hoists or ropes, or by other suitable tools or equipment which will not damage products, coatings, or linings. Do not drop or dump pipe, fittings, or valves into the trench.
9. Pipe laying shall proceed upgrade, beginning at the lower end of the pipe line.
10. The Contractor shall use laser beam equipment, surveying instruments, or other proven techniques to maintain accurate alignment and grade.
11. Deflection of pressure pipe from a straight line or grade shall not exceed the limits specified in this

Section. If the alignment requires joint deflections in excess of the allowable deflection per joint, furnish and install fittings or a sufficient number of shorter lengths of pipe.

12. Provide thrust restraint at horizontal and vertical deflection fittings and at tees, plugs, tapping sleeves, and tapping saddles.
13. Laying of ductile iron piping shall meet the requirements of ANSI/AWWA C600, unless otherwise specified in this Section.
14. Open excavation shall be satisfactorily protected at all times. At the end of each day's work, the open ends of all pipes shall be protected against the entrance of animals, children, earth, or debris by bulkheads or stoppers. The bulkheads or stoppers shall be perforated to allow passage of water into the installed pipe line to prevent flotation of the pipe line. Any earth or other material that may find entrance into the main sewer or into any lateral sewer through any such open end of unplugged branch must be removed at the Contractor's expense. The cost of all such plugs, and the labor connected therewith, must be included in the regular bid for the sewers.

B. Pipe Bedding and Foundation Backfill
1. Pipe Bedding shall meet the requirements of Section 02223.
2. Pipe Foundation Backfill shall meet the requirements of Section 02233.

C. Jointing
1. The ends of the pipe shall be satisfactorily cleaned just before laying, and the joint shall be made in satisfactory manner in accordance with the recommendations of the manufacturer on particular type of joint and the directions of the Engineer. All joint work shall be done by experienced workmen.
2. Joints shall be as specified in this Section.
3. Each length of pipe shall be mechanically pulled "home" with a winch or come-along against the section previously laid and held in place until the trench and bedding are prepared for the next pipe section. Care shall be taken in laying the pipe so not to damage the bell end of the pipe. Mechanical means consisting of cable placed inside the pipe with a winch, jack, or come-along shall be considered to pull the pipe home where pushing the pipe will not result in a joint going completely home and staying in place. Pushing the pipe home shall be done by means of a block and push bar. Use of hydraulic excavating equipment as the means of pushing or moving the pipe to grade will not be permitted.
4. Piping shall be tested as specified in this Section.

D. Copper Pipe Tape Wrapping
Coat of buried copper pipe by hand taping with pipe tape. Solvent clean and wire brush pipe surface to remove all dirt and loose scale and immediately prime the pipe surfaces as recommended by the pipe tape manufacturer. Solvent cleaning shall meet the requirements of SSPC-SP-1. Wire brushing shall meet the requirements of SSPC-ST-3. Apply the tape to the pipe after the primer has dried. Spirally apply the tape with a 50 percent overlap. Tape wrap or heat shrink wrap pipe joints. Wrap joints above grade or excavate a sufficient bell hole to permit joint wrapping without contamination.

3.3 INSTALLATION OF EXPOSED PIPING

A. Alignment
All pipe shall be installed to accurate lines and grades with fittings, valves, and appurtenances at the required locations. Wherever possible, piping shall be parallel to walls and floors.

B. Installation
1. All piping shall be cleared of debris, dirt, etc., before being installed and shall be kept clean until accepted at completion of work. During installation, no debris, tools, clothing, lumber, or other materials shall be placed in the pipe.
2. Piping shall be installed in a neat workmanlike manner. Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All piping shall be carefully installed in such a manner as to prevent damage to piping materials,

protective coatings, and liners.

3. The pipe, fittings, valves, and appurtenances shall be inspected for defects prior to installation.
4. Piping shall be installed such that no undue strain is placed upon piping joints, equipment, or structures.

C. Supports

1. The Contractor shall provide all supports necessary to hold the pipe and appurtenances in a firm, substantial manner at the lines and grades shown on drawings or as directed, and without strain upon the piping and connected equipment.
2. Piping shall be supported from concrete slabs by suitable saddle stands or concrete piers. Piping along walls shall be supported by suitable wall brackets with attached roll or saddle, or by wall brackets with hanger rods. For piping supported from overhead, approved rod anchors of a type capable of screw adjustments after erection of the pipe and with suitable adjustable concrete inserts or beam clamps shall be used.
3. Supports shall be located wherever necessary and in no case shall exceed the following:

a. Ductile Iron Pipe and Steel Pipe

Pipe Size	Maximum Support or Hanger Spacing
1-inch and smaller	4 feet
1-1/4 inch thru 2-inch	6 feet
3-inch and 4-inch	8 feet
6-inch and 8-inch	8 feet
10-inch and 12-inch	10 feet
14-inch thru 18-inch	10 feet
20-inch and larger	12 feet

b. Polyvinyl Chloride (PVC) Pipe

Hanger spacing for PVC pipe shall be as recommended by the pipe manufacturer for the temperature of the material conveyed in the pipe.

c. Copper Pipe

Pipe Size	Maximum Support or Hanger Spacing
1-inch and smaller	5 feet
1 1/4 inch thru 2-inch	6 feet
3-inch and 4-inch	8 feet

Copper pipe shall be supported with plastic coated clamps, hangers, and supports.

d. Stainless Steel Pipe

Pipe Size	Maximum Support or Hanger Spacing
1-inch and smaller	6 feet
1-1/4-inch thru 2-inch	8 feet
3-inch thru 6-inch	10 feet
8-inch thru 16-inch	11 feet
18-inch and larger	12 feet

Stainless steel pipe, smaller than 4-inch shall be supported with stainless steel clamps, hangers, and supports. Fasteners for stainless steel clamps, hangers, and supports shall be stainless steel.

3.4 INSTALLATION OF SMALL PIPE AND FITTINGS

A. Piping shall be installed in a neat and workmanlike manner. Exposed piping shall be installed parallel to the walls and slabs wherever possible. Piping shall be supported where necessary.

B. After cutting to final lengths, all pipe ends shall be reamed. Threads shall be cleaned. Screwed joints shall be made up with Teflon tape in thickness recommended by the manufacturer of threaded fittings.

C. All joints showing evidence of leaking shall be reworked.

D. All plumbing installations shall be in accordance with local plumbing code.

3.5 SETTING APPURTENANCES

Install all valves, fittings, and appurtenances in the lines as indicated on the drawings.

3.6 CONNECTING TO EXISTING PIPE

A. The Contractor shall locate existing pipe horizontally and vertically and verify the exact size of existing pipe. Locate existing pipe sufficiently in advance of making connections to allow ample time for making changes in the connection location and size.

B. Make each dry connection with fittings and valves indicated on the drawings. Furnish and install sleeves required to complete connections. All required pipe, fittings,, valves, tools, and equipment shall be at the connection site prior to starting connection. Wash interior of new potable water pipe, fittings, and valves with a solution containing 50 mg/l of chlorine prior to making connection. Make connections at night and on weekends when required. The Owner will operate existing valves. Install sufficient pipe and restrain joints so existing pipe can be put in service immediately after connection is completed. Inspect joints and eliminate leaks immediately after connection is completed and existing pipe is put in service. Install watertight plugs on open ends of pipe and valves and backfill excavation if new piping is not connected to dry connection within 48 hours after completing dry connection.

3.7 JOINTS

A. Shouldered Type Joints
   1. Remove antirust coatings from machined surfaces. Clean joint surfaces of the pipe, fittings, adapters, and valves being joined. Wipe surfaces clean of all dirt, oil, grease, and other foreign matter. Wipe surfaces dry. Wipe each gasket clean of all dirt, dust, and other foreign matter.
   2. Slip a gasket over one of the shoulder joints. Apply a thin layer of lubricant to the sealing surfaces of the joint. Use the lubricant furnished by the joint manufacturer. Align the joint of the adaptor or valve being installed with the joint of the receiving adapter or valve. Support the adapter or valve being installed so that the joint is properly aligned until jointing is completed. Install the gasket on the joint shoulders. Equalize gasket stretch. Install the joint coupling. Loosely assemble the joint bolts and nuts. Evenly tighten the nuts. The tightening torque shall not exceed the limits recommended by the joint manufacturer.
   3. Deflect pipe, fittings, adapters, or valves after jointing, if deflection is required. The amount of deflection shall not exceed limits recommended by the joint manufacturer.

B. Threaded Joints
   1. Threading of steel pipe shall be done after bending, forging, heat treating, or welding operations.
   2. Threads shall be concentric with the outside of the pipe and shall conform to ANSI B2.1.
   3. Threaded joints which are not to be seal welded shall be made leaktight by use of Teflon tape. Teflon tape shall not be applied to the first two threads on the pipe.
   4. When threading chemically cleaned pipe, use trichlorethane (menthyl chloroform), inhibited, as the cutting fluid.
   5. Care shall be taken to avoid overtightening of threaded joints and care shall be taken to avoid damaging the pipe exterior with the pipe wrench.
   6. Backing off of made-up threaded joints to facilitate fit-up or alignment will not be permitted.

C. Flange Joints

1. Remove antirust coating from machined surfaces. Clean joint surfaces of the pipe, fitting, and valves being joined. Wipe surfaces clean of all dirt, oil, grease, and other foreign matter. Wipe surfaces dry. Wipe each gasket clean of all dirt, dust, and other foreign matter.
2. Align the flange of the pipe, fitting, of valve being installed with the flange of the receiving pipe, fitting, or valve. Support the pipe, fittings, and valves being joined so the flanges are properly aligned. Lubricate bolts and nuts with a graphite and oil mixture prior to installation of bolts and nuts. Install gasket between the flanges. Loosely assemble bolts and nuts. Check gasket to insure the gasket is in proper position. Evenly tighten bolts and nuts. Tighten bolts and nuts so the joint will not leak. Do not overtorque bolts and nuts.

D. Welded Joints

1. Welding
   Welding shall be in accordance with the latest editions of Section IX, ASME Boiler and Pressure Vessel Code and the American National Standard Code for Pressure Piping, ANSI B31.3.
2. Welding Procedure Qualifications
   Furnish Engineer for prior review procedure specifications and qualification records of welding procedures for all pipe welding to be per-formed under this section, in accordance with Section IX, Article II of the ASME Boiler and Pressure Vessel Code.
3. Welding Performance Qualifications
   a. All welders and welding operators shall be qualified at Contractor's expense by an approved testing laboratory before performing any welding under this section. Qualification tests shall be in accordance with Section IX, Article III of the ASME Boiler and Pressure Vessel Code. Welders and welding operators shall be qualified for making groove welds in carbon steel pipe in positions 2G and 5G for each welding process to be used.
   b. Prior to start of the work, Contractor shall submit a list of the welders he proposes using and the type of welding for which each has been qualified.
4. Carbon Steel Piping Fabrication
   a. End Preparation
      Pipe edges shall be prepared preferably by machine shaping. Oxygen or arc cutting are acceptable only if the cut is reasonably smooth and true and all slag is removed either by chipping or grinding. Beveled ends for butt welding shall conform to ANSI B16.25.
   b. Cleaning
      Surfaces shall be clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.
   c. Alignment and Spacing
      Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness. Root opening of the joint shall be as stated in the procedure specification.
   d. Procedure
      1) The shielded metal-arc process shall be used for all field welding, unless otherwise approved. Shop fabrication shall be in accordance with the submittal welding procedure qualifications.
      2) No welding shall be performed if there is impingement of any rain or high wind on the weld area or if the ambient temperature is below 32°F. If the ambient temperature is less than 32°F, local preheating to a temperature warm to the hand is required.
      3) Tack welds, if not made by qualified welder using the same procedure as for the completed weld, must be completely removed. Tack welds which are not removed shall be made with an electrode that is the same as, or equivalent to, the electrode to be used for the first weld pass. Tack welds which have cracked shall be removed.
      4) Each layer of deposited weld metal shall be thoroughly cleaned prior to the deposition of each additional layer of weld metal, including the final pass, with a power-driven wire brush. Surface defects which will affect the soundness of weld shall be chipped out or ground out.

5) There shall be a minimum of three weld passes on all pipe sizes using the specified covered electrode.
6) Welds shall be free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity, slag inclusions and other defects in excess of the limits prescribed in Chapter V of ANSI B31.3.
7) Branch connections shall be fitted and groove-welded in accordance with the details described and shown in Chapter V of ANSI B31.3.

5. Fabrication and Installation
   a. All stainless steel pipe and fittings shall be pickled by immersion in an air agitated tank containing an ambient 25% solution of Nitric and Hydrofluoric acids for 40 to 50 minutes. A clean water rinse shall follow the acid pickle.
   b. Welding shall be performed by qualified welders in conformance with standard procedures. Piping with wall thickness up to 11 gauge (0.125") shall be welded with the TIG (GTAW) process. Heavier walls shall be properly beveled and have a root pass with the TIG (GTAW) process followed by subsequent passes with the TIG (GTAW), MIG (GMAW), or Metallic Arc (SMAW) process. Filler wire of ELC grades only shall be added to all welds to provide a cross section at the weld equal to or greater than the parent metal. Weld deposit shall be smooth and evenly distributed and have a crown of no more than 1/16 inch on the I.D. and 3/32 inch on the O.D. of the piping. Concavity, undercut, cracks or crevices shall not be allowed. Butt welds shall have full penetration to the interior surface, and inert gas shielding shall be provided to the interior and exterior of the joint. Excessive weld deposits, slag, spatter, and projections shall be removed by grinding. Angle face rings shall be continuously welded on both sides to the pipe or fitting. Welds on gasket surfaces shall be ground smooth.
   c. Spools shall be fabricated to the "Pipe Fabrication Institute" fabricating tolerances ES-3 (1981).
   d. After welding, all welded joints shall be treated with a pickling solution, brushed with stainless wire brushes and rinsed clean.
   e. All fabricated piping shall have openings plugged and flanges secured for storage and/or transport after fabrication. All fabricated piping shall be piece marked with identifying numbers or codes which correspond to the contractors layout and installation drawings. The marks will be located on the spools at opposite ends and 180 degrees apart.
   f. The piping supplier during manufacturing, fabrication and handling stages, and the contractor during handling and installation stages, shall use extreme care to avoid the contact of any ferrous materials with the stainless steel piping. All saws, drills, files, wire brushes, etc., shall be used for stainless steel piping only. Pipe storage and fabrication racks shall be non-ferrous or stainless steel or rubber lined. Nylon slings or straps shall be used for handling stainless steel piping. Contact with ferrous items may cause rusting of iron particles embedded in the piping walls. After installation, the contractor shall wash and rinse all foreign matter from the piping surface. If rusting of embedded iron occurs, the contractor shall pickle the affected surface with Oakite Deoxidizer SS or equal, scrub with stainless steel brushes and rinse clean.
   g. After installation, the contractor shall paint all steel or iron flanges, couplings and appurtenances in accordance with Section 09900. Painting of the stainless steel pipe is not required. However, the contractor shall be responsible for supplying and installing the stainless steel piping with a consistently clean surface. Identifying spool piece marks shall be removed with paint thinner or solvents and the entire stainless steel surface shall be washed with detergent and hot water and rinsed clean.

E. Workmanship on spool fabrication shall be of the highest quality and appearance equal to that furnished by Felker Brothers Corporation, Marshfield, WI. Fabricators shall have had a minimum of ten years experience supplying stainless steel fabrication to sewage treatment plants.
   1. Only weld procedures which have been qualified under ASME Section IX and only welders who have successfully completed performance qualification tests per ASME Section IX on these qualified procedures shall be utilized in pipe spool fabrication.

2. Only inert gas shielded welding processes, namely, GTAW(TIG), GMAW(MIG), PAW (plasma arc welding) shall be used in spool fabrication.
3. Inert gas shielding shall be utilized on the back as well as the torch side of a weld joint to prevent atmosphere contamination of the molten and adjacent metal.
4. Filler metal shall be added to all welds to provide a cross section of weld metal equal to or greater than parent metal.
5. Butt welds shall have 100% penetration to the interior or back side of the weld joint.
6. Weld joints shall be accurately fitted and cleaned of all foreign material prior to welding.
7. Weld reinforcement on both sides of the weld shall be smooth, uniform and no more than 7/16" in height.
8. Weld concavity and undercut shall not be acceptable on either side of the weld.
9. Only extra low carbon (ELC) filler metals shall be used.
10. Each spool piece shall be marked with identification relatable to the spool drawing and/or system line to facilitate job site assembly.
11. Spools shall be fabricated to the "Pipe Fabrication Institute" fabricating tolerances ES-3 (1981).
12. All spool pieces shall be immersion pickled after fabrication and prior to shipping in a pickling solution of 6-10% nitric acid and 3-4% hydrofluoric acid. Temperature and exact concentrations to be such that only a modest etch is produced but that all oxidation and ferrous contamination is removed from the metal surface. All residues of the pickling solution to be neutralized after pickling.
13. Backing flanges shall be secured to pipe ends for shipping protection and pipe spools shall be loaded and blocked and tagged as necessary to ensure protection from damage during shipping.

3.8 RESTRAINING AND SUPPORTS

A. Thrust Blocking
1. Construct thrust blocks of concrete having a 28-day compressive strength of not less than 2,000 psi.
2. Lubricate fitting surfaces to prevent bonding between fittings and thrust blocks.
3. Construct thrust blocks between fittings and undisturbed soil. The area of thrust blocking bearing on undisturbed soil shall not be less than the area indicated on the drawings. Construct thrust blocking so pipe and joints are accessible for repair and joint flexibility is not impaired.

B. Mechanical Joint Rod Restraint
1. Mechanical joint rod restraint shall be from fitting to fitting.
2. The number of rods shall conform to the following table:

Pipe Size	Rod Size	Minimum No. of Rods
4"	3/4"	2
6"	3/4"	2
8"	3/4"	4
10"	3/4"	4
12"	3/4"	6
14"	3/4"	6
16"	3/4"	8
18"	3/4"	8

Pipe Size	Rod Size	Minimum No. of Rods
20'	3/4"	10
24"	3/4"	16
30"	1"	14
36"	1"	20
42"	1-1/4"	18
48"	1-1/4"	24

C. Pipe Supports
1. Furnish and install supports required to hold pipe, fittings, and valves at the lines and grades indicated on the drawings and without strain upon pipe, fittings, and valves.
2. Support piping by suitable saddle stands, concrete piers, or hangers.
3. Locate supports where necessary and not less than eight feet on center.

3.9 HYDROSTATIC TEST

A. Test procedures shall meet the requirements of AWWA Standard C600.

B. The piping shall be complete, and thrust blocks shall have been in place for not less than 10 days prior to being tested.

C. Test closed-end pressure piping as follows:
1. Expel all air from the piping prior to the application of test pressure. Tap the piping at high points, if necessary, to release all air form the piping. Plug taps after the test is successfully completed. Plugs shall be watertight.
2. Test piping at a static pressure of 150 pounds per square inch over a period of not less than eight consecutive hours. The test will be considered successful when the pressure drop over the test period is five pounds per square inch of less. If the pressure drop exceeds five pounds per square inch, repair the leaks and repeat the test. Repair leaks and repeat the test until the pressure drop over the test period is five pounds per square inch or less.

D. Test open-end pressure piping and ductile iron sewer piping as follows:
1. The ends of piping being tested shall have test plugs or caps adapted with a tap of adequate diameter to fill and pressurize the system with water.
2. Water shall be introduced into the section to be tested at the lower end. The upper end shall have an orifice at the top of the plug or cap to expel air when filling the system with water. All air shall be expelled from the pipe.
3. The test plugs or caps shall be capable of withstanding an internal pressure of 175 psi.
4. Pumped flow systems shall be subjected to an internal pressure equal to 50% more than the maximum operating pressure, but in no case less than 50 psig or greater than 120 psig.
5. Hydrostatic test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed in such a way as to prevent blowouts. Inasmuch as a force of 2500 pounds is exerted on an 8-inch plug by an internal pipe pressure of 50 psi, it should be realized that sudden expulsion of a poorly installed plug or cap can be dangerous.

3.10 FLUSHING

A. Potable Water
   1. Flush piping with a flushing velocity of at least 2.5 feet per second. Following are flows required to provide flushing velocity of 2.5 feet per second:

Pipe Size	Inside Diameter	Flow at a Velocity 2.5 Feet Per Second
4"	4"	98 gpm
6"	6"	220 gpm
8"	8"	390 gpm
10"	10"	620 gpm
12"	12"	880 gpm
14"	14"	1,200 gpm
16"	16"	1,600 gpm
18"	18"	2,000 gpm
20"	20"	2,500 gpm
24"	24"	3,600 gpm

   2. Flush piping and hydrants until the water discharge is clear.
   3. Flush potable water piping to disinfection.

B. Air and Chemical Piping
   Piping system conveying the following services shall be cleaned after erection and testing by purging with dry compressed air (DCA) or nitrogen (N) until the specified dew point is reached and held for 5 minutes.

Services	Purge Gas	Dew Point
Dry Compressed Air - Plant & Instrument	DCA	-40°F
Chlorine	N	-40°F
Caustic	N	-40°F
Alum	N	-40°F
Fluoride	N	-40°F

3.11 DISINFECTION

A. Disinfect potable water piping prior to placing the piping in service. Disinfect pipe, fittings, and valves with a chlorine solution containing to 50 mg/l plus or minus 5 mg/l of available chlorine.

B. The chlorinating material shall be chlorine gas, calcium hypochlorite, or sodium hypochlorite. Calcium hypochlorite shall be 5.25% to 14.7% available chlorine. Placing chlorine tablets in the spring during construction is not an acceptable method of disinfection. The following table shown the quantity of chlorine or hypochlorite required to produce 50 mg/l of available chlorine per 100 feet of pipe.

Pounds	Ounces	Quarts

Pipe Size	Inside Diameter	Chlorine Gas	Cal. Hycl. (70%)	Cal. Hycl. (70%)	Sod. Hycl. (14.7%)	Sod. Hycl. (5.25%)	Sod. Hycl. (14.7%)	Sod. Hycl. (5.25%)
4"	4"	0.027	0.039	0.62	3.0	8.3	0.09	0.26
6"	6"	0.061	0.087	1.4	6.7	19	0.21	0.58
8"	8"	0.11	0.16	2.5	12	33	0.37	1.0
10"	10"	0.17	0.24	3.9	19	52	0.58	1.6
12"	12"	0.24	0.35	5.6	27	75	0.83	2.3
14"	14"	0.33	0.48	7.6	36	100	1.1	3.2
16"	16"	0.44	0.62	10	47	130	1.5	4.1
18"	18"	0.55	0.79	13	60	170	1.9	5.2
20"	20"	0.68	0.97	16	74	210	2.3	6.5
24"	24"	0.98	1.4	22	110	300	3.3	9.3
30"	30"	1.5	2.2	34				
36"	36"	2.2	3.1	50				
42"	42"	3.0	4.3	69				
48"	48"	3.9	5.6	90				
54"	54"	5	7.2	110				

C. Taping where required to inject chlorine solution into all pipe, fittings, valves, and hydrants installed and repaired. Inject chlorine solution into piping. Leave the chlorine solution in the piping for 24 hours or longer. Open and close valves in piping being disinfected. Open and close valves several times during contact period. Following the contact period, flush the piping with potable water until the chlorine residual is 1.0 mg/l or less.

D. Collect and submit samples for bacteriological analysis. Repeat disinfection and bacteriological testing until the water mains are approved for service.

3.12 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and calk, metal counterflash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower and mop sink drains watertight to adjacent materials.

E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

F. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

G. Adjust storm collars tight to pipe with bolts; calk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.13 SLEEVES

A. Set sleeves in position in form work. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors one inch above finished floor level. Calk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing fire stopping insulation and calk, air tight . Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel plastic stainless steel escutcheons at finished surfaces.

SECTION 15051

DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. **General**: The CONTRACTOR shall furnish and install Ductile Iron Pipe and all appurtenances, complete in place, all in accordance with the requirements of the Contract Documents. Where standards, specifications or methods are cited without dates, the reference shall be construed to apply to the latest revision in effect at the time of contract.

B. **Manufacturer:**

1. The term "MANUFACTURER" shall mean the party that manufactures, fabricates, or produces materials or products.

   All 30-inch through 64-inch ductile iron pipe shall be the product of one manufacturer experienced in manufacturing pipe of the size, class, and quantity specified herein. The pipe manufacturer shall have manufactured 30-inch through 64-inch ductile iron pipe for a minimum of five (5) years. Prior to bid (or manufacture) the pipe manufacturer upon request shall submit to the OWNER or OWNER's ENGINEER a reference list for at least five (5) projects of comparable magnitude. This list shall include the following information: Location of Project; Quantity, Size, and Class; Owner, Address, Contact Name, and Phone.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

1. ANSI/AWWA C104/A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. ANSI/AWWA C105/A21.5 Polyethylene Encasement for Ductile-Iron Pipe Systems
3. ANSI/AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in for Water and Other Liquids
4. ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115/A21.15 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
6. ANSI/AWWA C150/A21.50 Thickness Design of Ductile-Iron Pipe
7. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast for Water
8. ANSI/AWWA C153/A21.53 Ductile-Iron Compact Fittings, 3-in through 24-in and 54-in through 64-in for Water Service
9. ANSI/AWWA C600 Installation of Ductile-Iron Water Mains and their Appurtenances
10. ANSI/AWWA C606 Grooved and Shouldered Joints
11. ANSI/AWS D11.2 Guide for Welding Iron Casting

Note: Hereafter in this specification the specific referenced ANSI/AWWA standards are referred to either by their full description as in the first column of the above standards list, or only by their abbreviated AWWA "C" designation (e.g. AWWA C151 is meant to refer to ANSI/AWWA C151/A21.51, etc.).

1.3 CONTRACTOR SUBMITTALS

A. Shop Drawings/Lay Schedules: The CONTRACTOR upon request shall submit catalog cuts of pipe and fittings in accordance with the requirements of this Section.

1. Certified dimensional drawings of all valves, fittings, and appurtenances.
2. Certified dimensional drawings of joints, showing the manufacturer's allowable deflections.

3. Copies of the manufacturer's approved installation instructions for the types of joints being used.
4. For pipe 42 inches in diameter and larger, lay schedules that indicate the type of pipe, fitting, or special, and the location and the direction of each of these components in the completed line shall be provided. In addition, the lay schedule shall include: the pipe stationing at all changes in grade or horizontal alignment; all elements of curves and bends, both in horizontal and vertical alignment; and the limits of each reach of restrained joints, or concrete encasement.

B. **Certifications**: Upon request the CONTRACTOR shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section, as specified in the referenced standards and as specified in Section 1.4 – Quality Assurance.

C. **Sample Costs:** All expenses incurred in making samples for certification of specified tests shall be borne by the MANUFACTURER.

1.4 QUALITY ASSURANCE

A. **Inspection**: All pipe shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.

B. **Plant Access:** During the manufacture of the pipe, the ENGINEER shall be given access to all areas where manufacturing and testing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

C. **Tests:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with requirements as applicable.

D. **Test Costs:** The MANUFACTURER shall perform said material tests at no additional cost to the OWNER. The ENGINEER shall have the right to witness all testing conducted by the MANUFACTURER, provided that the MANUFACTURER's and CONTRACTOR's schedule is not delayed for the convenience of the ENGINEER.

E. **ISO/Third Party Inspection:**
1. All pipe material suppliers shall be ISO 9001:2000 registered or provide the services of an Independent Inspection Agency. ISO 9001:2000 registration shall have been certified by a qualified ISO registrar. Prior to the start of manufacturing any manufacturer not meeting the ISO registration requirements shall submit to the OWNER or OWNER's ENGINEER, for approval, a list of qualifications for a minimum of three (3) Independent inspection agencies. These qualifications shall include but are not limited to the following:
   a. List of project references for projects of similar type and size
   b. Resumes for inspection and testing personnel
   c. Capacities for chemical and mechanical testing of material specimens
   d. Frequencies for all instrument and testing equipment certifications
2. The independent testing agency will be responsible for observing, verifying, and documenting all quality assurance testing for the production of pipe material produced for this project. Independent inspection agency shall ensure that all pipe sections produced for this project have traceability such that each individual pipe section can be referenced to the following chemical, mechanical, and performance tests:
   a. Chemistry
      1) Ladle Number
      2) Ladle Chemistry

b. Mold Number
   1) Mold Production History
c. Bracketed Mechanical Testing
   1) Tensile Yield
   2) Elongation
   3) Charpy Test
d. Hydrostatic Proof Test
   1) Chart Recorder Graph
   2) Proof Test Pressure
e. Annealing
   1) Annealing Furnace Number
   2) Horizontal Continuous Annealing Ovens, Record Pipe Flow Through Speeds
   3) Horizontal Annealing Ovens, Record Pipe Rotation Speeds
   4) Vertical Stationary Annealing Ovens, Record Position of Pipe in Oven
   5) Chart Recorder Graph of Time and Temperatures During Annealing Process
f. Pipe Weight
g. Lining/Coating/Finishing
   1) Cement Analysis,
   2) Sand Cement Ratio
   3) Curing Temperature and Humidity Records
h. Prior to the start of pipe manufacture the independent testing agency shall review all calibration certifications for all measuring instruments (e.g., weight scales, tape measures, dial gage indicators, tensile tester load cells, etc.) used to ensure the quality of the pipe and if necessary perform certification tests in accordance with the National Institute of Standards and Technology. The independent testing agency shall verify that written procedures and job training records are available for operations personnel for each production operation, including but not limited to raw material processing, melting, pipe casting, annealing, testing and inspection, lining, coating, etc. At all times the independent inspection agency shall verify compliance with these written procedures and these specifications.
i. During pipe manufacture the independent inspection agency shall provide adequate qualified personnel to facilitate a thorough and complete observation of the pipe's production from raw materials through final shipment. The independent inspection agency shall observe, review, document all tests required by AWWA/ANSI C151/A21.51 and these specification performed by the manufacturer. The independent inspection agency shall also be responsible for performing verification tests on materials and samples to support the results of manufacturer performed testing. The table below indicates the required tests to be performed by the manufacturer and frequency of observations and re-testing for the independent testing agency.

Table No. 1

Operation Area	Required Tests	Frequency
Raw Materials	Analysis of chemical content of metallics, coke, fluxes, silicon.	Review daily
Cupola	Analysis of chemical content of molten stream.	Observed tests: every 30 minutes. Verification tests: retest one (1) each day
	Analysis of chemical content after inoculation.	Observed tests: every ladle Verification tests: retest one (1) sample out of every five (5).
Post Annealing	Visual inspection.	Observed tests: every pipe.
	Dimensional verification.	Observed tests: every pipe. Verification tests: retest one (1) pipe out of every ten (10)
	Mechanical properties verification (tensile, impact, hardness)	Observed tests: each test Verification tests: retest one (1) sample

Operation Area	Required Tests	Frequency
		out of every ten (10).
	Microstructure	Observed tests: each test
Hydrotesting	Hydrostatic proof test	Observed tests: each pipe
Lining	Visual inspection Lining thickness testing	Observed tests: each pipe
Final Inspection	Visual inspection	Verification Tests: each pipe shall be visually inspected and stamped with the inspector stamp.

j. The independent inspection agency shall verify that all test results of the manufacturer and those re-tests performed by the independent testing agency are referenced to each individual pipe section for traceability in the future. This information shall be in a suitable format that, at the request of the owner or owner's engineer, may be downloaded into a spreadsheet format.

F. **Factory Hydrostatic Test:** All pipe shall be subject to a factory hydrostatic test of at least 500 psi for a period of not less than 10 seconds, for 30-inches and larger the pressure will then be elevated to a peak pressure that induces a stress in the pipe wall equivalent to 75% of the minimum specified yield strength of ductile iron (42,000 psi) as calculated by the following formula:

$$p = \frac{2 f_s t}{D}$$

Where: p = peak hydrostatic pressure

f_s = 31,500 psi, stress in pipe wall during hydrostatic test, which shall be 0.75 times the minimum yield strength of the ductile iron in tension (42,000 psi)

t = nominal wall thickness, in.

D = outside diameter, in.

Table No. 2

Factory Hydrostatic Test Pressures for Ductile Iron Pipe
(30 in and Larger)

Pressure Class	150		200		250		300		350	
Pipe Size/ Outside Diameter	"t" (in)	Test Press. (psi)	"t" (in)	Test Press. (psi)	"t" (in)	Test Press. (psi)	"t" (in)	Test Press. (psi)	"t" (in)	Test Press. (psi)
30" / 32.00	0.34	669	0.38	748	0.42	827	0.45	886	0.49	965
36" / 38.30	0.38	625	0.42	691	0.47	773	0.51	839	0.56	921
42" / 44.50	0.41	580	0.47	665	0.52	736	0.57	807	0.63	892
48" / 50.80	0.46	570	0.52	645	0.58	719	0.64	794	0.70	868
54" / 57.60	0.51	558	0.58	635	0.65	711	0.72	788	0.79	865
60" / 61.60	0.54	552	0.61	624	0.68	695	0.76	777	0.83	849
64" / 65.70	0.56	537	0.64	614	0.72	691	0.80	767	0.87	835

G. **Affidavits:** Upon request the CONTRACTOR shall submit affidavits of compliance from the MANUFACTURER for the following:
1. Ductile iron pipe in accordance with the requirements of AWWA C151 and these specifications.
2. Cement mortar lining of ductile iron pipe, specials and fittings in accordance with the requirements of AWWA C104 and these specifications.

3. Polyethylene encasement for ductile iron piping in accordance with AWWA C105 (if specified).
4. Rubber gasket joints for ductile iron pressure pipe and fittings in accordance with the requirements of AWWA C111 and these specifications.
5. Charpy impact testing of ductile iron used in the manufacture of pipe shall be performed in accordance with AWWA C151.
   The minimum corrected absorbed energy (ft.-lb.) shall be as follows:

   7 ft.-lb. at 70° F ± 10° F

6. Low-temperature impact tests shall be made from at least 10% of the test pipe to assure compliance. The minimum corrected absorbed energy (ft.-lb.) shall be as follows:

   3 ft-lb at –40°F(°C)

7. The affidavits of compliance shall be certified by a registered professional engineer.

H. **Domestic Manufactures**

1. Ductile iron pipe shall be designed and manufactured in accordance with ANSI/AWWA C 150/A21.50 and ANSI/AWWA C 151/A21.51, latest revisions. All pipe must be new and shall be manufactured in the United States of America (USA); all ductile iron pipe shall be cast, cleaned, lined, coated, tested, and certified at a single manufacturing facility located in the USA - with all manufacturing units contiguous to one another. Approved USA manufacturers are American, U.S. Pipe, Tyler or equivalent.
2. All pressure pipe for water service shall be SMaRT certified by the institute for Market Transformation to Sustainability.

PART 2 - PRODUCTS

2.1 GENERAL

A. **Standards**: Ductile iron pipe shall conform to AWWA C151, subject to the following supplemental requirements. The pipe shall be of the diameter and class shown, shall be furnished complete with rubber gaskets as indicated in the Contract Documents, and all specials and fittings shall be provided as required under the Contract Documents. The ductile iron pipe, specials, and fittings shall be manufactured or supplied by American Ductile Iron Pipe (a division of American Cast Iron Pipe Company, Birmingham, Alabama) or pre-approved equal.

B. **Markings**: Upon request the CONTRACTOR shall require the MANUFACTURER to legibly mark specials in accordance with the laying schedule and marking diagram.

C. **Laying Lengths:** Pipe laying lengths shall be provided in 20 feet nominal lengths with allowable trim pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the Drawings.

2.2 PIPE DESIGN

A. Design Parameters: All ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and AWWA C151, respectively, for the following minimum operating conditions:
   1. The minimum internal design pressure shall be 150 psi with a 100-psi surge allowance, with a safety factor of 2, for a total internal design pressure of 500 psi. No reduction of safety factor for transient pressures shall be allowed.
   2. The external loads design criteria shall be a minimum of 4 feet depth of cover at 120 lbs. per cubic feet soil weight and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.
   3. The horizontal deflection of cement mortar lined ductile iron pipe resulting from external load

conditions shall not exceed three percent of the pipe diameter.

4. The pipe trench, per AWWA C150, for design purposes shall be:
   a. Laying condition Type 4 – Pipe bedded in sand, gravel or crushed stone to depth of ⅛ pipe diameter, 4" minimum. Backfill compacted to top of pipe. (Approximately 80% Standard Proctor, AASHTO T-99.)
5. For purposes of restrained joint calculations per the Ductile Iron Pipe Research Association (DIPRA) method, the soil classification* for both the native trench soil and also the backfill soil to surround the pipe shall be defined with one or more of the following options:

Option A	Option B	Option C	Option D	Option E	Option F	Option G
Clay 1	Silt 1	Clay 2	Silt 2	Coh-gran	Sand Silt	Good Sand

* As described in DIPRA's "Thrust Restraint Design for Ductile Iron Pipe," latest edition.

B. **Minimum Pipe Class:** Ductile iron pipe shall conform to AWWA C151. All pipe shall have a minimum pressure rating as indicated below, or higher ratings as indicated in the contract documents:

Table No. 3

Pipe Sizes (inch)	Pressure Class (psi)
4-12	350
14-20	250
24	200
30-64	150

2.3 JOINT DESIGN

A. **General:** Ductile Iron Pipe and fittings shall be furnished with push-on joints, push-on restrained joints, mechanical joints, flanged joints, and grooved joints as required.

B. **Push-on Joints:** Push-on joints shall conform to AWWA C111. Unless otherwise specified gasket material shall be standard styrene butadiene copolymer (SBR.) Push-on joints shall be Fastite, as manufactured by American Ductile Iron Pipe, or pre-approved equal. The pressure rating for push-on joints shall be a minimum of 350 psi or the specified pressure rating of the pipe, whichever is less. Standard allowable joint deflection for 4" – 30" Fastite pipe shall be five degrees, for 36" Fastite pipe shall be four degrees, and for 42" – 64" Fastite pipe shall be three degrees. Allowable deflection of American's Fastite joint "Special Deflection Bells" for 36" – 42" shall be five degrees and for 48" – 64" shall be four degrees.

C. **Restrained Joints:** Restrained joints shall be "Flex-Ring" or "Lok-Ring" restrained joints as manufactured by American Ductile Iron Pipe or pre-approved equal. Field-adaptable restraint shall be provided through the use of "Fast-Grip" or "Field Flex-Ring" as manufactured by American Ductile Iron Pipe, or other pre-approved and bolt-less, push-on restrained devices. When restrained joints require factory welding, the MANUFACTURER shall qualify all welding procedures and welders used to produce the product per the requirements of a documented quality assurance system based on ANSI/AWS D11.2. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR.) Restrained joints and restrained joint pipe shall be rated for the minimum pressure shown in **Table No. 4** or the specified pressure rating of the pipe, whichever is less. The MANUFACTURER shall furnish test results showing that restrained joints in the sizes specified have been successfully tested to at least twice the specified pressure rating of the joint without leakage or failure. Tests shall be performed on pipe with nominal metal thickness less than or equal to that specified for the project. Torque-activated restrained joint devices that rely on threaded bolts or set-screws for joint restraint shall not be used.

Table No. 4

RESTRAINED JOINT PRESSURE RATINGS, (psi) & ALLOWABLE JOINT DEFLECTIONS (Limited to the pressure rating of the pipe)				
JOINT SIZE	FASTGRIP	FIELD FLEXRING	FLEXRING	LOKRING
4”	350 / 5º		350 / 5º	
6”	350 / 5º		350 / 5º	
8”	350 / 5º		350 / 5º	
10”	350 / 5º		350 / 5º	
12”	350 / 5º		350 / 5º	
14”	250 / 4º	350 / 4º	350 / 4º	
16”	250 / 3º	350 / 3.75º	350 / 3.75º	
18”	250 / 3º	350 / 3.75º	350 / 3.75º	
20”	250 / 3º	350 / 3.5º	350 / 3.5º	
24”	250 / 3º	350 / 3º	350 / 3º	
30”	150/2.5 º	250 / 2.5º	250 / 2.5º	
36”		250 / 2º	250 / 2º	
42”				250 / 0.5º
48”				250 / 0.5º
54”				250 / 0.5º
60”				250 / 0.5º
64”				250 / 0.5º

D. Flanged Joints – Pipe: Candidate pipe for 4”- 54” flanged pipe thread-fabrication shall be Special Thickness Class 53 and for 60” – 64” flanged thread-fabrication shall be Pressure Class 350 ductile iron pipes, all in accordance with AWWA C115. Threaded companion flanges for ductile iron pipe shall be ductile iron in accordance with AWWA C115, not ANSI B16.1. Bolt circle and bolt holes match those of ANSI B16.1 class 125 and ANSE B16.5 class 150 flanges. The flanges shall be rated for at least 250 psi working pressure. The threaded flanges shall be individually fitted and machine tightened on the pipe ends. Bolts, gaskets and installation shall be in accordance with AWWA C115, Appendix A requirements, and flanged gaskets shall be Toruseal gaskets as manufactured by American Ductile Iron Pipe, with a special seal design. Toruseal gaskets must be used for all 54” – 64” flanged piping, for all glasslined piping, and for all buried flanged joints. Gaskets shall be full face Toruseal design for all service installations. Gaskets for flanged ductile iron pipe must not have the larger inside diameters provided by the requirements of ANSI B16.21. Flange facing shall be smooth or with shallow serrations per AWWA C115.

1 To insure accountability, all flanged pipe shall be fabricated at the factory by the pipe manufacturer.

E. **Flanged Joints – Fittings:** Flange fittings shall be ductile iron in accordance with AWWA C110 or AWWA C153, not ANSI B16.1. Bolt circle and bolt holes match those of ANSI B16.1 class 125 and ANSI B16.5 class 150 flanges. The flanges shall be rated for at least 250 psi working pressure. Bolts, gaskets and installation shall be in accordance with AWWA C110 or AWWA C115, Appendix A requirements, and flanged gaskets shall be Toruseal gaskets as manufactured by American Ductile Iron Pipe, with a special seal design. Toruseal gaskets must be used for all 54” – 64” flanged piping, for all glasslined piping, and for all buried flanged joints. Gaskets shall be full face Toruseal design for all

service installations. Gaskets for flanged ductile iron pipe must *not* have the larger inside diameters provided by the requirements of ANSI B16.21. Flange facing shall be smooth or with shallow serrations per AWWA C110 or AWWA C153.

F. **Welded-on Thrust Collars:** Welded-on thrust collars, for wall pipe and pipe thrust restraint, shall be welded steel collars designed for the thrust generated by 250 psi working pressure with a safety factor of at least two (2.0) against failure. Welded-on thrust collars shall be as manufactured by American Ductile Iron Pipe or pre-approved equal. The manufacturer shall qualify all welding procedures and welders per the requirements of a documented quality assurance system based on ANSI/AWS D11.2.

G. **Mechanical Joints:** Mechanical joints shall conform to AWWA C111. Bolts shall be high strength low alloy steel per AWWA C111. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR) per this standard.

H. **Grooved Joints:** Unless specifically otherwise called for on the contract drawings, grooved joints shall be an approved substitute for flanged joints. Grooved pipe and groove joints shall be in accordance with AWWA C606. Rigid radius groove dimensions shall be utilized. Flexible grooves shall be provided as necessary for settlement or expansion as determined and approved by the ENGINEER and as specifically shown on the contract drawings. Gasket material shall be Grade "M" halogenated butyl. Bolts shall be heat treated plated carbon steel, track head, conforming to the mechanical properties of ASTM A-183, minimum tensile strength 110,000 psi. Grooved ductile iron pipe shall be Special Thickness Class 53 for 4" – 16", Class 54 for 18", Class 55 for 20", and Class 56 for 24" – 36".

Commentary – The following table of available push-on and mechanical joint gaskets and services is to be used for selecting various gasket compounds for push-on and mechanical joints. The maximum service temperatures are based on lowest temperature rated mechanical joint applications, but shall also be suitable for push-on joint applications. The manufacturer should be consulted for higher temperature rating requirements that will generally be met by superior performance of push-on joint design.

Common Name Or Trade Name	Chemical Name	Temperature Capability	Common Uses
Plain Rubber	Styrene Butadiene (SBR)	120°F	Fresh Water, Salt Water, Sanitary Sewage
Neoprene	Polychloroprene (CR)	200°F	Fresh Water, Sewage, Outdoor Exposure
Fluoroelastomer Fluorel Viton	FKM	225°F	Aromatic Hydrocarbons, Gasoline, Refined Petroleum Products, most Chemicals and Solvents, High Temperature, Air
Buna-N Nitrile	Acrylonitrile Butadiene	120°F	Non-Aromatic Hydrocarbons, Petroleum Oil, Hydraulic Fluids, Fuel Oil, Fats, Oil, Grease, Digester Gas
EPDM	Ethylene Propylene Diene Monomer	225°F	Water, Sewage, Ketones, Dilute Acids and Alkalies, Vegetable Oil, Alcohols, Outdoor Exposures, Air

2.4 FITTINGS

A. **General:** Fittings shall be ductile iron in accordance with AWWA C110, AWWA C153, or AWWA

C606, latest revisions.

B. **Cement Lining:** Fittings shall be internally lined with cement mortar in accordance with AWWA C104. The lining thicknesses shall be equal to or greater than those for comparable size pipe.

C. **Buried Service Fittings:** Fittings, sizes 4" – 24", with push-on, restrained push-on, or mechanical joints shall be rated for 350 psi working pressure. Fittings, sizes 30" – 64", with push-on, restrained push-on, or mechanical joints shall be rated for 250 psi working pressure.

D. **Aboveground Service Fittings:** Fittings, sizes 4" – 64", with flanged joints shall be rated for 250 psi working pressure. Fittings, sizes 4" – 36", with grooved joints shall be rated for 250 psi working pressure. Grooved couplings shall be rated for 250 psi working pressure for 4" – 18" and 150 psi working pressure for 20" – 36".

2.5 WELDED-ON OUTLETS

A. Outlet Size and Parent Pipe Size: Welded-on outlets shall be limited to branch outlets having a nominal diameter not greater than 70% of the nominal diameter of the main line pipe or 36-inch whichever is smaller (see Table No. 1), with all fabrications subject to further requirements of the following specification with regard to design and manufacture. The MANUFACTURER shall have the capability to furnish welded-on outlets as a radial (tee) outlet, tangential outlet, or lateral outlet fabricated at a specific angle to the main line pipe (in 15° increments between 45° and 90° from the axis of the main line pipe), as indicated on the drawings. Welded-on outlets shall be fabricated by the pipe manufacture at the same facility where the pipe is produced. The pipe manufacturer shall have a minimum of 5 years experience in the fabrication and testing of outlets of similar size and configuration.

Table No. 5

Main Line Nominal Diameter
Versus
Maximum Nominal Branch Outlet Diameter

Main Line Nominal Dia.	Branch Outlet Nominal Dia.	Main Line Nominal Dia.	Branch Outlet Nominal Dia.
10"	6"	30"	20"
12"	8"	36"	24"
14"	8"	42"	30"
16"	10"	48"	30"
18"	12"	54"	*30"
20"	14"	60"	*30"
24"	16"	64"	*30"

B. **Outlet Joint Types:** The joints on welded-on branch outlets shall meet, where applicable, the requirements of AWWA C111 and/or AWWA C115.

C. **Design:**

1 The pipe wall thickness and weld reinforcement design for welded-on outlet fabrications shall be based on a method similar to that which is described in Section 13 of AWWA Manual M11 for similar welded outlets on steel pipe (which in turn refers to Section VIII of the ASME Unfired Pressure Vessel Code for design method details). Reinforcing welds shall be placed using Ni-Rod FC 55Ò cored wire, Stoody Castweld Ni 55-0 cored wire, or Ni-Rod 55Ò electrodes manufactured by INCO Alloys (or an electrode with equivalent performance properties). Carbon steel electrodes are not acceptable. Upon request, the MANUFACTURER shall provide test results indicating typical mechanical properties of the utilized weld material (an all-weld sample), as well as typical mechanical properties from transverse tensile and impact specimens machined from butt-weld joined ductile iron pipe coupons to show the suitability or equivalence of the electrodes used.

2 Parent pipe and branch outlet candidate pipe shall be centrifugally cast ductile iron pipe designed in accordance with AWWA C150 and manufactured in accordance with AWWA C151. Minimum classes for parent and outlet pipe shall be: for sizes 4-inch through 54-inch, Special Thickness Class 53; for sizes 60-inch through 64-inch, Pressure Class 350.

3 All welded-on outlets 6-inch through 30-inch shall be rated for a working pressure of 250 psi. Welded-on outlets 36-inch and larger shall be rated for 200 psi. Welded-on outlets of all diameters and configurations must have a minimum safety factor of 2.5 based on proof of design hydrostatic test results. The MANUFACTURER shall, at the request of the OWNER or OWNER's ENGINEER, provide representative proof test data confirming the design, hydrostatic test results, and safety factors.

4 Prior to the application of any coating or lining in the outlet area all weldments for branch outlets to be supplied on this project shall be subjected to an air pressure test of at least 15 psi. Air leakage is not acceptable. Any leakage shall be detected by applying an appropriate foaming solution to the entire exterior surface of the weldment and adjoining pipe edges or by immersing the entire area in a vessel of water and visually inspecting the weld surface for the presence of air bubbles. Any weldment that shows any signs of leakage shall be repaired and re-tested in accordance with the manufacturers' written procedures.

D. **Quality Assurance**

1 The manufacturer shall have a fully documented welding quality assurance system and maintain resident quality assurance records based on ANSI/AWS D11.2, the *Guide for Welding Iron Castings*. The manufacturer shall maintain appropriate welding procedure specification (WPS), procedure qualification (PQR), and welder performance qualification test (WPQR) records as well as appropriate air test logs documenting air leakage tests on all welded on outlet pipes furnished to the project. The manufacturer shall have ISO 9001:2000 registration.

2 Prior to the start of manufacturing any proposed manufacturer not meeting ISO 9001:2000 registration requirements shall submit to the OWNER or OWNER's ENGINEER the name of an Independent Inspection Agency and the agency's qualifications. Submitted qualifications shall include but are not limited to the following:

a. List of project references for projects of similar type and size
b. Resumes for inspection and testing personnel
c. Capacities for chemical and mechanical testing of material specimens
d. Frequencies for all instrument and testing equipment certifications

3 The independent inspection agency shall be responsible for all of the following:

a. Verify compliance to written welding procedures, specification (WPS), and procedure qualification (PQR).
b. Verify qualification of all welders (WPQR) per ANSI/AWS D11.2 criteria
c. Document use of Ni-Rod FC 55® cored wire or Ni-Rod 55® electrodes manufactured by INCO Alloys, Stoody Cast-Weld 55-0 cored wire, or an electrode with equivalent performance properties. The independent testing agency shall provide test results indicating typical mechanical properties of the utilized weld material (an all-weld sample), as well as typical mechanical properties from transverse tensile and impact specimens machined from butt-weld joined ductile iron pipe coupons to show the suitability or equivalence of the electrodes used.
d. Witness and document all air testing of outlet welds

2.6 *CEMENT-MORTAR LINING*

A. Cement-Mortar Lining for Shop Application: Except otherwise provided herein, interior surfaces of all ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with a standard thickness cement-mortar lining applied in conformity with AWWA C104. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the damaged or unsatisfactory portions shall be repaired or replaced with lining conforming to these Specifications.

B. **Lining Thickness:** The minimum lining thickness shall be as follows:

Table No. 6

Nominal Pipe Diameter (in)	Minimum Lining Thickness (in)
3-12	1/16
14-24	3/32
30-64	⅛

C. Seal Coat or Non-Seal Coat Cement-Mortar Lining:

1 ***General:*** Ductile iron pipe shall be internally lined with cement mortar lining in accordance with AWWA C104, by a high speed, centrifugal process. The quality system of the manufacturer shall be registered to an ISO 9000 quality standard by an accredited registrar. Grinding of linings shall not be allowed. The finished cement lining shall be uniformly smooth. In addition to complying with AWWA C104, the linings shall also comply with the following additional requirements.

2 ***Material:*** The cement used shall be in conformity with AWWA C104. Sand shall consist of inert, hard, strong, and durable silica grains. The water used in the cement mortar shall be potable, and free from injurious quantities of organic matter, alkali, salt or other impurities that might reduce the strength, durability, or other desirable qualities of the lining. All material in contact with water shall be certified to meet the requirements of ANSI/NSF Standard 61. The cement mortar shall contain not less than one part of cement to two parts of sand, by volume.

3 ***Lining Thickness:*** Cement lining thicknesses shall be per AWWA C104 either single or double thickness and as shown in the Table No. 6.

4 ***Surface Preparation:*** All surfaces to be mortar lined shall be cleaned as necessary to remove foreign matter that could interfere with the adherence of the cement mortar or protrude through the lining.

5 ***Lining Equipment and Process:*** Linings shall be manufactured using centrifugal pipe rotational equipment capable of sufficient rotation speed to sustain 60 G to 100 G of compaction force. Simultaneous controlled vibration shall be applied to the pipe during high-speed rotation to produce a lining of such high density and firm compaction that the laitance can be washed from the surface of the lining immediately after consolidation. Upon request, the MANUFACTURER shall submit an affidavit of compliance certified by a registered professional engineer that the linings have been applied according to these specifications. The mortar shall be mixed in batches. The amount of cement and sand entering into each batch shall be measured by weight. The quantity of mixing water entering into each batch shall be measured automatically by an adjustable device, or it shall be otherwise measured to ensure that the correct quantity of water is being added.

6 ***Washing and Finish:*** After the mortar has been distributed, the rotational speed and vibration shall be increased to produce a mortar lining with a uniformly smooth, firm surface. Immediately after lining, the surface of the lining shall be flushed with a large volume of water to remove excess laitance.

7 ***Water Cement Ratio:*** The lining process, as described above, shall remove approximately 33% of the water, and after centrifugation the uncured cement mortar lining shall have a water to cement ratio of no greater than 0.3.

8 ***Curing:*** Cement mortar linings shall be lined and stored in a building with controlled atmosphere for a minimum of 18 hours. Linings shall be furnished standard without seal coat.

9 All repairs of handling or other damage shall be made in accordance with the recommendations of the MANUFACTURER and shall be reasonably smooth and may not project into the waterway.

2.7 OPTIONAL INTERIOR LINING - SEWER

A. Lining and Coatings for Ductile Iron Pipe

1 Option 1

a. The interior of the pipe shall be blasted and cleaned to remove all loose oxides and rust. After cleaning, the lining material shall be applied to yield 40 mils for the complete system.

2 The lining material shall be a two component epoxy with the following requirements:

a. A permeability rating of 0.0 perms when measured by ASTM E96-66, Procedure A. Duration of test - 6 weeks.

b. A direct impact resistance of 125 inches-pounds with no cracking when measured by ASTM D-2794.
c. The ability to build at least 50 mils dry in one coat. The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.
d. The material shall contain at least 20% by volume of ceramic quartz pigment.
e. A test and service history demonstrating the ability of the material to withstand the service expected.
f. Lining shall be Protecto 401

3 Option 2

a. Lining Material
The standard of quality for interior liquid epoxy lining shall be a two component, amine cured novolac epoxy containing a minimum of 20% by volume ceramic pigmentation. Due to health and environmental concerns, the lining must be both coal tar free (polycyclic aromatic hydrocarbons) and HAPS free (hazardous air polluting solvents), and no less than 97% solids by volume. Permox-CTF™ by Permite Corp., Stone Mountain, GA, meets both composition and performance standards of this specification. The following properties are minimum performance test requirements and must be obtained from 40 mil DFT films of lining material applied to the specified substrate and certified by the lining manufacturer.

b. In the event a formulary change is made by the manufacturer subsequent to the performance testing and certification of the lining material, the new formulation must be re-qualified. The new project, a related to the formulary change, is subject to meeting the same composition and performance standard and must be re-certified by the lining manufacturer.

(1) Testing-Physical Properties
a) ASTM G-95 Cathodic Disbondment shall be not greater than .05mm disbandment, 30 days duration.
b) ASTM D-4060 Abrasion Resistance shall not exceed a weight loss of more than 0.30 grams (CS17 Wheel, 1000-gram load, 1000 cycles).
c) ASTM D-4541 Adhesion 700 psi minimum.
d) ASTM D-1653 Permeability, Method A 40-mils free cast film 30-day duration. 0.00 perms.
e) ASTM G-53-77 MoistureULTRAVIOLET Light. UVB-313 Bulb. Cycle-8 hrs. UV @ 60° C followed by 100% Humidity @ 40° C. 1 year - pass, no crazing, cracking, or loss of adhesion.
f) ASTM D-2794-92 Direct Impact Resistance 140 in./lbs. minimum.

(2) Testing-Chemical Resistance by Immersion
a) ASTM D-1308 evaluated by ASTM D-714
20% Sulfuric Acid @ 77°F 2 years, no effect
25% Sodium Hydroxide @ 140°F 2 years, no effect
5% Sodium Chloride Solution @ 77°F 2 years, no effect
Distilled Water @ 160°F 2 years, no effect

(3) Surface Preparation
a) All pipe and fittings shall be delivered to the application facility without cement or asphalt lining or any other lining on the interior surface. Because total removal of old linings is generally not possible nor cost effective, the intent of this specification is that the entire interior of the DIP and fittings shall be as cast without any lining material prior to application of the specified lining. Upon completion of inspection as outlined above, all surface preparation shall be in strict accordance with NAPF 500-03 revision dated 2/14/2006 as published by: National Association of Pipe Fabricators, Inc.
1901 N. W. 161st Street
Edmond, OK 73013
A copy of this specification may be obtained at http://www.napf.com/
* Pre-blast Cleaning consult NAPF 500-03-01
** Blast Cleaning specification is per NAPF 500-03-04

(4) Application of Lining
   a) Application of the lining material may only be performed by approved firms as designated by the manufacturer or its authorized representative. No deviations are allowed from this specification included but not limited to accompanying procedures that may be provided by the manufacturer for the job inherent to this specification.
   b) Upon completion of the blast cleaning operation, the lining material should be applied to the interior of the pipe within 12 hours in order to avoid any possible post blast surface contamination. Any area found to have rust bloom prior to application must be reblasted.
   c) The barrel of the pipe from the inside shoulder of the gasket groove to the end of the interior spigot shall receive a nominal coating of 40 mils dry film thickness of the protective lining. If flange fittings or pipe are included, the lining must not be used on the face of the flange. All fittings shall be lined with 40 mils nominal of the protective lining.
   d) Due to the tolerances involved, the gasket groove and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum wet film thickness of un-reduced Permox-CTF™ Joint Compound. Application shall be by brush with care taken to insure the coating is smooth and without excess buildup in the gasket groove or on the spigot end. No coating application to the gasket groove and spigot shall take place prior to lining of the pipe barrel

(5) Inspection
   a) Each pipe joint and fitting shall be marked in accordance with the application date of the lining system including its numerical sequence of application for that date. Applicator may be required to maintain such records for a reasonable period of time.
   b) Dry film thickness determination for all DIP and Fittings must be checked and verified using a properly calibrated magnetic film thickness gauge and testing shall be accomplished using the method outlined in SSPC-PA-2 Film Thickness Rating.
   c) The barrel of all pipe and fittings shall undergo a non-destructive 2,500-volt pinhole test. Any pinholes detected must be repaired based upon lining manufacturer's written recommendations.

(6) Certification
   a) The pipe or fitting MANUFACTURER must supply a written certificate attesting to the fact that the APPLICATOR met the requirements of this specification, that the material used was as specified, and that the material was applied as required by the specification.

4 Option 3
a. Basis of Design
   (1) Tnemec Series 431 Perma-Shield PL modified polyamine ceramic epoxy lining
   (2) Generic Type: Polyamine Ceramic Epoxy
b. Properties:
   (1) Solids by Volume: 100 percent
   (2) Hazardous Air Pollutants: Zero
   (3) Ceramic Hollow Microspheres: 20 percent by volume (no silica fume, fly ash, or alumina dust)
   (4) Pigment Volume Concentration: Less than 22 percent
   (5) Coal-Tar Content: Zero
   (6) Dry Film Thickness: 40 mils nominal
   (7) High Voltage Holiday Testing Requirements: 4,000 volts (100 volts per mil)
   (8) High Velocity Sewer Jet Cleaning (Hydrocleaning): Lining material shall be able to withstand high velocity sewer jet cleaning with the following parameters.
      — 2,500 psi operating pressure utilizing 0º Nozzles.
      — Cleaning jet nozzles (fixed) shall be no greater than a 30 degree angle of incidence to the pipe wall and up to 90 degree angle of incidence for rotational or spinner nozzles.
      — Lining shall be able to withstand a stationary hold time of 60 seconds for up to 30 degree nozzles in accordance with NASSCO Jetter Code of Practice.
   (9) Above Ground Storage Life: 3 Years

c. Performance Criteria:

All testing shall be in accordance with current ASTM appropriate standards

(1) Abrasion: (ASTM D4060-07, CS-17 wheel, 1,000 grams) – 41 mg loss.
(2) Abrasion: (BS EN 598:2007+A1:2009, 50,000 cycles) – 0.6 mils loss
(3) Adhesion: (ASTM D 4541 – Substrate: DIP) – Not less than 3,000 psi.
(4) Severe Wastewater Analysis Test (ASTM G 210-13): (150°F, 500 ppm H2S, 4000 ppm NaCl, 10% H2S04, EIS Permeation Analysis) – Initial impedance of 11.2 (log-z). No blistering, cracking, checking or loss of adhesion. Reduction in electrical impedance of 0.5 after 28 days exposure.
(5) Cathodic Disbondment: ASTM G 8 (1.5 V) Classification Group A. No more than 0.000 inch (0.00 mm) disbonded equivalent circle diameter.
(6) Chemical Resistance: (ASTM C 868-02, 25 percent sulfuric acid, 100 degrees F, 100 days – (NACE TM0174-2002, 6 months continuous immersion, 50 percent sulfuric acid, 13 percent sodium hypochlorite, 5 percent sodium hydroxide, 75 degrees F – No effect.
(7) Dielectric Strength: (ASTM D 149-09) – greater than 600 volts per mil
(8) Hardness: (ASTM D 2240): Shore D hardness of 79. (ASTM D 3363).
(9) Immersion: 140°F (60°C) De-ionized Water Immersion. No blistering, cracking or delamination of film after 5,000 hours continuous immersion.
(10) Impact: (ASTM D 2794-04) – No visible cracking or delamination after 160 inch-pounds (18.0 J) direct impact.
(11) Salt Spray (ASTM B 117-09): No blistering, cracking, rusting or delamination of film after 10,000 hrs.
(12) Water Absorption (ASTM C413-01(2006) – 0.0 percent water absorption
(13) Water Vapor Transmission (ASTM D 1653-03(2008) Method B, Wet Cup, Condition C) – 1.25 g/m2 per 24 h water vapor transmission and 0.09 perms water vapor permeance.

d. Surface Preparation:

(1) All ductile iron pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. All oils, small deposits of asphalt paint, grease, and soluble deposits shall be removed in accordance with NAPF 500-03-01 Solvent Cleaning prior to abrasive blasting.
(2) Ductile Iron Pipe: Uniformly rotary-abrasive blast the entire interior surface using angular abrasive to an NAPF 500-03-04: “Internal Pipe Surface Condition, with full removal of annealing oxide layer”. When viewed without magnification, the interior surfaces shall be free of all visible dirt, dust, annealing oxide, rust, mold coating and other foreign matter. Any area where rust reappears before application shall be re-blasted. The surface shall contain a minimum angular anchor profile of 3.0 mils (76.2 microns) (Reference NACE RP0287 or ASTM D 4417, Method C).
(3) Ductile Iron Fittings: Uniformly abrasive blast to a NAPF 500-03-05: “Fitting Blast Clean #1 Condition, No Staining”. When viewed without magnification, the interior surfaces of cast iron fittings shall be free of all visible dirt, dust, annealing oxide, rust, mold coating and other foreign mater. The surface shall contain a minimum angular anchor profile of 3.0 mils (76.2 microns).
(4) Surface shall be coated within eight hours of surface preparation.

e. Application

(1) The lining shall be applied by an approved applicator with successful history of applying ceramic epoxy linings to the interior of ductile iron pipe and fittings.
(2) Within 8 hours of surface preparation, the interior shall be coated with the following dry film thicknesses (DFT).
    a) Pipe Interior: 40 mils
    b) Fittings Interior: 40 mils
    c) Push-on Joints: 6-10 mils
    d) Mechanical Joints: Extend lining from spigot end to edge of gauging ring.

f. Inspection
   (1) Each pipe joint and fitting shall be marked in accordance with the application date of the lining system including its numerical sequence of application for that date. Applicator may be required to maintain such records for a reasonable period of time.
   (2) Dry film thickness determination for all DIP and Fittings must be checked and verified using a properly calibrated magnetic film thickness gauge and testing shall be accomplished using the method outlined in SSPC-PA-2 Film Thickness Rating.
   (3) The barrel of all pipe and fittings shall undergo a non-destructive 2,500-volt pinhole test. Any pinholes detected must be repaired based upon lining manufacturer=s written recommendations.

2.8 EXTERIOR LINING - SEWER

A. Buried Ductile Iron Pipe: The exterior of ductile iron pipe, special, and fittings shall be coated with a 1 mil asphaltic coating in accordance with AWWA C151, Section 51-9. When specified, loose polyethylene encasement shall be supplied in accordance with AWWA C105.

B. Aboveground Ductile Iron Pipe: The exterior of ductile iron pipe, specials, and fittings shall be coated with one of the following coatings or primers:

   Above Grade - Exterior (Mild Exposure)
   Tnemec Series N140-1211 Pota-Pox Plus Primer at 6.0 – 8.0 mils DFT.
   Above Grade - Interior/Exterior Immersion/Non-immersion (Mild to Aggressive Exposure). Tnemec Series N140—1211 Pota-Pox Plus Primer applied at 6.0- 8.0 mils DFT

C. Below Grade Ductile Iron Pipe: The exterior of the ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The coating system shall conform in every respect to ISO 8179-1 “Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01.”

D. Below Grade Ductile Iron Fittings: The exterior surfaces of ductile iron fittings shall be coated as noted in Section C above or they shall be coated with Tnemec Series 90-98 Tneme-Zinc applied at a rate to achieve 2.0 – 3.0 mils DFT. The coating shall conform to ISO 8179 – Part 2 “Liquid Zinc Coatings for Ductile Iron Pipe”.

2.9 PIPE AND FITTINGS JOINTS

A. JOINTS:
   1 Ductile iron pipe and fittings to have rubber gasket joints in accordance with the latest revision of ANSI/AWWA C111/A21.11. Buried piping and fittings shall be either push-on joint (pipe), push-on restrained joint, or mechanical joint (fittings-only, where specified; see ** below).
   2 Piping and fittings above ground shall be flanged.
   3 Where buried restrained pipe joints are required to resist thrust due to internal pressure, restrained gasket [AMERICAN Amarillo Fast-Grip or equal, colored (yellow, orange, etc.) restrained joint gasket] - or fabricated, push-on restrained joints (AMERICAN Flex-Ring or AMERICAN Lok-Ring joints - or equal) shall be utilized at the specified locations.
   4 Where buried restrained fitting joints are required to resist thrust due to internal pressure, restrained mechanical joints (MJ) [in limited situations; see ** below] utilizing torque-activated MJ restraints (MegaLugs, One-Loks, or equal), restrained gasket [AMERICAN Amarillo Fast-Grip or equal, colored (yellow, orange, etc.) restrained joint gasket] - or fabricated, push-on restrained

joints (AMERICAN Flex-Ring or AMERICAN Lok-Ring joints - or equal) shall be utilized at the specified locations.

5 Restrained joints shall be rated for a working pressure of 350 psi minimum (4@-18@) and 250 psi minimum (20@-64@).

** Restrained joints (for items other than fittings less than or equal to 14@ and MJ sleeves and MJ valves) using set screws such as retainer glands, Mega-Lugs, or other torque-activated means of restraint shall be permitted only following specific approval by the owner / engineer.

2.10 AMARILLO FAST-GRIP GASKETS FOR DUCTILE IRON PIPE

A. Four-inch through 30-inch restrained joints shall be AMERICAN Amarillo Fast-Grip gasket and joint restraining system.

B. Pressure ratings shall be 350 psi for 4-inch through 18-inch; 250 psi for 20-inch through 24-inch; and 150 psi for 30-inch, but in no case shall the joint be considered rated at a higher pressure than the pipe of which it is a part.

C. Joint deflection shall be 5 degrees for 4-inch through 12-inch; 4 degrees for 14-inch; 3 degrees for 16-inch through 24-inch; and 2.5 degrees for 30-inch.

D. Gaskets shall meet applicable requirements of AWWA/ANSI C111/A21.11, shall be styrene butadiene rubber (SBR), and shall be ANSI/NSF Standard 61 certified for contact with potable water.

E. Gaskets shall be yellow in color, and the yellow color shall be consistent throughout the entire cross section of the gasket. The yellow color shall not be attained by surface coating; it shall be inherent within the rubber.

F. Restraining gaskets shall be manufactured in the United States.

2.11 V-BIO ENHANCED POLYETHYLENE ENCASEMENT FOR DUCTILE IRON PIPE

A. Polyethylene encasement for use with ductile iron pipe shall meet all the requirements of ANSI/AWWA C105/A21.5, *Polyethylene Encasement for Ductile Iron Pipe Systems*.

B. In addition, polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils.

C. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of antimicrobial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

D. Ductile iron pipe and the polyethylene encasement used to protect it shall be installed in accordance with AWWA C600 and ANSI/AWWA C105/A21.5 and also in accordance with all recommendations and practices of the AWWA M41, *Manual of Water Supply Practices – Ductile Iron Pipe and Fittings*. Specifically, the wrap shall be overlapped one foot in each direction at joints and secured in place around the pipe, and any wrap at tap locations shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.

E. All installations shall be carried out by personnel trained and equipped to meet these various requirements.

F. The installing contractor shall submit an affidavit stating compliance with the requirements and practices of ANSI/AWWA C150/A21.50, ANSI/AWWA C151/A21.51, ANSI/AWWA C105/A21.5, AWWA C600 and M41.

SECTION 15062

FABRICATED PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and shop application of Series 431 Perma-Shield PL, a high-performance polyamine ceramic epoxy lining for use in the interior and on the exterior of fabricated ductile iron pipe and fittings exposed to severe wastewater environments.

B. The ceramic epoxy lining material shall be an amine-cured epoxy containing at least 20% by volume of ceramic hollow microspheres.

1.2 REFERENCES

A. ASTM International, (ASTM)
   1. ASTM B 117-99(2007) – Standard Practice for Operating Salt Spray (Fog) Apparatus
   2. ASTM C 413-01(2006) – Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
   3. ASTM C 868-02(2008) – Standard Test Method for Chemical Resistance of Protective Linings
   4. ASTM D 149-09 – Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
   5. ASTM D 870-09 – Standard Practice for Testing Water Resistance of Coatings Using Water Immersion
   6. ASTM D 1653-03(2008) – Standard Test Methods for Water Vapor Transmission of Organic Coating Films
   7. ASTM D 2370-98(2002) – Standard Test Method for Tensile Properties of Organic Coatings
   8. ASTM D 2240-05 – Standard Test Method for Rubber Property—Durometer Hardness
   9. ASTM D2583-07 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
   10. ASTM D 2794-93(2004) – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
   11. ASTM D 4400-99(2007) – Standard Test Method for Sag Resistance of Paints Using a Multinotch Applicator
   12. ASTM D 4060-07 – Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
   13. ASTM D 4541-09 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
   14. ASTM G 8-96(2003)e1 – Standard Test Methods for Cathodic Disbonding of Pipeline Coatings
   15. ASTM G 210-13 – Standard Practice for Operating the Severe Wastewater Analysis Testing Apparatus (S.W.A.T.)

B. British Standard, (BS)
   1. BS EN 598:2007+A1:2009 – Ductile Iron Pipes, Fittings, Accessories and Their Joints for Sewerage Applications – Requirements and Test Methods

C. NACE International, (NACE)
   1. NACE SP0188-2006 – Standard Practice for Discontinuity (Holiday) Testing of New Protective

Coatings on Conductive Substrates

2. NACE TM0174-2002 – Laboratory Methods for the Evaluation of Protective Coatings and Lining Materials in Immersion Service

D. SSPC: The Society for Protective Coatings, (SSPC)

1. SSPC-PA2 – Paint Application Specification No. 2: Measurement of Dry Coating Thickness with Magnetic Gages

E. Unless otherwise specified, references to documents shall mean the documents in effect at the time of receipt of Bids. If referenced documents have been discontinued by the issuing organization references to those documents shall mean the replacement documents or the last version of the document before it was discontinued.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide products from a company specializing in manufacture of high-performance epoxy coatings with a minimum 10 years experience.

1. Materials shall be products of a single manufacturer or items standard with manufacture of specified coating materials.

2. Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

B. Applicator's Qualifications: Engage a single installer approved by the manufacturer with a minimum of three years experience performing this type of lining installation and with documented skill and successful experience in the installation of ceramic epoxy lining to interior of ductile iron pipe and fittings.

1. Submit name and qualifications to Engineer.

2. Submit proof of acceptability of applicator by manufacturer to Engineer.

1.4 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01200 entitled "Submittals", the applicator shall submit all required information as specified herein.

B. Shop Drawings: Submit for approval prior to commencing any Work:

1. Product Data Sheet

2. Material Safety Data Sheet

3. Performance Testing Reports: Copies of test data for the entire physical, chemical, and permeation properties listed herein and as outlined within this Section.

4. Instillation Instructions: Manufacturer's written installation instructions for the materials specified in this Section.

5. Copies of specifications, technical information, and general recommendations from the coating manufacturer for the specified material.

6. Qualifications Data: Submit qualifications in accordance with Article 1.3, above:

a. Manufacturer

b. Applicator

C. Application Reports: Submit at the completion of Work

Daily Reports: Include surface preparation, substrate conditions, ambient conditions application

procedures, lining materials applied, material quantities, and material batch number(s).

1.5 PRODUCT STORAGE, HANDLING AND APPLICATION

Coating materials shall be handled, stored and applied in accordance with the manufacturer's recommendations.

1.6 WARRANTY

A. Protective Lining Manufacturer shall warranty its products as free from material defects for a minimum period of three (3) years. Provide associated Warranty Certificate.

PART 2 - PRODUCTS

2.1 MATERIALS

A. To define requirements for materials, size, and design, this specification lists specific products manufactured by Tnemec Company, Inc. of Kansas City, Missouri. Materials specified herein are cited as the minimum standard of quality which will be acceptable.

B. Interior Pipe Lining:

1. Tnemec Series 431 Perma-Shield PL polyamine ceramic epoxy lining
    a. Dry Film Thickness: 40 mils (nominal)
2. Generic Type: Polyamine Ceramic Epoxy
3. Properties:
    a. Solids by Volume: 100 percent
    b. Hazardous Air Pollutants: Zero
    c. Ceramic Hollow Microspheres: 20 percent by volume (no silica fume, fly ash, or alumina dust)
    d. Pigment Volume Concentration: Less than 22 percent
    e. Coal-Tar Content: Zero
4. Performance Criteria:
    a. Abrasion: (ASTM D4060-07, CS-17 wheel, 1,000 grams) – 76 mg loss. (BS EN 598:2007+A1:2009, 50,000 cycles) – 0.6 mils loss
    b. Adhesion: (ASTM D 4541) – Not less than 2,866 psi, DIP.
    c. Severe Wastewater Analysis Test (S.W.A.T.): (ASTM G 210-13) Initial electrochemical impedance of 10.3 (log-z). No cracking, checking or loss of adhesion. Not less than 85% retained impedance and no more than 1.6 ohms●cm^2 reduction in log-z following 28 days exposure.
    d. Cathodic Disbondment: ASTM G 8 (1.5 V) Classification Group A. No more than 0.00 inch (0.00 mm) disbonded equivalent circle diameter.

e. Chemical Resistance: (ASTM C 868-02, 25 percent sulfuric acid, 100 degrees F, 100 days – (NACE TM0174-2002, 6 months continuous immersion, 50 percent sulfuric acid, 13 percent sodium hypochlorite, 5 percent sodium hydroxide, 75 degrees F – No effect.

f. Dielectric Strength: (ASTM D 149-09) – greater than 600 volts per mil

g. Hardness: (ASTM D 2240): Shore D hardness of 79.

h. Immersion: 140°F (60°C) De-ionized Water Immersion. No blistering, cracking or delamination of film after 5,000 hours continuous immersion.

i. Impact: (ASTM D 2794-04) – No visible cracking or delamination after 160 inch-pounds (18.0 J) direct impact.

j. Salt Spray (ASTM B 117-09): No blistering, cracking, rusting or delamination of film. No rust creepage at scribe after 1,000 hrs.

k. Water Absorption (ASTM C 413-01(2006) – 0.0 percent water absorption

l. Water Vapor Transmission (ASTM D 1653-03(2008) Method B, Wet Cup, Condition C) – 1.25 g/m2 per 24 h water vapor transmission and 0.09 perms water vapor permeance

C. Exterior Pipe Coating:
   1. Tnemec Series 140 Pota-Pox Plus epoxy primer
      a. Dry Film Thickness: 4.0 – 6.0 mils
   2. Tnemec Series 431 Perma-Shield PL polyamine ceramic epoxy exterior lining
      a. Dry Film Thickness: 30.0 – 40.0 mils

D. No substitutions allowed

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. All ductile iron pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior or exterior surface. All oils, small deposits of asphalt paint, grease, and soluble deposits shall be removed in accordance with NAPF 500-03-01 Solvent Cleaning prior to abrasive blasting

B. Ductile Iron Pipe Interior Preparation: Uniformly rotary-abrasive blast the entire interior surface using angular abrasive to an NAPF 500-03-04: "Internal Pipe Surface Condition, with full removal of annealing oxide layer". When viewed without magnification, the interior surfaces shall be free of all visible dirt, dust, annealing oxide, rust, mold coating and other foreign matter. Any area where rust reappears before application shall be re-blasted. The surface shall contain a minimum angular anchor profile of 3.0 mils (76.2 microns) (Reference NACE RP0287 or ASTM D 4417, Method C).

C. Ductile Iron Pipe Exterior Preparation: Uniformly abrasive blast the entire exterior surface using angular abrasive to an NAPF 500-03-04: "External Pipe Surface Condition". When viewed without magnification, the exterior surfaces shall be free of all visible dirt, dust, loose annealing oxide, loose mold coating, rust and other foreign matter. Tightly adherent annealing oxide, mold coating and rust staining may remain on the surface provided they cannot be removed by lifting with a dull putty knife. Any area where rust reappears before application shall be re-blasted. The surface shall contain a

minimum angular anchor profile of 3.0 mils (76.2 microns) (Reference NACE RP0287 or ASTM D 4417, Method C).

D. Ductile Iron Fittings: Uniformly abrasive blast the interior and exterior surfaces to a NAPF 500-03-05: "Fitting Blast Clean #1 Condition, No Staining". When viewed without magnification, the interior surfaces of cast iron fittings shall be free of all visible dirt, dust, annealing oxide, rust, mold coating and other foreign mater. The surface shall contain a minimum angular anchor profile of 3.0 mils (76.2 microns).

E. Surface shall be coated within a maximum of eight hours of surface preparation.

3.2 APPLICATION

A. The lining shall be applied by an approved applicator with successful history of applying ceramic epoxy linings to the interior of ductile iron pipe and fittings.

B. Within 8 hours of surface preparation, the interior shall be ceramic epoxy coated with the following dry film thicknesses (DFT).

1. Pipe Interior: 40 mils
2. Fittings Interior: 40 mils
3. Push-on Joints: 6–10 mils
4. Mechanical Joints: Extend lining from spigot end to edge of gauging ring.

C. The exterior shall be coated with the following dry film thickness (DFT):
1. Pipe Exterior: 4.0 – 6.0 mils of epoxy primer
2. Pipe Exterior: 30.0 – 40.0 mils ceramic epoxy liner

3.3 CUTTING PIPE

Cutting shall be done in a neat manner, without damage to the pipe or the lining. Use wheel cutters when practicable. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the ends of the pipe shall be dressed with a power grinder to remove all sharp edges. The cut ends of push on joint pipe shall be suitably beveled.

3.4 HANDLING

Series 431 Perma-Shield PL lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, cables or other devices shall be placed inside the pie and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling. Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers. Only nylon straps or similar lifting devices are to be used.

3.5 INSPECTION

A. Inspection

1. All ceramic epoxy lined pipe and fittings visual examined for film defects, including any runs,

sags, and debris in the film. Repairs shall be made in accordance with the manufacturer's instructions.

2. All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic dry film thickness gauge. The thickness testing shall be in according with SSPC-PA2 film thickness rating.
3. The interior and exterior lining of all pipe and fittings shall be tested for holidays, pinholes, and discontinuities in accordance with NACE SP0188. All holidays shall be properly repaired in accordance with the manufacturer's instructions and retested at no additional cost to the Owner.
4. Each pipe joint and fitting shall be marked with the date of application of the ceramic epoxy lining system and with its numerical sequent of application on that date.

B. Certification: The pipe or fitting manufacturer shall supply a certificate attesting to the fact that the applicator met the requirements of this Specification, and that the material was applied as required by the Specification.

3.6 COATING REPAIR

A. Repairs and touch-up shall be performed in accordance with the manufacturer's recommended repair and touch-up procedures.

B. All field cut ends shall be repaired and sealed prior to the installation.

SECTION 15100

VALVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install valves, operators and appurtenances necessary to complete work as shown on the Drawings or as specified.

B. Codes, specifications, and standards referred to by title or number 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.

1.2 QUALITY ASSURANCE

A. Mark gates, operators, and appurtenances. Marking shall meet the requirements of the applicable specification or standard.

B. Testing
   1. Perform factory tests in accordance with the applicable specification or standard.
   2. Perform field tests specified in this section.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit the following:
   1. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.
   2. Certified copies of test reports of concrete mixes required by applicable standards.
   3. Shop drawings with performance data, physical characteristics and with dimensioned layouts of gates.
   4. Manufacturer's written installation instructions.
   5. Manufacturer's operation and maintenance material and manuals.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for the delivery, storage, and handling of products.

B. Load and unload all gates, and appurtenances by hoists or skidding. Do not drop products. Do not skid or roll products on or against other products. Use sling, hooks, and pipe tongs in such a manner to prevent damage to products. No inward projecting lifting device shall be allowed.

C. Keep stored products safe from damage or deterioration. Keep the interior of gates, operators, and appurtenances free from dirt or foreign matter. Store gates in a manner that will protect gates from damage.

D. Store gates, operators and appurtenances in accordance with manufacturer's recommendations.

E. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.1 BUTTERFLY VALVES

A. General
1. Butterfly valves and operators shall meet the requirements of AWWA Standard C504, except buried valves shall have mechanical joint type ends. Valves and operators shall be Class 150B.
2. Buried butterfly valves shall mechanical joints. Mechanical joints shall meet the requirements of ANSI/AWWA C110. Butterfly valves installed above ground or in structure shall have flanged joints as specified in AWWA C504. Nuts, bolts, and gaskets for flange joints shall meet the requirements of ANSI/AWWA C110. Nuts and bolts shall be cadmium plated. Gaskets shall be full face and velumoid or equal.
3. Each buried butterfly valve shall have a manual operator and a 2-inch operating nut. Valve opening direction shall be consistent with operation of existing valves in the facilities in which the valves are installed, unless otherwise directed by the Engineer.
4. Each butterfly valve installed above ground or in a structure shall have a manual operator and handwheel or chainwheel and chain, unless otherwise specified.
5. Valves shall be as manufactured by DeZurik, Henry Pratt, M&H Valve or Mueller.

B. Class 150 B Butterfly Valves
1. Valve seating shall be 360° continuous with the seat offset.
2. The body shall be cast iron ASTM A126 Grade B with 125 lb. flanged ends per ANSI B16.1 standard for cast iron flanges.
3. The disc shall be cast iron per ASTM A-48, Class 40C, with a disc seating edge of solid 316 stainless steel.
4. The seat shall be of Buna-N for water, and shall be molded in and vulcanized to the valve body. The seat shall contain an integral shaft seal protecting the valve bearings and packing form any line debris.
5. The valve shaft shall be type 304 stainless steel and shall have self-compensating V-type packing seals with a minimum of 4 sealing rings.
6. The disc shall be securely attached to the valve utilizing a field removable/replaceable 304 stainless steel torque screw on sizes 3"-12" or a tangential pin locked in place with a set screw on sizes larger than 12".
7. Valves with the seat mechanically retained to the disc shall be unacceptable.

C. Class 250 Butterfly Valves
1. alves shall be designed for compliance with AWWA C504 with the following additional features necessary for 250 psig rated working pressure.
2. The body shall be of cast iron per ASTM A126 Class B. Flanged end valves shall be of the short body design with 250 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges. Mechanical Joint end valve bodies shall be of ductile iron per ASTM A536 (65-45-12) and shall meet the requirements of AWWA C11/ANSI 21.11.
3. The disc shall be offset to provide an uninterrupted 360 degree seating edge and shall be ductile iron per ASTM A 536 (65-45-12).
4. The valve shaft shall be of ASTM A564 Type 630 stainless steel.

D. Butterfly Valve Operators
1. Valve operators shall be of the traveling nut type of a self locking design to prevent disc creep in any position. Operators shall be provided with input stops which are field adjustable to any disc position and which will accept a minimum of 450 ft/lbs of input torque without failure.

2. Valve operators shall be sized for the torques provided in Table 1 of ANSI/AWWA C504 for size and class of valve specified.
3. 250 valve operators shall be sized for pressure and dynamic conditions listed in Appendix "A" of ANSI/AWWA C504. Based on 250 psi pressure differential and 16 fps flow unless other flow rates are specified by the engineer.
4. Each valve shall be operated through three open/close cycles to insure free operation at all positions. Each valve shall be hydrostatically tested at twice rated pressure with the disc open, and a rated pressure in each direction with the disc closed. No permanent deformation or visible leakage shall be allowed on either hydrostatic test.

E. Air Line Butterfly Valves
1. An offset disc shall allow full 360° seating.
2. Valve shall have lug bodies made of cast iron.
3. Shaft seal shall be EPDM with an EPDM resilient seat.
4. Disc and shaft shall be 316 stainless steel with TFE-coated stainless steel bearings.
5. Actuator shall be adjustable memory stop, infinite position lever.

2.2 GATE VALVES

A. Resilient Seat Gate Valves
1. Valves shall meet the requirements of AWWA C509, latest revision.
2. Valves shall be seat tested at 200 psi water pressure for zero leakage and 400 psi for no leakage through the metal, flanged joints, or stem seals.
3. Gate valves shall be furnished with flanged ends, mechanical joints or push-on as detailed on the drawings or as noted in the valve schedule.
4. Stem shall be manganese bronze having a minimum tensile strength of 60,000 psi.
5. The gate, body, bonnet, bonnet cover and wrench nut shall be cast iron (ASTM A126 Class B).
6. Valves shall be of the non-rising stem type. Two O-rings shall seal the stem above the stem collar.
7. The interior and exterior ferrous surfaces shall be coated with a minimum 8 mils of epoxy.
8. The bolts and nuts shall be electro-zinc plated steel (ASTM A307) unless underground where all nuts and bolts shall be stainless steel.

B. Double Disc Gate Valve
1. Valves shall be of the double revolving disc, parallel seat design with independent wedging action to spread the two discs against the seat.
2. Valves shall be seat tested at 200 psi water pressure for zero leakage and 400 psi for no leakage through the metal, flanged joints, or stem seals.
3. Gate valves shall be furnished with flanged ends, mechanical joints or push-on as detailed on the drawings or as noted in the valve schedule.
4. Stems shall be manganese bronze with a minimum tensile strength of 60,000 psi for valves sizes up to 24" and a minimum tensile strength of 80,000 psi for valve sizes 30" and larger.
5. Gate valves shall be of the non-rising stem type for valves sizes less than 12".
6. Valves 14" and larger shall be installed with stem in horizontal position and equipped with tracks and scrappers.
7. Valves 16" and larger that operate on line with pressure greater than 60 psi shall have a bypass valve furnished with the same type materials as main valve.
8. The interior and exterior ferrous surfaces shall be coated with a minimum 8 mils of epoxy.
9. The bolts and nuts shall be electro-zinc plated steel (ASTM A307) unless underground where all nuts and bolts shall be stainless steel.
10. Valves mounted in vertical pipes shall be square bottom valves with shoes and tracks on both disc.
11. Valves on raw sewage or sludge lines shall have double clean-out pockets.

C. Gate valve locations
   1. Gate valves 6" and smaller shall be resilient seat gate valves.
   2. Gate valves 8" and larger shall be double disc gate valves.
   3. Valves shall be as manufactured by American Flow Control, M&H Valve, American R&D, Mueller or Kennedy.

2.3 GATE VALVES SMALLER THAN 3"

Gate valves smaller than 3-inch installed above ground or in structures shall be bronze, 125 lb. S.W.P. double disc, screwed-in bonnet, rising stem, inside screw gate valves with screwed ends and malleable iron handwheels. Valves shall meet the requirements of Federal Specification WW-V-54d for Class A, Type III valves.

2.4 STAINLESS STEEL ANGLE VALVES AND GLOBE VALVES, 4" AND LARGER

Stainless steel angle valves and globe valves, 4-inch and larger, installed above ground or in structures shall be 304 stainless steel construction, 150 psi W.P., bolted flange yoke-bonnet, outside screw rising stem with flanged ends and handwheels. Flanged ends shall be faced and drilled to meet the requirements of ANSI B16.5 for 150 lb. standard flanges.

2.5 BRONZE GLOBE VALVES, 3" AND SMALLER

Bronze globe valves, 3-inch and smaller, installed above ground or in structures shall be 150 pound, union bonnet type with ASTM B62 bronze body and bonnet, 500 Brinnel plug type disc, 500 Brinnel screwed-in seat, screwed ends, and handwheels.

2.6 PLUG VALVES

A. Plug Valves
   1. All plug valves shall be eccentric plug valves unless otherwise specified.
      a. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valve shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111-64, grooved ends per AWWA C-606-87. Screwed ends shall be to the NPT standard.
      b. Valves bodies shall be of ASTM A126 Class B cast iron. Bodies in 4" and larger valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.
      c. Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.
      d. Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF-8M in 1/2"-36" sizes. In valves large than 36", the upper and lower plug journals shall be fitted with ASTM A-240 type 316 stainless sleeves with bearings of SATM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.
      e. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable with out removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

f. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.

g. Manual valves shall have lever (valves smaller than 6") or gear actuators (all valves 6" and larger) and tee wrenches, extension stems, floorstand, extended bonnets etc., as indicated on the plans. All extended bonnets must have gear located at the operator - stem extensions with handwheel operators and gearing at valve are not an acceptable equivalent. All floorstands shall be of the geared type with a handwheel operator. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.

h. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. Extension stems are required on all valves with the centerline greater than 4' below grade. All exposed nuts, bolts, springs and washers shall be stainless steel.

   1) All valves and actuators shall be as manufactured by DeZurik, ValMatic, Milliken, American R&D, Rotork or AUMA.

B. For valves located in digester gas service, the plug shall be completely coated with a chloro-isobutene-isoprene compound of a minimum of 70 durometer hardness bonded to the plug and rated for temperatures of 250°F.

2.7 MUD VALVES

A. Mud valves shall be of the heavy duty flange type with non-rising stems.

B. Frame, plug, yoke, and extension stem connection shall be cast iron (CASTM 126B). Valve operating stem and lift nut shall be ASTM B421 bronze. Seating shall be heavy wear resistant rubber seat.

C. Seating surfaces shall be ASTM B62 bronze with tapered, accurately machined, seating face.

D. Extension stems, pedestal lifts, stem guides and wall brackets will be furnished by valve manufacturer for a complete unit.

2.8 STAINLESS STEEL BALL VALVES

Stainless steel ball valves, ¼ inch through inch, shall be Class 600, three-piece valves with TFE seats, reinforced teflon stem seals, screwed ends, 316 stainless steel bodies, end pieces, balls and stems, and lever operators. Valves shall be manufactured by Contromatics, or equal.

2.9 BRONZE BALL VALVES

Bronze ball valves, ¼ inch through 3 inch, shall be Class 600, three-piece valves with TFE seats, reinforced teflon stem seals, screwed ends, bronze bodies and end pieces, stainless steel balls and stems, and lever operators. Valves shall be manufactured by Contromatics, or equal.

2.10 PVC BALL VALVES

PVC ball valves shall be manufactured of Type 1, Grade 1, polyvinyl chloride and shall have teflon seats and viton seals. Valves shall be 150 pound working pressure and shall have double union screwed ends. Valves shall have polyvinyl chloride handles.

2.11 SILLCOCKS

Sillcocks shall be ¾ inch with ¾ inch hose end, wall flange, antifreeze type.

2.12 NEEDLE VALVES

Needle valves shall be designed to accurately regulate the flow of water through a pipe. The valves shall be constructed for a non-shock cold water pressure of 200 psi. Valves shall be globe type with cast bronze, ASTM B62, bodies and bonnets; bronze stems; and indicator handwheel.

2.13 CURB STOPS

Buried valves 2 inch and smaller in water lines shall be curb stops. Curb stops shall meet the applicable requirements of AWWA C800, ASTM B-62 for 85-5-5-5 composition bronze, and USAS B2.1. Curb stops shall be Mueller H-10283, Mark II Oriseal Valve or equal.

2.14 MANUAL OPERATORS

Manual operators shall be specified in this section. Gate, plug, and butterfly valves with the valve centerline less than six feet above the floor or platform shall be provided with handwheels. Gate, plug, and butterfly valves with the valve centerline six feet or more above the floor or platform shall be provided with chainwheels and chains. Chains shall terminate four feet above operating floor or platform.

2.15 VALVE STANDS

Valve stands shall be cast iron with indicators and shall be compatible with the valve being served.

2.16 VALVE BOXES

A. Valve boxes shall be cast iron. Valve boxes shall be of two piece or three piece type. Each two piece box shall be complete with bottom section, top section, and cover. Valve boxes shall be extension type with slide or screw type adjustment. Each base and bottom section shall be the proper size for the valve served. Each valve box assembly shall be the proper length for the valve served. The minimum thickness of metal shall be 3/16 inch. Cast the work "WATER" in each valve box cover used on valves in potable water piping.

B. Underground valves, 3 inch and larger, provided with valve boxes shall also be provided with compatible extension stems of sufficient length to place operating nut within approximately nine inches of the finished ground surface. Extension stem shall be furnished by the valve manufacturer.

C. Valve boxes for curb stops shall be cast iron. Curb boxes shall be extension type. Each curb box shall be complete with foot piece, curb box, and lid.

2.17 AIR & VACUUM VALVES

Air valve shall consist of a body, cover, baffle, float and seat. The baffle design shall protect the float from direct contract of the rushing air and water to prevent the float from closing prematurely. Valve to be equal to APCO Air and Vacuum Valve.

2.18 VALVE ACTUATORS

A. Valve actuators and appurtenances shall be sized and furnished by the valve manufacturer for the service shown or specified.

B. Cylinder valve operators shall be swivel cylinder type operators using water as the source of hydraulic power. The operators shall also include limit switches for remote indication of open valve position, speed control valves to limit valve opening and closing speed, 4-way solenoid valve for remote control of valve and an adjustable cylinder stop. The speed control valves shall consist of a check valve and throttle valve installed in one or more of the cylinder lines.

C. Large electric actuators (for butterfly valves 8- inches and larger, gate valves 4-inches and larger, globe valves 4-inches and larger, eccentric plug valve 4-inches and larger, ball valves 4-inches and larger).
   1. Electric motor actuators shall be as manufactured by Limitorque,E.I.M., Rotork or AUMA. Electric actuator shall include the motor power gearing, limit switches, built-in controls, declutch and auxiliary handwheel for manual operation in a grease-tight, NEMA rated, weatherproof housing. Actuator shall be sized to operate the valve from fully open to fully closed in not less than two seconds per inch of valve diameter, plus or minus 50% through 20- inch, and plus or minus 30% for valves 24-inches and larger.
   2. Actuator shall be sized to deliver not less than one and one-half (1.5) times the required torque based upon maximum dynamic flow conditions.
   3. Power gearing shall consist of helical or spur type gears of alloy heat treated steel. Worm gears shall be carburized and hardened alloy steel and ground after heat treatment. The worm gear pinion shall be alloy bronze. The gearing shall be designed to allow field repair and change in gear ratio. All gearing shall be designed for 100% overload. Ball or roller bearing shall be used where necessary.
   4. A handwheel shall be provided for manual operation of the valve. The handwheel shall not rotate during electric operation, and the motor shall not rotate during hand operation. To place the operator in manual operation, a declutching lever shall mechanically (not electrically) disconnect the motor drive from the gear train. Failure of the motor gearing or a fused motor shall not prevent hand operation. Hand operation shall not require more than 80 pound pull on the rim of the handwheel. The handwheel shall rotate counter-clockwise to open, and an arrow with the work "open" shall be cast on the handwheel. Operation shall automatically return to electric drive position when the motor is energized.
   5. A mechanical type valve position indicator shall be furnished to show valve position at all times. The indicator shall be part of an intermediate gear head of the electric motor actuator.
   6. Two adjustable torque switches of the quick breaktype shall be furnished. Torque switches shall be responsible to an excessive load encountered in either the opening or closing direction. Four fully adjustable, double pole, double throw limit switches shall be furnished in addition to the switches required for built-in control. Torque and limit switches shall be rated 10 amp at VAC. Switch compartments shall be furnished with a case heater. Auxiliary position potentiometer rated 0-10 K ohm shall be furnished when specified in the valve list.
   7. Built-in control for non-modulating service shall consist of an integrally mounted reversing starter equipped with thermal overloads or motor thermostat, local pushbuttons, selector switches, and indicating lights as specified in the valve list, and a 120 VAC control power transformer.
   8. Built in control for modulating shall be of the electronic solid state type with time proportional motor energization to control the average speed of the motor. Local pushbuttons, selector switches, and indicating lights shall be furnished as specified in the valve list. The control system shall be mounted within the valve actuator limit switch housing and shall consist of a comparator circuit powered by a closely regulated D.C. power supply, controls to determine zero, span, deadband and gain, and a thyristor-type solid state reversing starter section. The solid state control system shall be capable of accepting a 4-20 MADC current signal. The comparator section shall

compare the input signal to the feedback signal, and if a difference is detected, it shall cause the motor to move the valve to the appropriate position, thus correcting the error. Control voltage shall be 120 volts A.C. supplied by an integrally mounted control volt transformer. The solid state reversing starter shall be capable of controlling three phase 480 volts A.C. by switching two of the three phases. The thyristors shall be protected by three line fuses and by properly sized inrush resistors. Rotation direction shall be shown by two neon indicating lights.

9. The actuator motor shall be totally enclosed and designed for the electric service specified in the valve list.
10. Motor for non-modulating service shall be provided with Class B insulation, and the observed temperature rises by the thermometer shall not exceed 75°C above ambient 40°C when operating continuously for 15 minutes under the full rated load. Motor for modulating service shall be designed for continuous full load duty.

D. Small electric actuators (for butterfly valves 6-inches and smaller, and all other quarter turn valves 3-inches and smaller).
   1. Electric motor actuator shall be as manufactured by RCS, Hills-McLanna, or Worchester. The actuator shall consist of a high-torque, reversible electric motor, reduction gearbox, and output shaft "open" and "close" end travel limit switches, all contained in a NEMA 4 watertight enclosure. Actuator shall be sized to operate the valve from fully open to fully closed in not less than 8 seconds and not greater than 30 seconds and non-modulating service and not less than 30 seconds and not greater than 60 seconds for modulating service.
   2. Actuator shall be sized to deliver not less than two (2) times the required torque based upon maximum dynamic flow conditions.
   3. The actuator shall be suitable for operation in ambient temperature ranging from -40° to +150°F. For temperatures below 32°F and where actuators are exposed to temperature variations of 35° or more, a space heater and thermostat is required.
   4. Actuator shall be complete with disengageable manual override to permit operation of the valve in the event of electrical power failure, or system malfunction. Actuators shall be furnished with a disengageable shaft as manual override with top of shaft indicating direction of travel. The valve shall not be capable of being operated electrically when manual override is engaged.
   5. A mechanical type valve position indicator shall be furnished to show valve position at all times. The indicator shall be part of an intermediate gear head of the electric motor actuator.
   6. A cam actuated end travel limit switch shall be provided for each direction of travel. Each switch shall be independently adjustable and capable of being set to operate at any point. Travel limit and auxiliary switches shall be single pole, double throw snap acting, totally enclosed and rated 15 apms at 250 VAC. Clearly marked terminal strips shall be provided in actuator housings for ease of field installations. Auxiliary NO/NC independently adjustable contacts shall be furnished at the open and closed limits for remote monitoring when specified in the valve list.
      a. Auxiliary position potentiometer rated O-10K ohm shall be furnished when specified in the valve list.
   7. Provision shall be made for an electromechanical brake to minimize overrun and prevent back driving of valve disc or plug.
   8. The motor shall be permanent split capacitor type designed for operation on a 120 VAC-1 phase - 60 Hz supply. The motor winding insulation shall be Class B. A self-resetting thermal overload switch shall be provided to prevent motor overheating. The motor shall be rated for 25% out-cycle at maximum rated output for non-modulating service. Extended duty motors shall be furnished for modulating service and shall be designed for 20 starts/minute maximum.
   9. Built-in control shall consist of local pushbuttons, selector switches and indicating lights as specified in the valve list.
   10. Actuators for modulating service shall be furnished with a solid state positioning controller capable for receiving a 4-20 millamp control signal. Positioner shall consist of an error detection circuit, amplifier, either solid state or electro-mechanical relays. By means of a solid state approach module, it shall provide proportional speed action to the motor actuator with adjustments for 5:1

turn down ratio to an error signal of 10% to 1.0%. The main printed circuit board shall have adjustments for zero, span, sensitivity, and input trim. Enclosure shall be of NEMA 4 (weatherproof) construction, suitable for surface mounting, or mounting to the actuator.

E. Pneumatic actuators shall be double acting type, permanently lubricated and sealed for watertightness with self-lubricating bronze or stainless steel sleeve bearings, thrust bearings, and built-in adjustable opening and closing stops. Each actuator shall include limit switches to indicate full open and full close valve position, one four-way solenoid valve, needle valves to reduce air pressure, air supply strainer, and supply pressure shutoff valve.

F. Provide piping and wiring necessary to complete actuators. Power and control wiring shall be as specified in Section 16100.

G. Valves shall be as manufactured by APCO, American Flow Control, ValMatic, American R&D, M&H Valve or Milliken.

2.19 RUBBER FLAPPER SWING CHECK VALVE

A. The check valve shall be cast iron body, long pattern design, with integrally cast-on end flanges.

B. The flapper shall be Buna-N having an internally molded elastic spring and o-ring seating edge.

C. Valve shall be designed for 175 psi working pressure.

D. Flapper shall be easily removed from valve without need to remove valve from line.

E. Valve shall have stainless steel cover bolts.

F. Valve exterior to be painted with red phenolic prime paint as accepted by the FDS for use in contact with potable water.

G. Valve to be APCO series 100 rubber flapper swing check valve or valmatic.

2.20 3-WAY PLUG VALVES

A. Valves shall be of the non-lubricated tapered plug type with resilient faced plugs for drip tight shutoff. End connections shall be flanged and shall be drilled to ANSI 125/150 pound standard. Valves shall be available in cast iron, ni-resist, aluminum, carbon steel, soft rubber lined, hard rubber lined, stainless steel and other alloys on special order. All cast iron, aluminum, ni-resist, carbon steel and stainless steel valves shall have stainless steel bearings in the upper and lower journal areas. All three-way valves shall be furnished as standard with a plug to shut off one port at a time.

B. Manual valves for drip tight shut off shall be furnished with a resilient facing bonded to the plug sealing surface and shall be provided with double handwheel actuators. These actuators shall be of the worm and gear type and shall have one handwheel to lift and reseat the plug and one handwheel to rotate the plug. Handwheel actuators shall be totally enclosed and shall have seals and gaskets to prevent entry of dirt, water on corrosive atmospheres. Actuators shall have corrosion resistant bearings on the gear sector. Manual actuators shall provide plug rotation up to 360 °.

PART 3 - EXECUTION

3.1 SETTING VALVES AND VALVE BOXES

A. Clean the interiors of valves of foreign matter before installation. Tighten stuffing boxes. Inspect valves in opened and closed positions to insure all parts are in working condition.

B. Set buried valves and valve boxes plumb. Center valve boxes on the valves or valve operators. Tamp backfill around each valve box to a distance of four feet on all sides of the box, or to the undisturbed trench face if less than four feet.

NOTES:

A. Ends
MJ - Mechanical Joint; Flg. - Flanged, F250 - Class 250 flange

B. Service

A	Air (backwash)
CD	Chemical Drain
CG	Chlorine Gas
CS	Chlorine Solution
FE	Filter Effluent
F1	Filter Influent
FTW	Filter To Water
FW	Finished Water
HF	Hydrofluosilicic Acid
SF	Sludge Filtrate
SL	Sludge
TS	Thickened Sludge
TW	Treated Water
WWS	Washwater Supply

C. Operator
1. Cylinder operated with solenoid valve, speed control valves, adjustable limit switches, and an adjustable cylinder stop screw.
2. Handwheel operator with chain.
3. Gear operator with extension stem, operating nut and valve box.
4. Handwheel operator.
5. Electric operator.
6. Lever operator.
7. Indicating floorstand with extension stem.

D. Valves associated with Membrane System and associated appurtenances to be furnished by membrane supplier.

E. Mark Legend

BFV	Butterfly Valve
CV	Check Valve
GV	Gate Valve
PV	Plug Valve

SECTION 16010

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Electrical General Provisions are in addition to the General Conditions and General Requirements and shall be extension of these sections of the Specifications.

B. The Electrical General Provisions apply to all electrical materials, equipment, installations, and services supplied under any portion of the work.

C. The Contractor shall coordinate the Electrical General Provisions as applicable to any equipment, installations, and services of an electrical nature.

D. It is the intention of this division of the Specifications and the accompanying Drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations of equipment hereinafter specified and/or shown on the Drawings. The work shall include all materials, appliances, and apparatus not specifically mentioned herein or noted on the Drawings but which are necessary to make a complete working installation of all electrical systems shown on the Drawings or described herein. Equipment and devices furnished and installed under other divisions of this Specification (or by the Owner) shall be connected under this division. The Drawings and Specifications are complementary and what is called for in either is binding as if called for in both.

E. Permits and Fees
This work shall include the procurement of any payment for all permits and fees for the performance of the electrical work.

1.2 RELATED SECTIONS

Equipment and devices furnished under other divisions of this specification shall be installed and connected under this division. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

1.3 COORDINATION OF ELECTRICAL WORK

A. General
1. Refer to General Conditions and Section 01001, General Requirements, for general coordination requirements applicable to the entire work. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the electrical work, and that such establishment is the exclusive responsibility of the Contractor.
    a. Arrange electrical work in a neat, well organized manner with conduit and similar services running parallel with primary lines of the building construction, and with a minimum of 7 feet 0 inch overhead clearance where possible.
    b. Locate operating and control equipment properly to provide easy access, and arrange entire electrical work with adequate access for operation and maintenance.
    c. Advise other trades of openings required in their work for the subsequent move-in of large units of electrical work (equipment).

B. Coordination Drawings
For locations where several elements of electrical (or combined mechanical and electrical) work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings (shop drawings) showing the actual physical dimensions (at accurate scale) required for the installation. Prepare and submit coordination drawings prior to purchase-fabrication-installation of any of the elements involved in the coordination.

C. Coordination of Options and Substitutions
Where the contract documents permit the selection from several product options, and where it becomes necessary to authorize a substitution, do not proceed with purchasing until coordination of interface requirements has been checked and the Engineer's satisfaction has been established.

D. Special attention is called to the following items, and all conflicts shall be reported to the Engineer before installation for decision and correction.
1. Locate light switches on the latch side of the door. Verify door hinge location in field prior to the switch outlet installation.
2. Location of grilles, pipes, sprinkler heads, ducts, and other mechanical equipment so that all electrical outlets, lighting fixtures, and other electrical outlets and equipment are clear from and in proper relation to these items.
3. Location of cabinets, counters, and doors so that electrical outlets, lighting fixtures, and equipment are clear from and in proper relation to these items.

E. The Contractor will not be paid for cutting, patching, and finishing required for relocation of work installed due to interference between the various Contractors' work.

1.4 QUALITY ASSURANCE

A. In case of difference between building codes, specifications, state laws and federal laws, local ordinances, industry standards, utility company regulations, and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Engineer in writing of any such difference.

B. Non-Compliance
Should the Contractor perform any work that does not comply with the requirements of the applicable building codes, state and federal laws, local ordinances, industry standards, and utility company regulations, he shall bear all costs in correcting all deficiencies.

C. Applicable codes and standards shall include all the state laws, local ordinances, utility company regulations, and the applicable requirements of the following nationally accepted codes and standards. All of the following codes shall apply to the equipment, and equipment installation, of Division l6, where applicable. All equipment of Division l6 shall bear U.L. labels where labeled equipment is available.

D. Industry Standards, Codes, and Specifications
1. NECNational Electric Code
2. ANSI C2National Electrical Safety Code
3. IEEEInstitute of Electrical and Electronic Engineers
4. ASAAmerican Standards Association
5. ASTMAmerican Society of Testing Materials
6. ICEAInsulated Cable Engineers Association
7. NBSNational Bureau of Standards
8. NEMANational Electrical Manufacturers Association - Standards for Materials & Products

9. NFPANational Fire Protection Association
10. UL Underwriters Laboratories
11. NECANational Electrical Contractors Association - Standard of Installation
12. NFPA #101Life Safety Code
13. ANSI C73 Dimensions of Attachment Plugs and Receptacles

E. All electric materials shall be new, in original cartons, bundles, or shipping crates.

F. Nothing in these drawings and specifications shall be construed to permit work not conforming with governing codes. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the plans and specifications which may be in excess of requirements of the hereinbefore mentioned governing codes and rules and not contrary to same.

G. Additional quality assurance requirements are stated in specific sections of Division l6, where applicable.

H. Definitions
1. Manufacturers
Firms regularly engaged in the manufacture of the equipment specified of the types and capacities required, whose products have been in satisfactory use in similar service for not less than five years, unless specified otherwise in other sections of Division l6.
2. Installer
A firm with at least five years of successful installation experience on projects with electrical installation work similar to that required for the project, unless specified otherwise in other specific sections of Division l6.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit the following:
1. Shop drawings shall be submitted for all electrical equipment in Division l6, unless noted otherwise.
2. Include complete catalog information such as construction, physical dimensions, ratings, wiring diagrams, and insulation systems, as applicable.

1.6 SYMBOLS

Except as indicated otherwise, refer to "Electrical Legend" on drawings for definitions of symbols and abbreviations used on the drawings to show electrical work.

1.7 RECORD DRAWINGS

Record drawings shall be as specified in Section 01700.

1.8 INSTRUCTION PERIODS

A. Upon completion of the work and after all tests and final inspection of the work by the authority(s) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operating and maintenance personnel in the operation and maintenance of the various electrical systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system and suppliers representatives when so specified.

B. Scheduled instruction periods shall be as tabulated in the Data Sheet of this Section.

C. Costs for time involved by the Contractor and scheduled manufacturer's services shall be included in the bid.

1.9 PRODUCTS, ELECTRICAL WORK

A. Refer to the General Conditions and Section 0100l, General Requirements, for general requirements on products, materials, and equipment. The following provisions expand or modify the requirements as applicable work.
   1. Product Listing
      Prepare the product listing for electrical work, separately from the listing(s) of products for other work. Include listing of each significant item of equipment and material used in the work and indicate the generic name, product name, manufacturer, model number, related specification section number(s),and estimated date for start of installation. Materials such as conductors, conduit, and boxes taken from Installer's stock need not be listed.
   2. Compatibility
      Provide products which are compatible with other products of the electrical work, and with other work requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with other work.

1.10 INSPECTION AND TESTING

A. All equipment installed shall be inspected for compliance with the specifications, manufacturer's requirements, and reasonableness of quality work.

B. All equipment shall be tested for grounds, shorts, opens, and proper working ability.

PART 2 - PRODUCTS

2.1 ELECTRICAL SYSTEM IDENTIFICATION

A. Distribution System Equipment
Provide engraved plastic laminate nameplates (black with white letters) on all distribution system equipment including but not limited to switchboards, distribution panels, panelboards, and system control panels. Text shall be panel name, designation, and electrical characteristics. Letters shall be l/8 inch high (minimum) or a larger size if required for clarity on large arrangements. Nameplates shall be secured to the equipment with screws or bolts.

B. Cable/Conductor Identification
Provide cable/wire labels on each conductor of principal electrical runs at enclosures where conductors of more than one circuit or system are present and interrupted. Mark to match contract document and other numbering as subsequently established.

C. Operational and Warning Signs
   1. General
      Provide warning signs where there is hazardous exposure or danger associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with ANSI Al3.1 & NEC standard for color and design.

2. Operational Tags
   Where needed for proper and adequate information on operation and maintenance of electrical systems, provide tags of plasticized card stock, pre-printed to convey the message; example "DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING."

2.2 EXPLOSION - PROOF EQUIPMENT

A. Enclosures — Class 1, Group D, NEMA 7

B. Locations — digester pipe gallery, digesters

C. All conduit, fittings, boxes, lighting fixtures, sealing fittings and connectors shall meet Class 1, Group D requirements.

D. Light switches — Appleton Type ART

E. Motor Connections — Appleton Type EX

F. Seal-off Fittings — Appleton Type VSU

G. Unions and Connecters — Appleton Type UNY or UNF

PART 3 - EXECUTION

3.1 SITE INSPECTION

Installer must examine the areas and conditions under which electrical equipment is to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer and the Engineer.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle all equipment carefully to prevent internal components damage, breakage, and denting and scoring the finish. Do not install damaged equipment.

B. Store equipment in a clean, dry space. Protect equipment from dirt, fumes, water, construction debris, and physical damage.

C. Provide auxiliary heaters, or store in a heated space, for any equipment that would be damaged by moisture condensation, such as electric motors, electronic components, contacts, etc.

3.3 WORK RESPONSIBILITIES

A. Drawings indicate diagrammatically desired locations or arrangement of conduit runs and outlets equipment. Proper judgement shall be exercised in executing work so as to secure best possible installation in available space and to overcome local difficulties due to space limitations or interference with structural conditions. Contractor shall be responsible for correct placing of work and proper location and connection of work in relation to work of other trades. Advise appropriate trade as to locations of access panels.

B. Locations shown on ceiling plans or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify Engineer for instructions.

C. In the event changes in indicated locations or arrangements are necessary, due to developed conditions in building construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost, providing the change is ordered before the conduit runs, and work directly connected to same is installed and no extra materials are required.

D. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.

E. Lighting fixtures in mechanical spaces are shown in their approximate locations only. Do not install outlets or fixtures until mechanical piping and ductwork is installed; then lights shall be installed in locations best suited for equipment arrangement or as directed by the Engineer.

F. Scaled and figure dimensions are approximate of typical equipment of the class indicated. Before proceeding with any work, check and verify dimensions and sizes with manufacturer's drawings to see that equipment will fit into spaces provided without violation of applicable codes.

G. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.

H. Should any changes to work indicated on drawings or described in specifications be necessary in order to comply with above requirements, notify Engineer immediately and cease work on parts of Contract which are affected until approval for any required modifications to construction has been obtained from Engineer.

I. Contractor shall be responsible for any cooperative work which must be altered due to lack of proper supervision or failure to make proper provisions in time. Such change shall be made to the Engineer's satisfaction.

J. Perform work with competent and skilled personnel.

K. Work, including aesthetic as well as electrical and mechanical aspects of work, shall be of quality consistent with best practices of trade.

L. Replace or repair, without additional compensation, any work which, in the opinion of the Engineer, does not comply with these requirements.

3.4 INSTALLATION, GENERAL (FOR SPECIAL REQUIREMENTS REFER TO SPECIFIC EQUIPMENT UNDER OTHER SECTIONS)

A. Excavation
Unless otherwise specified elsewhere in the specifications, do excavating necessary for installation of electrical work in accordance with Section 02200, Earthwork. Where conduit runs traverse public property, depth below finish grade shall be as required by legally constituted public authorities having jurisdiction.

B. Locations of Openings
Locate chases, shafts, and openings required for installation of electrical work during framing of structure. Do additional coring and/or cutting and patching required due to improperly located or omitted openings without cost to the Owner, and with approval of the Engineer. Coring and/or cutting or drilling in any structural member is prohibited without written approval of the Engineer. No coring or cutting in any post tension slab.

C. Location of Sleeves
Wherever conduits pass through concrete walls or suspended slabs, furnish and install sleeves of ample size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations with Engineer.

D. Type of Sleeves
Shall be PVC, steel pipe, or galvanized sheet metal.

E. Finish Around Sleeves
Rough edges shall be finished smooth. Space between conduit and sleeves where conduit passes through exterior walls shall be sealed to permit movement of conduit or sleeve. Space between conduit and sleeves where conduit passes through fire rated interior walls and slabs shall be sealed with a U.L. classified sealing device that is fireproof and will remain pliable. Provide adequate space around conduit for device installation . Where it is impossible to install the fire seal, sleeves and slots shall be packed with approved materials to provide a fire barrier conforming to the requirements of the legal authorities having jurisdiction. All unused sleeves shall be similarly packed. Acceptable seal is Dow Corning's 3-6548 Silicone RTV Foam.

F. Flashing
Wherever conduit extends through roof, furnish and install flashings consisting of roof jack and flashing collar sealed with duxeal to conduit and covering top of roof jack. Roof jack shall extend 6 inches out on roof and up conduit at least 8 inches. Coordinate installation of flashings with roofing installation to permit roofing installer to mop in flanges between roofing plies.

G. Cutting and Patching
Be responsible for cutting and patching which may be required for proper installation of electrical work. Work shall be performed by trade originally installing same and paid for under this section of work.

H. Storage of Equipment
Protect work, materials, and equipment from damage from any cause whatever, and provide storage facilities during progress of work. Storage out of doors shall be weather protected and shall include space heaters to prevent condensation. Provide for safety and good condition of work until final acceptance of work by Owner, and replace damaged or defective work, materials, and equipment before requesting final acceptance.

I. Conduit and Busway
Conduit, busway, and all equipment shall be installed. Clean to remove plaster, splattered paint, cement, and dirt on both exterior and interior.

J. Conduit and Equipment to be Painted
Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil, and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.

K. Items with Factory Finish
Remove cement, plaster, grease, and oil and leave surfaces including cracks and corners, clean and polished. Touch up any scratched or bare spots.

L. Site Cleaning
Remove from site packing cartons, scrap materials, and other rubbish relating to electrical installation.

M. Painting
Electrical equipment, conduit and materials exposed to public and in finished areas shall be finished painted after installation to coordinate with surrounding walls. Surfaces shall be cleaned for receiving paint. Paint color coordination shall be as directed by the Engineer. Paint shall be identical to that on adjacent surfaces to ensure proper matching of quality and color with surrounding areas. Painting shall be as per Section 09900 of these Specifications.

N. Pads, Bases and Anchors
The Contractor shall provide all pads, bases, and anchors required to complete the electrical work. Unless noted otherwise, 4 inch concrete pads shall be provided for floor mounted equipment such as switchboards, transformers, motor control centers, motor controllers, etc. Set bolts in pipe sleeves from templates or actual measurements. Set equipment level and grout in place.

O. Platforms and Support Stands
1. The Contractor shall provide all platforms and supporting stands for electrical equipment required to complete his work.
    a. Each piece of equipment or apparatus suspended below ceiling or mounted above floor level shall be provided with suitable structural support, platform or carrier in accordance with the best recognized practice.
    b. The Contractor shall exercise extreme care that structural members of the building are not overloaded by such equipment. In all cases, details of such hangers, platforms, and supports, together with the total weights of mounted equipment, shall be reviewed by the Engineer.

P. Ceiling and Wall Access
1. Ceiling and wall access panels for electrical equipment shall be provided by the Contractor.
    a. Provide where shown or required for access to the electrical equipment, access panels as hereinafter specified.
    b. Acoustical Tile Wall or Ceiling
    24 inch x l2 inch, unless otherwise noted. Constructed to receive plaster to match the adjacent finish.
    c. Plastered Wall or Ceiling
    24 inch x l2 inch, unless otherwise noted. Constructed to receive plaster to match the adjacent finish.

Q. Escutcheons
Install chrome plated pipe escutcheons on exposed pipe at wall, floor, and ceiling.

R. Painting and Cabinets
Painting of all equipment, cabinets, junction boxes, supports, etc., are required in accordance with these Specifications.

3.5 SERVICE TIE CONNECTIONS

A. Contractor shall check and verify all voltage and phasing of service tie connections at electrical equipment.

B. A record shall be submitted of each test made and the results submitted to the Engineer as shop drawings.

C. Phasing to be maintained shall be A.B.C. top to bottom, east to west, and north to south in all cases.

3.6 ELECTRICAL CONNECTIONS TO EQUIPMENT

A. Contractor shall provide all connections to mechanical equipment supplied under various sections of these specifications.

B. All equipment shall be wired complete in each detail, including all interlocks, safety switches, control devices, starters, and disconnects.

C. Drawings include equipment as anticipated to be furnished; however, in case other makes, etc., are furnished than shown, the furnished equipment shall be wired completely as required at no additional cost.

D. All connections and wiring diagrams, where shown on the drawings, are for bidding purposes only, and the Contractor shall obtain final wiring diagrams from equipment vendors. Diagrams as supplied shall be specifically for this project.

E. Motor sizes, where shown on the drawings, are for bidding purposes only, and the Contractor shall verify all motor sizes prior to wiring. Contractor shall furnish proper starters for the equipment as furnished at no additional cost to the Owner.

F. Conduits and wires, where shown on the contract documents, are for bidding purposes. Contractor shall verify all wire sizes, number of wires required, and supply the proper number to each piece of equipment before installation.

3.7 REMOVAL OF MATERIAL

A. The Contractor shall remove all unnecessary equipment, materials, fixtures, and wiring in those areas affected by the construction.

B. All materials and equipment removed and not reinstalled become the property of the Contractor and shall be removed from the site, unless indicated otherwise on the drawings.

3.8 WARRANTY

The Contractor shall be responsible for all work installed under this specification. He shall make good, repair or replace, at his own expense as may be necessary, any defective work, materials or parts in accordance with the General Conditions and Section 01001, General Requirements, and any additional requirements stated in specific sections of Division 16. Incandescent lamps are not warranted, but all shall be operating at time of final acceptance.

3.9 COMPLETION OF ELECTRICAL WORK

A. General
Refer to the General Conditions and Section 01001, General Requirements, for general completion work requirements.

B. Coordination with Mechanical
Coordinate completion of work operations with completion of work of mechanical systems and other power consuming equipment. Accurately record locations of conductors which are underground or otherwise concealed. Test run electrical equipment in coordination with test runs of mechanical systems. Clean and lubricate operational equipment. Instruct Owner's operating personnel thoroughly in the operation, sequencing, maintenance and safety/emergency provisions of the electrical systems. Turn over the operations to the Owner's personnel at the time(s) of substantial completion. Until the time of final acceptance of the total work of the Contract, respond promptly with consultation and services to assist the Owner's personnel with operation of electrical systems.

C. General Operating Instructions

1. In addition to specific training of Owner's operating personnel specified in Division l6 sections, and in addition to preparation of written operating instructions and complied maintenance manuals specified in the Division l6 sections and elsewhere in these specifications, provide general operating instructions for each operational system and equipment item of electrical work. Coordinate instructions with instructions for mechanical work and other equipment where associated with electrical systems or equipment.
    a. Describe each basic electrical system.
    b. Explain identification system, displayed diagrams, signals, alarms, communication systems, and similar audio visual provisions.
    c. Describe interfaces with mechanical equipment, including interlocks, sequencing, start-up, shutdown, emergency, safety, system failure, security, and similar provisions.
    d. Outline basic maintenance procedures and major equipment turnaround requirements, including adjustments to optimize output and efficiency of electrical systems.
    e. Display an conduct a "thumb-through" explanation of maintenance manuals, record drawings, spare parts inventory, storage of extra materials, meter readings, and similar service items.

D. Construction Equipment

After completion of performance testing and Owner's operating instructions and demonstrations, remove installer's tools, test facilities, construction equipment, and similar devices and materials used in execution of the work but not incorporated in the work.

E. Complete the Job Completion Form and submit to the Engineer. Final payment will be withheld until all items indicated on the form are completed to the Engineer's satisfaction.

SECTION 16111

CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal conduit.

B. Flexible metal conduit.

C. Liquidtight flexible metal conduit.

D. Electrical metallic tubing.

E. Nonmetal conduit.

F. Flexible nonmetallic conduit.

G. Fittings and conduit bodies.

1.2 RELATED SECTIONS

A. Section 16118 - Underground Duct Bank.

B. Section 16130 - Boxes.

C. Section 16170 - Grounding and Bonding.

D. Section 16190 - Supporting Devices.

E. Section 16195 - Electrical Identification.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI C80.5 - Rigid Aluminum Conduit.

D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

E. ANSI/NFPA 70 - National Electrical Code.

F. NECA "Standard of Installation."

G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 DESIGN REQUIREMENTS

Conduit Size: As shown on drawings, minimum size shall be ¾"

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, nonmetallic conduit, fittings, conduit bodies.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual routing of conduits larger than 2 inches.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.8 FIELD SAMPLES

A. Provide under provisions of Section 01400.

B. Provide field sample of conduit, two each at 2 feet long.

C. Provide field sample of expansion/deflection fitting, two each.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 01600.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.10 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum Size: ¾ inch unless otherwise specified.

B. Underground Installations:
   1. More than Five Feet from Foundation Wall: Use IMC or Schedule 80PVC conduit encased in concrete.
   2. Within Five Feet from Foundation Wall: Use rigid steel conduit.
   3. In or Under Slab on Grade: Use rigid steel conduit, and Schedule 40 PVC conduit.
   4. Minimum Size: ¾ inch.

C. Outdoor Locations, Above Grade: Use rigid steel or rigid aluminum.

D. In Slab Above Grade:
   1. Use rigid steel or rigid aluminum conduit.
   2. Maximum Size Conduit in Slab: 2 inch.

E. Wet and Damp Locations: Use rigid steel or rigid aluminum conduit.

F. Dry Locations:
   1. Concealed: Use rigid steel or rigid aluminum.
   2. Exposed: Use rigid steel or rigid aluminum.

G. Instrumentation
   1. Use rigid steel or rigid aluminum conduit.
   2. ¾" conduit minimum size.

2.2 METAL CONDUIT

A. Manufacturers:
   1. Allied Tube and Conduit Corp.
   2. Century Tube Corp.
   3. Steel Electric Products.
   4. Substitutions: Under provisions of Section 01600.

B. Rigid Steel Conduit: ANSI C80.1.

C. Rigid aluminum conduite ANSI C80.5

D. Intermediate Metal Conduit (IMC): Rigid steel.

E. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit. All steel fittings.

2.3 PVC COATED METAL CONDUIT

A. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction with PVC jacket.

B. Fittings: ANSI/NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression type.

2.6 NONMETALLIC CONDUIT

A. Description: NEMA TC 2; Schedule 80 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation."

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 16190.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route exposed conduit parallel and perpendicular to walls.

K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

L. Route conduit in and under slab from point-to-point.

M. Do not cross conduits in slab.

N. Maintain adequate clearance between conduit and piping.

O. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

P. Cut conduit square using saw or pipecutter; de-burr cut ends.

Q. Bring conduit to shoulder of fittings; fasten securely.

R. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

S. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

T. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 2 inch size.

U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

V. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

W. Provide suitable pull string in each empty conduit except sleeves and nipples.

X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

Y. Ground and bond conduit under provisions of Section 16170.

Z. Identify conduit under provisions of Section 16195.

SECTION 16114

CABLE TRAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Cable trays and accessories.

1.2 RELATED SECTIONS

A. Section 16121 - Insulated Wire and Cable.

B. Section 16190 - Supports.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NEMA VE 1 - Metallic Cable Tray Systems.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.

C. Product Data: Provide data for fittings and accessories.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Record actual routing of cable tray and locations of supports.

1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 LADDER-TYPE CABLE TRAY

A. Description: NEMA VE 1, Class 20C ladder type tray.

B. Material: Aluminum.

C. None required.

D. Inside Width: 24 inches, minimum.

E. Inside Depth: 6 inches minimum.

F. Straight Section Rung Spacing: 9 inches on center.

G. Inside Radius of Fittings: 24 inches.

H. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

I. Covers: Flanged, ventilated flush raised cover.

2.2 TROUGH-TYPE CABLE TRAY

A. Description: NEMA VE 1, Class 12B trough type tray.

B. Material: Aluminum.

C. None required.

D. Inside Width: 30 inches.

E. Inside Depth: 6 inches minimum.

F. Inside Radius of Fittings: 24 inches.

G. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

H. Covers: Flanged, solid cover.

2.3 WARNING SIGNS

A. Engraved Nameplates: ½ inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install metallic cable tray in accordance with NEMA VE 1.

C. Install fiberglass cable tray in accordance with NEMA FG 1.

D. Support trays in accordance with Section 16190. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 6 ft maximum.

E. Use expansion connectors where required.

F. Ground and bond cable tray under provisions of Section 16170.
   1. Provide continuity between tray components.
   2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
   3. Provide 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.
   4. Connections to tray may be made using mechanical or exothermic connectors.

G. Install warning signs at 50 ft centers along cable tray, located to be visible.

SECTION 16118

DUCTBANK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal conduit.

B. Duct.

C. Manholes.

1.2 RELATED SECTIONS

A. Section 02222 - Excavation.

B. Section 02223 - Backfilling.

C. Section 02225 - Trenching.

D. Section 02607 - Manholes and Covers.

E. Section 02781 - Site Grounding.

F. Section 03100 - Concrete Formwork.

G. Section 03200 - Concrete Reinforcement.

H. Section 03300 - Cast-In-Place Concrete.

I. Section 07160 - Bituminous Dampproofing.

J. Section 15430 - Plumbing Specialties.

1.3 REFERENCES

A. AASHTO - Standard Specification for Highway Bridges.

B. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.

C. ANSI/ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

D. ANSI/ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality.

E. ANSI/IEEE C2 - National Electrical Safety Code.

F. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

G. ANSI/NFPA 70 - National Electrical Code.

H. ASTM A48 - Gray Iron Castings.

I. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.

J. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

K. NEMA TC 6 - PVC and ABS Plastic Utilities Duct for Underground Installation.

L. NEMA TC 8 - Extra-Strength PVC Plastic Utilities Duct for Underground Installation.

M. NEMA TC 9 - Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.

N. NEMA TC 10 - PVC and ABS Plastic Communications Duct and Fittings for Underground Installation.

O. NEMA TC 14 - Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

C. Product Data: Provide for metallic conduit, nonmetallic conduit, and manhole.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual locations of exact routing of ductbank.

C. Accurately record actual locations of each manhole.

1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

1.8 FIELD SAMPLES

Provide under provisions of Section 01400.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 01600.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.10 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

D. Duct bank routing is shown on Drawings in approximate locations unless dimensions are indicated. Route as required to complete duct system.

E. Manhole locations are shown on Drawings in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT

A. Manufacturers:
   1. Allied Tube and Conduit.
   2. Century Tube Corp.
   3. Steel Electric Products.
   4. Substitutions: Under provisions of Section 01600.

B. Rigid Steel Conduit: ANSI C80.1.

C. Fittings: ANSI/NEMA FB 1; steel.

D. Use: Instrumentation conduit.

2.2 PLASTIC CONDUIT

A. Manufacturers:
   1. Available Plastics, Inc.
   2. Carlon.
   3. Substitutions: Under provisions of Section 01600.

B. Description: NEMA TC 2; Schedule 80 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavation under provisions of Section 01039.

B. Verify that excavation, base material installation, and compaction is completed.

3.2 PREPARATION

Prepare excavation in accordance with manhole manufacturer's instructions.

3.3 DUCT BANK INSTALLATION

A. Install duct in accordance with manufacturer's instructions.

B. Install power and communications duct to locate top of ductbank minimum 30 inches below finished grade.

C. Install duct with minimum slope of 4 inches per 100 feet. Slope duct away from building entrances.

D. Cut duct square using saw or pipe cutter; de-burr cut ends.

E. Insert duct to shoulder of fittings; fasten securely.

F. Join nonmetallic duct using adhesive as recommended by manufacturer.

G. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

H. Install no more than equivalent of three 90-degree bends between pull points.

I. Provide suitable fittings to accommodate expansion and deflection where required.

J. Terminate duct at manhole entries using end bell.

K. Stagger duct joints vertically in concrete encasement 6 inches minimum.

L. Use suitable separators and chairs installed not greater than 4 feet on centers.

M. Band ducts together before placing concrete.

N. Securely anchor duct to prevent movement during concrete placement.

O. Place concrete under provisions of Section 03300. Use mineral pigment to color concrete red

P. Provide minimum 3 inch concrete cover at bottom, top, and sides of ductbank.

Q. Provide steel reinforcing bars in bank as shown on the drawings.

R. Connect to existing concrete encasement using dowels.

S. Connect to manhole wall using dowels.

T. Provide suitable pull string in each empty duct except sleeves and nipples.

U. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

V. Backfill trenches under provisions of Section 02225.

W. Interface installation of underground warning tape with backfilling specified in Section 02225. Install tape 6 inches below finished surface.

SECTION 16130

BOXES AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Floor boxes.

C. Pull and junction boxes.

1.2 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

D. ANSI/NFPA 70 - National Electrical Code.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

1.5 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of floor boxes and outlets in buildings and work areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, stainless steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include ½ inch (13 mm) male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.2 FLOOR BOXES

A. Floor Boxes: ANSI/NEMA OS 1, semi-adjustable.

B. Material: Formed stainless steel.

C. Shape: As required.

D. Conform to regulatory requirements for concrete-tight floor boxes.

2.3 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: Stainless steel and aluminum.

B. Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
1. Material: Cast aluminum.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. In-Ground Cast Metal Box: NEMA 250, Type 6, inside flanged, recessed cover box for flush mounting.
1. Material: Cast aluminum.
2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: ELECTRIC.

2.4 ENCLOSURES

A. Construction: Aluminum or stainless steel.

B. Hardware & Hinges: Type 304L stainless steel.

C. Enclosure Base & Supports: Aluminum or stainless steel, two (2) inch by two (2) inch.

D. Latching: Three point latching shall be provided on all doors.

E. NEMA Rating: 3R

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07270.

F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

G. Use flush mounting outlet boxes in finished areas.

H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic rated walls.

I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

J. Use stamped stainless steel bridges to fasten flush mounting outlet box between studs.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Use adjustable stainless steel channel fasteners for hung ceiling outlet box.

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

O. Use gang box where more than one device is mounted together. Do not use sectional box.

P. Use gang box with plaster ring for single device outlets.

Q. Use cast outlet box in exterior locations exposed to the weather and wet locations.

R. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

S. Set floor boxes level.

T. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
   1. Interior Dry Locations: Use hinged enclosure.
   2. Other Locations: Use surface-mounted cast metal box.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for equipment furnished under Division 11.

B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

C. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

D. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

A. Adjust floor box flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closure in unused box opening.

SECTION 16170

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.2 RELATED SECTIONS

A. Section 03200 - Concrete Reinforcement.

B. Section 03300 - Cast-In-Place Concrete.

C. Section 16670 - Lightning Protection System.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NPFA 99 - Health Care Facilities.

1.4 GROUNDING ELECTRODE SYSTEM

A. Metal frame of the building.

B. Concrete-encased electrode.

C. Rod electrode.

D. Plate electrode.

E. Active electrode.

1.5 PERFORMANCE REQUIREMENTS

Grounding System Resistance: 25 ohms.

1.6 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual locations of grounding electrodes.

1.8 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

A. Manufacturers:
   1. Thompson Lightning Protection, Inc.
   2. Advanced Lightning Technology, Inc.
   3. Substitutions: Under provisions of Section 01600.

B. Material: Copper-clad steel.

C. Diameter: ¾ inch.

D. Length: 10 feet.

2.2 MECHANICAL CONNECTORS

A. Manufacturers:
   1. Thompson Lightning Protection, Inc.
   2. Advanced Lightning Technology, Inc.
   3. Substitutions: Under provisions of Section 01600.

B. Material: Bronze.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers:
   1. Thompson Lightning Protection, Inc.
   2. Advanced Lightning Technology, Inc.
   3. Substitutions: Under provisions of Section 01600.

2.4 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes:4/0 AWG.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

2.5 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inch diameter by 24 inch long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.

C. Provide grounding well pipe with cover at rod locations where indicated . Install well pipe top flush with finished grade.

D. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated.

E. Provide bonding to meet Regulatory Requirements.

F. Bond together metal siding not attached to grounded structure; bond to ground.

G. Install transient suppression plate where indicated.

H. Install ground grid under access floors where indicated. Construct grid of 2 AWG bare copper wire installed on 24 inch centers both ways. Bond each access floor pedestal to grid.

I. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Use 2 AWG bare copper conductor.

J. Provide grounding and bonding in patient care areas to meet requirements of NFPA 99 and ANSI/NFPA 70.

K. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.3 INTERFACE WITH OTHER PRODUCTS

Interface with lightning protection system installed under Section 16670.

3.4 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall- of-potential method.

SECTION 16190

SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.2 REFERENCES

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide manufacturer's catalog data for fastening systems.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Stainless steel or aluminum.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Anchors and Fasteners:
1. Concrete Structural Elements: Use expansion anchors and preset inserts.
2. Steel Structural Elements: Use beam clamps, spring steel clips and welded fasteners.
3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Use expansion anchors and preset inserts.
6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.

2.2 ALUMINUM CHANNEL

A. Manufacturer:
   1. Unistrut.
   2. Substitutions: Under provisions of Section 01600.

2.3 POWDER ACTUATED ANCHORS

A. Manufacturer:
   1. Hilti.
   2. Ram Tool.
   3. Substitutions: Under provisions of Section 01600.

B. Description: Stainless steel anchors, Type 304

2.4 SPRING STEEL CLIPS

A. Manufacturer:
   1. Grinnel.
   2. Unistrut.
   3. Substitutions: Under provisions of Section 01600.
   4. Description: Stainless steel, Type 304.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not use spring steel clips and clamps.

E. Obtain permission from Engineer before using powder-actuated anchors.

F. Obtain permission from Engineer before drilling or cutting structural members.

G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

I. In wet and damp locations use stainless steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.

J. Use stainless sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.2 RELATED SECTIONS

Section 09900 - Painting.

1.3 REFERENCES

ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

1.6 EXTRA MATERIALS

A. Furnish under provisions of Section 01700.

B. Provide two of each style marker.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

B. Locations:
   1. Each electrical distribution and control equipment enclosure.
   2. Communication cabinets.

C. Letter Size:
   1. Use ⅛ inch letters for identifying individual equipment and loads.
   2. Use ¼ inch letters for identifying grouped equipment and loads.
   3. Use ⅛ inch letters for identifying circuits.

D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations.

2.2 WIRE MARKERS

A. Manufacturers:
   1. 3M.
   2. Southwire.
   3. Substitutions: Under provisions of Section 01600.

B. Description: Tape type wire markers.

C. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

D. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

2.3 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. 3M.
   2. Seton.
   3. Substitutions: Under provisions of Section 01600.

B. Description: 4 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws or adhesive.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Identify conduit using field painting under provisions of Section 09900.

E. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

SECTION 16461

DRY-TYPE DISTRIBUTION TRANSFORMERS (1500 KVA AND BELOW)

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install single-phase and three-phase general purpose individually mounted dry-type transformers of the two-windings type, self-cooled as specified herein, and as shown on the contract drawings.

1.2 RELATED SECTIONS

1.3 REFERENCES

A. The transformers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI, NEMA and UL.

B. Transformers shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

C. Transformers shall meet the requirements of the 2016 California Energy Code (CEnC), Part 6 – Subchapter 2, Section 110.1 under “Distribution Transformers” and be Certified by the Manufacturer as required by the Title 20 Appliance Efficiency Regulations, unless otherwise EXEMPT under 110.10(a).

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Outline dimensions and weights
2. Transformer ratings including:
    a. kVA
    b. Primary and secondary voltage
    c. Taps
    d. Basic impulse level (BIL) for equipment over 600 volts
    e. Design impedance
    f. Insulation class and temperature rise
    g. Sound level.
3. Product data sheets

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes.

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Connection diagrams
3. Installation information
4. Seismic certification and equipment anchorage details as specified.

1.6 QUALIFICATIONS

A. The manufacturer of the dry-type distribution transformers shall be the same as the manufacturer of the other major electrical distribution equipment on the project.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer shall be a participant in the UL Data Acceptance Program (DAP) under the Client Test Data Program (CTDP) certification to ensure UL test methodologies and record traceability complies with the requirements of ISO 17025.

D. Transformer must bear the UL Energy Efficiency Verification Mark to confirm that the unit meets the requirements of 10 CFR Part 431.

E. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years.

1.7 REGULATORY REQUIREMENTS

A. All transformers shall be UL listed and bear the UL label.

1.8 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.9 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton

B. Square D

C. Approved Equal

D. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 RATINGS

A. The kVA and voltage ratings shall be as indicated on the drawings.

B. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

C. Transformers shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

D. Transformers efficiency shall be measured according to federal law 10 CFR Part 431.

E. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

	Self Cooled Ventilated		Self Cooled Sealed
Equivalent Winding kVA Range	K-Factor=1 K-Factor=4 K-Factor=9	K-Factor=13 K-Factor=20	
3.00 and below	40	40	45
3.01 to 9.00	40	40	45
9.01 to 15.00	45	45	50
15.01 to 30.00	45	45	50
30.01 to 50.00	45	48	50
50.01 to 75.00	50	53	55
75.01 to 112.50	50	53	55
112.51 to 150.00	50	53	55
150.01 to 225.00	55	58	57
225.01 to 300.00	55	58	57
300.01 to 500.00	60	63	59
500.01 to 700.00	62	65	61
700.01 to 1000.00	64	67	63
Greater than 1000	Consult Factory	Consult Factory	Consult Factory

F. Where K-factor transformers are indicated on the drawings, the transformers shall be specifically designed to supply circuits with a harmonic profile equal to or less than a K-factor of 4 without exceeding115 degrees C temperature rise.

2.3 CONSTRUCTION – GENERAL PURPOSE TRANSFORMERS

A. Insulation Systems

1. Transformer insulation system shall be as follows:

   a. 1 – 75 kVA, three-phase (37.5 kVA, single-phase): 180 degrees C insulation system with 115 degree C rise, encapsulated design; 5-45 kVA minimum of 200 degrees C insulation system with 115 degree C rise; 50 kVA and above: minimum of 220 degrees C insulation system with 115 degree C rise, ventilated design.

2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C

3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635

B. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade copper with continuous wound construction

2. On three-phase units rated 75 kVA and below and single-phase units rated 37.5 kVA and below the core and coil assembly shall be completely encapsulated in a proportioned mixture of epoxy or resin and aggregate to provide a moisture proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level

3. On three-phase units rated 75 kVA and above and single-phase units rated37.55 kVA and above the coils assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture; the core shall be coated with HAPs (Hazardous Air Pollutants) free water reducible electrical varnish to give good corrosion resistance. The assembly shall be installed on vibration-absorbing pads

4. Terminals shall be welded to the leads of the coils for better conductivity, less maintenance, and lower risk of hot spots. Terminals shall not be spot welded or bolted to the coil leads.

C. Taps

1. Three-phase transformers rated 15 through 225 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage. Three-phase transformers rated greater than 225 kVA shall be provided with manufacturer's standard taps for that rating.

2. All single-phase transformers, and three-phase transformers rated below 15 kVA and above 500 kVA, shall be provided with the manufacturer's standard tap configuration.

D. Electrostatic Shielding

1. Where shown on the drawings, provide shielded isolation transformers with an electrostatic shield consisting of a single turn of aluminum placed between the primary and secondary winding and grounded to the housing of the transformer.

   a. Electrostatic shield shall provide primary to secondary winding capacitance between 24 and 18 picofarads over the range of 100 Hz to 20 kHz.

   b. Electrostatic shielding shall provide the following minimum attenuation when tested per MIL-Std-220A, Method of Insertion Loss Measurement, with matched impedance no load technique:

2. Common mode noise attenuation: Minus 80 dBA minimum at 0.1 kHz to 1.5 kHz; minus 55 dBA minimum at 1.51 kHz to 100 kHz.Normal mode (Transverse mode) noise attenuation: Minus 35dBA minimum at 1.5 kHz to 10 kHz.

E. Motor Drive Isolation

1. Where shown on the drawings, provide motor drive isolation transformers

2. Motor drive isolation transformers shall be designed for use with three-phase ac adjustable frequency drives 600 volts and below to provide isolation between the incoming line and drive circuitry. These drives minimize the line disturbances caused by SCR firing within the drive unit. Thermoguards shall be included in all motor drive isolation transformers to provide additional protection for the transformer from increased heating due to the non-sinusoidal characteristics of drive currents. The transformer shall provide reduced short-circuit currents and voltage line transients. The transformer shall be specifically sized to the drive kVA requirements dictated by the horsepower of the motor and, as such, will be mechanically braced to withstand the stress of current reversals and short-circuit currents associated with the specific drive kVA rating.

2.4 CONSTRUCTION – K-FACTOR TRANSFORMERS

A. Insulation Systems

1. Transformers shall be insulated with a UL recognized minimum 200 degrees C insulation system

2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient and a 24-hour average ambient of 30 degrees C

3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635

B. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade copper with continuous wound construction. The core shall provide reduced induced currents in the steel caused by the high ratios of peak-to-rms currents and voltages found in harmonic loads

2. The neutral bus shall be configured to accommodate 200% of the rated current

3. The coils assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture; the core shall be coated with HAPs (Hazardous Air Pollutants)

free water reducible electrical varnish to give good corrosion resistance. The assembly shall be installed on vibration-absorbing pads

C. Taps

1. Three-phase K-factor rated transformers through 225 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage. Three-phase transformers rated greater than 225 kVA shall be provided with the manufacturer's standard taps for that rating.

2. Single-phase K-factor rated transformers shall be provided with manufacturer's standard tap configuration

D. Electrostatic Shielding

1. Provide K-rated transformers with electrostatic shielding consisting of a single turn of aluminum placed between the primary and secondary winding and grounded to the housing of the transformer.

a. Electrostatic shield shall provide primary to secondary winding capacitance between 24 and 18 picofarads over the range of 100 Hz to 20 kHz.

b. Electrostatic shielding shall provide the following minimum attenuation when tested per MIL-Std-220A, Method of Insertion Loss Measurement, with matched impedance no load technique:

c. Common mode noise attenuation: Minus 80 dBA minimum at 0.1 kHz to 1.5 kHz; minus 55 dBA minimum at 1.51 kHz to 100 kHz.Normal mode (Transverse mode) noise attenuation: Minus 35dBA minimum at 1.5 kHz to 10 kHz.

2.5 CONSTRUCTION – HARMONIC MITIGATING TRANSFORMERS

A. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, non-aging electrical steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed.

2. The coils assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture; the core shall be coated with HAPs (Hazardous Air Pollutants) free water reducible electrical varnish to give good corrosion resistance. The internal core and coil assembly shall be installed on vibration-absorbing pads.

3. Transformers shall be of two-winding construction. The primary winding shall be a delta, three-wire connection and the secondary winding shall be wye-zigzag with a wye field connection.

4. Primary and secondary windings shall be wound of electrical grade copper with continuous wound construction. All terminals and bussing shall be copper.

5. Transformers shall be insulated with a UL recognized minimum 200 degrees C insulation system. Winding temperature rise shall not exceed 80 degrees C.

6. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24 hour average ambient of 30 degrees C.

7. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

8. Neutral conductor shall be copper and rated to carry 200% of normal phase current.

9. Windings shall have a BIL of 10 KV.

B. Taps

1. Three-phase harmonic mitigating transformers rated 15 through 225 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage. Three-phase transformers rated greater than 225 kVA shall be provided with manufacturer's standard taps for that rating.

C. Electrostatic Shielding

1. Harmonic mitigating transformers shall be provided with an independent, double, full-width electrostatic shield consisting of a single turn of copper placed between each primary and secondary winding and grounded.

   a. Electrostatic shield shall provide primary to secondary winding capacitance between 24 and 18 picofarads over the range of 100 Hz to 20 kHz.

   b. Electrostatic shielding shall provide the following minimum attenuation when tested per MIL-Std-220A, Method of Insertion Loss Measurement, with matched impedance no load technique:

   c. Common mode noise attenuation: Minus 80 dBA minimum at 0.1 kHz to 1.5 kHz; minus 55 dBA minimum at 1.51 kHz to 100 kHz.Normal mode (Transverse mode) noise attenuation: Minus 35dBA minimum at 1.5 kHz to 10 kHz.

2.6 HARMONIC TREATMENT

A. Harmonic Mitigating Transformers (HMTs) shall have a low Positive/Negative sequence impedance (between 4.6% and 7.2%) and low Zero-Sequence impedance/reactance (less than 0.55% and 0.47% respectively)

B. Triplen harmonics shall be treated in the secondary windings through flux cancellation and not coupled in to the primary delta winding.

C. 5^{th} and 7^{th} harmonic currents shall be treated through the pairing of phase-shifted transformers such that these harmonic currents subtract at the common bus feeding the transformers with harmonics produced by other similar sources.

D. Each of the transformers used to treat 5^{th} and 7^{th} harmonic currents shall also treat triplen harmonics in the secondary windings of each transformer.

E. Fundamental current imbalance shall be reduced on the primary when compared to the secondary load measurements.

F. Harmonic treatment shall be through electromagnetic means; filters, capacitors, power electronic circuitry or other such devices shall not be used to treat harmonics.

G. Thermal Sensors

1. When required, provide transformers with a thermal sensor set at 190 degrees C. Provide a second thermal sensor set at 175 degrees C when required. Thermal sensor(s) shall be factory-installed in the center coil of the transformer and factory-wired to a terminal strip. Thermal sensors shall consist of a set of dry contacts.

2.7 WIRING/TERMINATIONS

A. Recommended external cable shall be rated 90 degrees C (sized at 75 degrees C ampacity) for encapsulated and 75 degrees C for ventilated designs. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer.

2.8 ENCLOSURE

A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C per UL requirement. The core of the transformer shall be grounded to the enclosure.

B. On three-phase units rated 75 kVA and below and single-phase units rated 37.5 kVA and below the enclosure construction shall be encapsulated, totally enclosed, non-ventilated,NEMA 4X , with lifting provisions.

C. On three-phase units rated 75 kVA and above and single-phase units rated 37.5 kVA and above the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting provisions. All ventilation

openings shall be protected against falling dirt. On outdoor units, provide weathershields over ventilated openings.

D. Ventilated type transformers that meet 10 CFR Part 431 efficiency requirements, with a core size of 150 kVA or less, shall be suitable for installation with 2-inch clearance from a wall or other obstruction behind the transformer enclosure.

2.9 FINISH

A. Steel enclosures shall be finished with ANSI 61 color, weather-resistant enamel. Stainless steel enclosures shall not be painted.

2.10 OPTIONAL ACCESSORIES

A. On ventilated outdoor units provide suitable weathershields over ventilation openings.

B. Lug kits shall be provided by the Manufacturer of the transformer

C. Provide hinged, padlockable front cover to facilitate visual inspection and infrared scanning.

D. Provide infrared viewing windows of size and quantity to scan the terminals of the transformer.

E. Provide surge protective device rated 80 kA per phase integral to the transformer enclosure. The surge protective device shall be installed on the primary of the transformer. Provide an indicating light that is visible on the outside of the transformer enclosure that shows if the surge protective device is operating.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. Ratio tests at the rated voltage connection and at all tap connections
2. Polarity and phase relation tests on the rated voltage connection
3. Applied potential tests
4. Induced potential test
5. No-load and excitation current at rated voltage on the rated voltage connection

3.2 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

3.3 FIELD ADJUSTMENTS

A. Adjust taps to deliver appropriate secondary voltage.

3.4 FIELD TESTING

A. Measure primary and secondary voltages for proper tap settings.

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.2 REFERENCES

A. The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL as follows:

1. UL 67 – Panelboards
2. UL 50 – Cabinets and boxes
3. NEMA PB1
4. Fed. Spec. W-P-115C
5. UL98 – Fusible Switches

1.3 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Breaker layout drawing with dimensions indicated and nameplate designation
2. Component list
3. Conduit entry/exit locations
4. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
5. Cable terminal sizes
6. Product data sheets

1.4 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Installation information
3. Seismic certification and equipment anchorage details as specified

1.5 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.6 SQUAREGULATORY REQUIREMENTS

A. Panelboard overcurrent protective devices shall be selectively coordinated with all supply side overcurrent protective devices as required for this project by the National Electrical Code/NFPA 70 Articles 645.27, 700.27, 701.27 and 708.54.

B. The panelboards shall be UL labeled.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 - PRODUCTS

2.1 MAUFACTURERS

A. Eaton

B. Square D_____

C. Approved Equal_____

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 RATINGS

A. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or panelboard schedules, but not less than 10,000 amperes RMS symmetrical.

B. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings or panelboard schedules, but not less than 14,000 amperes RMS symmetrical.

C. Panelboards shall be labeled with a UL short-circuit rating. Series rated panelboards shall be provided with a label or manual stating the conditions of the UL series ratings. Information in the manual shall include, at minimum:

1. Size and type of upstream device

2. Branch devices that can be used

3. UL tested and listed series short-circuit rating

2.3 CONSTRUCTION

A. Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

B. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

D. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

F. All locks shall be keyed alike.

2.4 BUS

A. Main bus bars shall be tin-plated copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

B. A system ground bus shall be included in all panels.

C. Full-size (100%-rated) insulated stand-off neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200%-rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.5 BRANCH CIRCUIT PANELBOARDS – CIRCUIT BREAKER

A. The minimum short-circuit rating for branch circuit panelboards shall be 10,000 amperes symmetrical at 240 volts, and 14,000 amperes symmetrical at 480 volts, or as indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton type Pow-R-Line 1X, Pow-R-Line 2X or Pow-R-Line 3X.

B. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

C. All circuit breakers shall be thermal-magnetic type with common handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame. Ratings through 100-ampere trip shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.

1. Circuit breaker handle locks (ON position) shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

2.6 BRANCH CIRCUIT PANELBOARDS – FUSIBLE

A. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton type Pow-R-Line 3FQS, Bussman Type QSCP, or engineer approved equal.

B. Panelboard shall have an integrated spare fuse compartment for up to (6) spare CUBEFuses as standard.

C. Branch circuit disconnecting means shall be bolt-on Bussmann Type CCPB with Bussmann Low-Peak CUBEFuses utilized for overcurrent protection. Ratings shall be available from 15-100A with minimum interrupting rating of 300kA symmetrical and 200kA short circuit current assembly rating.

D. Branch circuit devices shall include a non-defeatable interlock to prevent removal of fuse under load. Provide a fuse ampacity rejection feature to prevent overfusing of branch disconnect. Fuses shall be indicating type with permanently installed neon indicating light. Branch devices shall be finger-safe when panelboard trim is removed. Provide lockout/tagout provision for each branch circuit position.

2.7 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

A. Distribution panelboards equipped with bolt-on devices shall have interrupting ratings as indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton type Pow-R-Line 3X or Pow-R-Line 4X. Panelboards shall have molded case circuit breakers as indicated below.

B. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

C. Main breakers, if furnished, shall be equipped with microprocessor based trip units that have integral Arc Flash Reduction trip feature. The use of zone selective interlocking to emulate this function does not meet the intent of this specification and will not be allowed.

D. Distribution circuit breakers shall be fixed mounted type and equipped with either microprocessor based trip units or thermal magnetic trip units as scheduled on the contract drawings.

E. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

2.8 DISTRIBUTION PANELBOARDS – FUSIBLE SWITCH TYPE

A. Distribution panelboards shall be equipped with main and branch fusible switches and include fuses with ratings indicated on the drawings. Fusible distribution panelboards shall be Eaton type Pow-R-Line 4F.

2.9 PANELBOARD SUBMETERING

A. Where shown on the drawings, supply a UL listed microprocessor-based Multi-Point Metering System (MPM), Eaton type PX Multipoint Meter or approved equal having the specified features.

B. MPM shall have 60 channels for current sensor input. Meter shall auto-detect sensor rating and have standard tamper detection.

C. MPM shall calculate power and energy consumption in accordance with ANSI C12.20 (0.5%) metering specification and store metered data in nonvolatile memory.

D. MPM shall store the following per phase and system total for each metering point

1. Voltage, Current, and Frequency (system total only)
2. Watts, VAR, VA, and power factor
3. Watt hours including forward and reverse

E. MPM shall store energy profile information for each metering point in non-volatile memory. The demand profile time period shall be adjustable from 1, 5, 15, 30 and 60 minutes for fixed method and 1, 5, and 15 minutes for sliding method. The MPM shall have the ability to sync with external input to the on board demand input. The MPM shall be able to save a minimum of 1 year of load profile data for all 60 meter points on a 15 minutes basis.

F. MPM shall be provided with multiple communications ports and protocols, including the following capability:

1. RS-485 remote display port
2. RS-485 Modbus RTU
3. USB Local Configuration Port
4. HTML web pages
5. File transfer protocol (ftp)
6. RJ-45 10/100Base-T Ethernet network port
7. Modbus TCP
8. BACnet/IP
9. SMTP(Simple Mail Transfer Protocol) for email support
10. SNMP(Simple Network Management Protocol) MIB support
11. Ethernet TCP/IP
12. NTP(Network Time Protocol) support

2.10 SURGE PROTECTIVE DEVICES

A. SPD shall comply with ANSI/UL 1449 4th Edition or later listing by Underwriters Laboratories (UL).

B. SPD shall be factory installed integral to the panelboard by the original equipment manufacturer, and shall be a product of the same manufacturer as the panelboard and breakers.

C. The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

D. Electrical Requirements:

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards. End of life mode to be open circuit. Unit with end of life short-circuit mode are not acceptable.
4. Unit shall operate without the need for an external overcurrent protection device (OCPD), and be listed by UL as such. Unit must not require external OCPD or replaceable internal OCPD for the UL Listing.

5. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

6. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.

7. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

2.11 ENCLOSURE

A. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

B. Enclosures shall be provided with blank ends.

C. Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.12 NAMEPLATES

A. Provide an engraved nameplate for each panel section.

2.13 FINISH

A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.2 INSTALLATION

The contractors shall install all equipment per the manufacturer's Recommendations and the contract drawings.

SECTION 16477

FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED SECTIONS

Section 09900 - Painting: Painting of spare fuse cabinet.

1.3 REFERENCES

A. NFPA 70 - National Electric Code.

B. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data sheets showing electrical characteristics including time-current curves.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Record actual fuse sizes.

1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.8 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of Section 01700.

B. Provide two fuse pullers.

1.9 EXTRA MATERIALS

A. Furnish under provisions of Section 01700.

B. Provide three of each size and type fuse installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bussman.

B. Ferrule.

C. Substitutions: Under provisions of Section 01600.

2.2 FUSE REQUIREMENTS

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Main Service Switches Larger than 600 amperes: Class L (time delay).

D. Main Service Switches: Class RK1 (time delay).

E. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).

F. Power Load Feeder Switches: Class RK1 (time delay).

G. Motor Load Feeder Switches: Class RK1 (time delay).

H. Lighting Load Feeder Switches Larger than 600 amperes: Class L time delay.

I. Lighting Load Feeder Switches: Class RK1 (time delay).

J. Other Feeder Switches Larger than 600 amperes: Class L time delay.

K. Other Feeder Switches: Class RK1 (time delay).

L. Power Branch Circuits: Class RK1 (time delay).

M. Motor Branch Circuits: Class RK1 (time delay).

N. Lighting Branch Circuits: Class G.

2.3 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet, suitably sized to store spare fuses and fuse pullers specified.

B. Doors: Hinged, with hasp for Owner's padlock.

C. Finish: Prime finish for field painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions.

B. Install fuse with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

SECTION 16482

MOTOR CONTROL CENTERS – LOW VOLTAGE (FREEDOM)

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the motor control centers as specified herein and as shown on the contract drawings.

1.2 RELATED SECTIONS

A. Section 16475 – Circuit Breakers and Fusible Switches

B. Section 16481 – Motor Starters and Overload Relays – Low Voltage

C. Section 16483A, B, C, & D – Adjustable Frequency Drives

D. Section 16671A – Transient Voltage Surge Suppression

E. Section 16901 – Microprocessor-Based Metering Equipment

F. Section 16902 – Electric Control Devices

G. Section 16903 – Protective Relays

H. Section 16906 – Logic Controllers

I. Section 16911 – Power Management Systems and Products

1.3 REFERENCES

A. The Motor Control Centers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA, ANSI and UL 845.

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Master drawing index
2. Front view elevation
3. Floor plan
4. Top view
5. Unit wiring diagrams
6. Nameplate schedule
7. Starter and component schedule
8. Conduit entry/exit locations
9. Assembly ratings including:
   a. Short-circuit rating
   b. Voltage

c. Continuous current

10. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
11. Cable terminal sizes
12. Product data sheets

B. Where applicable the following information shall be submitted to the Engineer:
1. Busway connection
2. Connection details between close-coupled assemblies
3. Key interlock scheme drawing and sequence of operations

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:
1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Unit wiring diagrams
3. Certified production test reports
4. Installation information
5. Seismic certification and equipment anchorage details as specified

1.6 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.7 REGULATORY REQUIREMENTS

A. The motor control centers shall bear a UL label.

1.8 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.9 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton

B. Square D_____

C. Approved Equal_____

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the engineer ten (10) days prior to bid date.

2.2 RATINGS

A. The Motor Control Center(s) shall be 600-volt class suitable for operation on a three-phase, 60 Hz system. The system operating voltage and number of wires shall be as indicated on the drawings.

2.3 CONSTRUCTION

A. Motor Control Center(s) shall be equal to Eaton type F2100 design.

B. Structures shall be totally enclosed, dead-front, free-standing assemblies. They shall be 90 inches high and 21 inches deep for front-mounted units and 21 inches deep for back-to-back mounted units. Structures shall contain a horizontal wireway at the top 9inches tall, isolated from the horizontal bus via metal barriers and shall be readily accessible through a hinged cover. Structures shall also contain a horizontal wireway at the bottom 9 inches tall that is open to the full rear of the structure. Adequate space for conduit and wiring to enter the top or bottom shall be provided without structural interference.

C. Compartments for mounting control units shall be incrementally arranged such that not more than six (6) Size 1 or Size 2 starters for front-mounted only can be mounted within each vertical structure. Guide rails shall be provided.

D. A vertical wireway with minimum of 35 square inches of cross-sectional area shall be adjacent to each vertical unit and shall be covered by a hinged door. Wireways shall contain steel rod cable supports.

E. All full voltage starter units through NEMA Size 5 and all feeder breakers through 400 Amp shall be of the draw-out type. Draw-out provisions shall include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Draw-out units shall have a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend outside of the draw-out unit. Interior of all units shall be painted white for increased visibility. Units shall be equipped with side-mounted, positive latch pull-apart type control terminal blocks rated 600 volts. Knockouts shall be provided for the addition of future terminal blocks. In addition, a master terminal block, when Type C wiring is specified, shall be draw-out and shall be located in the top wireway, readily accessible through a hinged cover. All control wire to be 14 gauge minimum.

F. All draw-out units shall be secured by a spring-loaded, quarter turn, indicating type fastening device located at the top front of the unit. With the exception of the dual-mounted units, each unit compartment shall be provided with an individual front door.

G. An operating mechanism shall be mounted on the primary disconnect of each starter unit. It shall be mechanically interlocked with the unit door to prevent access, unless the disconnect is in the “OFF” position. A defeater shall be provided to bypass this interlock. With the door open, an interlock shall be provided to prevent inadvertent closing of the disconnect. A second interlock shall be provided to prevent removal or reinsertion of the unit while in the “ON” position. Padlocking facilities shall be provided to positively lock the disconnect in the “OFF” position with

up to three (3) padlocks with the door open or closed. In addition, means shall be provided to padlock the unit in a partially withdrawn position with the stabs free of the vertical bus.

2.4 BUS

A. Each structure shall contain a main horizontal silver-plated copper bus, with minimum ampacity of 600 amperes or as shown on the drawings. The horizontal bus shall be rated at 65 degrees C temperature rise over a 40 degrees C ambient in compliance with UL standards. Vertical bus feeding unit compartments shall be tin-plated copper and shall be securely bolted to the horizontal main bus. All joints shall be front-accessible for ease of maintenance. The vertical bus shall have a minimum rating of 600 amperes or as shown on the drawings. Both vertical and horizontal bus shall be fully rated; but shall not be tapered. Tapering of vertical bus via a center feed is not acceptable. Both top and bottom of this type bus must be individually fully rated.

B. Isolation of the vertical bus compartment from the unit compartment shall be by means of a full height insulating barrier. This barrier shall be a single sheet of glass-reinforced polyester with cutouts to allow the unit stabs to engage the vertical bus every 6 inches. Provide snap-in covers for all unused openings.

C. Buses shall be braced for 65,000amperes RMS symmetrical.

D. A silver-plated copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the motor control center. The ground bus shall be located in the bottom horizontal wireway.

E. Each structure shall contain tin-plated vertical ground bus rated 300 amperes. The vertical ground bus shall be directly connected to the horizontal ground bus via a tin-plated copper connector. Units shall connect to the vertical bus via a tin-plated copper stab.

2.5 WIRING/TERMINATIONS

A. Wiring shall be NEMA Class I Type B.

2.6 MOTOR CONTROLLERS

A. Combination starter units shall be full-voltage non-reversing, unless otherwise shown, and shall utilize Eaton type HMCP Motor Circuit Protectors.

1. Each combination unit shall be rated 65,000 IC symmetrical at 480 Volt. The HMCP shall provide adjustable magnetic protection and be adjustable to 1700% motor nameplate full load current to comply with NEC requirements. All HMCP combination starter units shall have a “tripped” position on the unit disconnect and a push-to-test button on the HMCP. Type HMCP motor circuit protectors through size 4 shall include transient override feature for motor inrush current.

B. Motor Starters

1. Magnetic starters through NEMA Size 9 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring. Each starter shall have a minimum of one (1) normally open auxiliary contact

2. Coils shall be of molded construction through NEMA Size 9. All coils to be color-coded through size 5 and permanently marked with voltage, frequency and part number

3. Solid-State Motor Management Relay- C445

a. Where indicated on the drawings, provide a microprocessor-based Overload Relay (OLR) in each starter and/or where indicated on the drawings for protection, control and monitoring of the motors. The OLR shall be Eaton type C445 (Power Xpert) relay. The OLR shall meet UL 60947-4-1, IEC/EN 60947-4-1, IEC/EN 60947-5-1, EN 60947-8, ATEX 95, and CSA 22.2 #60947-4-1 standards

b. The OLR shall offer a flexible modular form factor where sensing and protection are broken out in order to provide the most compact configuration possible

c. The relay shall not require external current transformers for applications up to 136 amperes for motors rated less than 600 Vac. Where larger motors are involved, external current transformers shall be used.

d. The OLR shall provide both protection and control functionality. OLR shall provide pre-defined operation modes which define input and output behavior if used. The following functionality shall support protection and control.

1. 1— One primary Fault relay, NO contact with a rating code of B300 per UL 60947-4-1 to be used for both protection and optional control of motor contactor or MCCB

2. 1— A second output relay, NO contact with rating code of B300 per UL 60947-4-1 to be used in providing both protection and optional control of a second contactor or MCCB when used in wye/delta, two speed, auto-transformer and HMCP/MCCB applications. Output to be available for general purpose use if not required by application.

3.1— A third output relay, NO/NC Form C output contact with rating code of B300 per UL 60947-4-1 that can be used in providing both protection and optional control of a third contactor when used in wye/delta, two speed dahlander, and auto-transformer applications. Output to be available for general purpose use if not required by application

4. 1— An input able to accept 120Vac or 24Vdc run or start signal from local or remote fieldwire control source when required

5.1— An input able to accept 120Vac or 24Vdc permissive signal from local or remote fieldwire control source when required. Input to be available for general purpose use if 3-wire control is not used

6.1— An input able to accept 120Vac or 24Vdc reset signal from local or remote fieldwire control source when required

7.1— An input able to accept 120Vac or 24Vdc remote signal from local or remote fieldwire control source when required

8. 1— Trip status indicator

9.1— Ability to run 2-wire or 3-wire control schemes

10.1— Ability to accept local control signals from a user interface or fieldwiring

11.1— Ability to accept remote control signals from a fieldbus network or fieldwiring

e. The OLR shall be capable of accommodating external current transformers with ranges from 300:5, 600:5, and 800:5 amperes. Provide three (3) current transformers sized per manufacturer's recommendations based on motor full-load amperes and service factor.

f. The OLR shall accept 24 Vdc control power. The OLR shall be suitable for application from 20-80 Hz.

g. The OLR shall have selectable trip classes 5-40.

h. The OLR shall be equipped with an operator-interface (OI)/ display interface panel that is safely, remote mountable on the panel door. The OI shall have the following features for control, monitoring, programming and diagnostics

1.1— Status LEDs that indicate a FAULT or WARN condition

1.2— Monitoring window to display current, voltage, power, thermal and other motor system parameters with no network or setup required

1.3— Ability for customer to fully program and customize the device using only the user interface

1.4—Setup Wizard for fast commissioning

1.5—Running, Stopped and Auto Status LEDs with user selectable LED color schemes

1.6—Complete fault description on screen if fault event occurs

1.7—Access to 10 fault queue and trip snapshot

1.8—Dedicated Reset button, that may be disabled if desired

1.9—Optional Local Control functionality that is automatically customized based on operation mode without the need for multiple part numbers or user applied stickers, marking or programming

1.10—Powered off the base device, with no separate power source required

1.11—Optional local password protection

1.12—Micro-USB port for connection to PCs

i. The OLR shall protect and monitor the following conditions. Where applicable, all protection types will offer both trip and alarm settings with uniquely settable delays.

   1) Motor Protection consisting of**:**

      a) Thermal overload

      b) Instantaneous overcurrent

      c) Jam

      d) Stall

      e) Undercurrent

      f) Current unbalance

      g) Current phase loss

      h) Ground fault

      i) Allowed starts per hour

      j) Optional PTC protection (Positive Temperature Coefficient)

   2) Load protection consisting of:

      a) Low power

      b) High power

      c) Power Factor Deviation

   3) Line Protection consisting of**:**

      a) Phase Rotation

      b) Over-voltage

      c) Under-voltage

      d) Voltage unbalance

      e) Phase loss

f) Frequency deviation (fast and slow)

g) Voltage loss restart algorithm providing automatic staggered restart of motors during a voltage loss conditions offering (3) user settable time intervals and individual re-start delays

j. The OLR shall have the following monitoring capabilities:

1) Current—Average and phase RMS

2) Current unbalance %

3) Ground fault current

4) Average motor current as % of FLA

5) Maximum motor starting current

6) Voltage—Average line-to-line and L1-L2, L2-L3, L3-L1

7) Voltage unbalance %

8) Power—Motor kW, VA, VARs, real energy, apparent energy, reactive energy, peak demand

9) Power factor

10) Motor speed in RPM

11) Motor torque

12) Thermal memory %

13) Frequency

14) Motor state

15) Operating seconds (total and resettable)

16) Time to trip and reset

17) PTC status

18) Motor run time (total and resettable)

19) Last measured starting time

20) Number of starts (total and resettable)

21) Number of contactor operations last hour

22) Latest run time

k. The OLR shall record the following data on fault conditions

1) Active fault

2) Active warning

3) Active inhibit

4) Fault Queue – A list of last 10 faults shown in the order they occurred

5) Trip snapshot – 12 recorded parameters at time of trip for last trip (current and voltage each phase, ground current, frequency, thermal memory, VA, watts, power factor), optionally time stamped

l. The OLR shall provide the following communications without increasing the footprint of the device or requiring a separate power source. The OLR shall provide the user the option to configure communication loss behavior to trip or hold last state.

1) On-board Modbus Serial

2) [PROFIBUS communication port with support for DVP0 and DVP1 messages] or [Ethernet communication ports with support for Ethernet/IP and ModbusTCP messaging and web pages. Ethernet will be in the form of a 2 port switch with port forwarding allowing configuration in star, redundant ring topologies, and redundant master topologies.]

3) USB for connection to a PC for commissioning and monitoring

4) Free software tool for commissioning and monitoring, which allows the user to save configuration files

5) Embedded web pages (with Ethernet option)

m. The OLR shall provide the following optional functionality

1) Real time stamping

2) Memory backup module that saves all configuration data to non-volatile memory and copies that data to a new device in the event of device replacement

3) Four versions of optional password protection – Administrator, USB lockout, Running Lock and User Interface

4. NEMA Size 00 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any arrangement normally open or normally closed. Size 3 through 8 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any arrangement normally open or normally closed

5. Motor starters shall be Eaton FREEDOM Series or approved equal

C. Each starter shall be equipped with a fused control power transformer, two (2) indicating lights, Hand-Off-Auto (HOA) selector switch, and two (2) normally open contacts, unless otherwise scheduled on the drawings. A unit-mounted device panel shall have space to accommodate six (6) 30 mm oil-tight pilot-control devices or indicating ammeters, voltmeters, or elapsed time meters. In order to improve maintenance capabilities, the device panel shall withdraw with the unit. Door-mounted pilot devices are not acceptable.

D. Solid-state reduced-voltage starters, Eaton type S811 shall be provided where shown on the contract drawings. The solid-state reduced-voltage starter shall be UL and CSA listed in the motor control center, and consist of an SCR-based power section, logic board and paralleling bypass contactor. The paralleling bypass contactor shall be energized when the motor reaches full speed. Each solid-state reduced voltage starter shall have an addressable communication card capable of transmitting control and diagnostic data over an open network to either a personal computer or Logic Controller via network translator to DeviceNet with I/O, Modbus 485, Modbus 485 with I/O, Modbus TCP with I/O or Ethernet IP with I/O.

E. Circuit Breakers

1. Individual feeder breakers shall have a minimum interrupting capacity of 65 kAIC at rated voltage or as scheduled on the drawings.

F. Fusible Switches

1. Individual feeder switches shall be quick-make, quick-break gang-operated type, utilizing Class [R] [J] fuse clips. The fused switch shall be rated 100 kAIC at rated voltage.

2.7 AUTOMATIC INSULATION TESTER

A. Automatic insulation testers shall be provided for individual MCC motor starter units where indicated on contract documents. The insulation tester shall be rated for 600 VAC, 60 Hz, motor circuits. When equipment motor is de-energized, the automatic insulation tester shall automatically apply a 500VDC potential at a current-limited, operator-safe, maximum amperage of 200 micro-amperes to "megger" the insulation of the motor windings and the insulation of the circuit between the automatic insulation tester and the motor. The automatic insulation tester shall have a 10-second time delay before alarm circuit will activate. The insulation tester shall have an input of 120 VAC, 60 Hz and be interlocked with the starter such that the insulation tester will continuously monitor the integrity of the insulation during the period that the equipment motor is de-energized, and upon detection of a leakage current to ground the insulation tester shall provide a visual alarm indication. When the equipment motor is energized, the insulation tester shall be interlocked with the starter to automatically stop testing and be automatically disconnected from the circuit. Insulation tester shall be equipped with 1 (one) Form C latching alarm contact for remote alarm status. Insulation tester shall be provided with a manual reset button and a "test-on" and "alarm" LED display. Automatic insulation tester shall be Eaton Catalog No. MGRDGP500-E. A 2 % analog door-mount meter with a color coded dial and a 0 – 200 meg-ohm scale shall be provided for insulation test indication. The meg-ohm meter shall be Eaton Catalog No. MGRDGP500-E1. An additional 6" of space shall be allowed for this option in size 1 and 2 starters.

2.8 VOLTAGE PRESENCE INDICATOR

A. Voltage Presence Indicators shall be provided on the unit door of MCC starter and feeder units as per contract documents. The voltage presence indicator shall be a hardwired voltmeter or voltage detector connected to the load side of the main incoming disconnect, and shall provide a "through-door" visual indication at the MCC unit door of any voltage presence in any individual phase to enable operators to "pre-verify" voltage presence while the MCC unit door is safely closed. The voltage presence indicator shall be equipped with an adapter to enable installation in a 30mm device-panel on the MCC unit or any other standard 30mm pilot device knockout. The voltage presence indicator shall be of potted construction with 6-foot leads and equipped with dual redundant circuitry to ensure reliability. The voltage presence indicator shall also be phase insensitive, UL type 4X listed and have immunity to high surges. The voltage presence indicator shall be Eaton "VoltageVision™" Catalog No. R-3W.

2.9 FIELDBUS COMMUNICATIONS

A. MODBUS SERIAL DEVICES

1. Motor Control Center assemblies shall be provided with a factory assembled Modbus RTU field bus communications network providing direct connectivity between MCC devices and the system controller and/or HMI.

2. The Modbus RTU system installed in the MCC shall include a complete and tested cabling system compliant and approved by Modbus standard. The cabling system shall be a daisy chain using shielded twisted pair cable between each Modbus RTU device. The Modbus RTU cabling shall be 600 Volt insulation and include electrical shielding, non-standard, non-shielded cable will not be accepted.

3. Each shipping split of motor control shall allow for the Modbus RTU cable to be disconnected for shipment and then reconnected during installation. All cabling shall be securely supported and attached to the MCC structure in accordance with the contract drawings and the manufacturer's recommendations.

4. Modbus RTU communications modules shall be provided at each device interfacing to the Modbus RTU field bus. The communications modules shall be installed in the unit device compartment or bucket, and shall be direct-connected to the Modbus RTU communication cable. Each device shall be provided with the appropriate factory fabricated cable for interfacing the communications module with the associated Modbus RTU device.

5. Operator interface unit(s) shall be an Eaton XP Series or approved equal. Operator interface units shall be able to display the following: starter status, three-phase current, control voltage, overload condition (alarm), cause of device trip, operations count, run time, set points, starter description and identification, and system process graphics screens. Operator interface shall have the capability of communicating on the Modbus RTU network.

B. ETHERNET/IP DEVICES

1. Motor Control Center assemblies shall be provided with a factory assembled EtherNet/IP field bus communications network providing direct connectivity between MCC devices and the system controller and/or HMI.

2. Ethernet 10/100 auto negotiate layer 2 managed industrial switches shall be provided as required in the MCC lineup. The Ethernet switch shall have sufficient ports available to connect to each EtherNet/IP device and have at least 2 open ports for a customer connection and a PC connection for maintenance. The Ethernet switch shall be mounted in the top removable unit of each vertical section or shipping split and not in the vertical wireway. If required by the application, the switch shall be capable of connecting to multiple sections.

3. The EtherNet/IP system installed in the MCC shall include a complete and tested cabling system. The cabling system shall be 600V Cat 5 and consist of home run connections from the device to a switch located in the MCC and in accordance with the ODVA specification. Non-standard, non-shielded cable will not be accepted.

4. It shall be permissible to daisy chain Ethernet/IP devices using a 2-port switch configuration in each device unit or bucket and not use the home run topology.

5. All cabling shall be securely supported and attached to the MCC structure in accordance with the contract drawings and the manufacturer's recommendations.

6. EtherNet/IP communications modules shall be provided at each device interfacing to the EtherNet/IP field bus. The communications modules shall be installed in the unit device compartment or bucket, and shall be direct-connected to the EtherNet/IP Ethernet cable. Each device shall be provided with the appropriate factory fabricated cable for interfacing the communications module with the associated EtherNet/IP device.

7. Operator interface unit(s) shall be an Eaton XP Series or approved equal. PanelMate [Power] [ePro] Series. Operator interface units shall be able to display the following: starter status, three-phase current, control voltage, overload condition (alarm), cause of device trip, operations count, run time, set points, starter description and identification, and system process graphics screens. Operator interface shall have the capability of communicating on the EtherNet/IP network.

2.10 MISCELLANEOUS DEVICES

2.11 INCOMING FEEDER TERMINATIONS AND DEVICE

A. Incoming cable shall terminate within the control center on a main breaker termination point. Main lug terminations shall have adequate dedicated space for the type and size of cable used and the lugs shall be compression-type] with anti-turn feature. Main breakers shall be provided as indicated on the drawings and shall be molded case.

2.12 OWNER METERING

A. Where indicated on the drawings, provide a separate, owner metering compartment with front hinged door.

B. Provide as a minimum of three (3) current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.

C. Provide potential transformers including primary and secondary fuses with disconnecting means for metering as shown on the drawings.

D. Web-Enabled Communications

1. Where indicated on the drawings, provide a separate compartment with a front facing hinged door as a central point of connection for all internally located communicating devices to an external Ethernet network and allow close monitoring of the power infrastructure with real-time, web-enabled data.

2. The compartment shall have a lockable, hinged door with a functional through-the-door RJ45 network access port. Power for the components in the compartment shall be supplied by a pre-wired, bus-connected control transformer in the compartment that is fused and has a disconnecting means.

3. The included communications components shall be a [Power Xpert Ethernet Switch(es)] [Power Xpert Gateway(s)], which [is] [are] specified in Section 16911-1(should specify paragraphs in the section.

2.13 ENCLOSURES

A. The type of enclosure shall be in accordance with NEMA standards for type 12 dust-tight and drip-proof. All enclosing sheet steel, wireways and unit doors shall be gasketed.

2.14 NAMEPLATES

A. Each unit will have a 1.0 x 2.5-inch engraved nameplate. The lettering shall be 3/16-inch high, black on a white background.

2.15 FINISH

A. The control center shall be given a phosphatizing pretreatment. The paint coating shall be a polyester urethane, thermosetting powder paint. Manufacturer's standard color shall be used. All structural steel and panels will be painted.

B. The control center finish shall pass 600 hours of corrosion-resistance testing per ASTM B 117.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. Representative motor control centers shall have been tested in a high-power laboratory to prove adequate mechanical and electrical capabilities.

B. All factory tests required by the latest ANSI, NEMA and UL standards shall be performed.

C. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.2 FIELD QUALITY CONTROL

A. Provide the services of a qualified factory-trained manufacturer's representative to perform startup of the equipment specified under this section for a period of __5__ working days.

B. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative:

1. Rig the MCC assembly into final location and install on level surface

2. Check all removable cells and starter units for easy removal and insertion

3. Perform insulation tests on each phase and verify low-resistance ground connection on ground bus

4. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.3 TRAINING

A. The Contractor shall provide a training session for up to five (5) owner's representatives for __2__ normal workdays at the job site or other office location chosen by the owner.

B. A manufacturer's qualified representative shall conduct the training session.

C. The training program shall consist of the following:

1. Review of the MCC one-line drawings and schedules

2. Review of the factory record shop drawings and placement of the various cells

3. Review of each type of starter cell, components within, control, and power wiring

4. Review contactor coil replacement and contact replacement procedures

5. Discuss the maintenance timetable and procedures to be followed in an ongoing maintenance program

6. Provide three-ring binders to participants complete with copies of drawings and other course material covered

3.4 EXAMINATION

A. Contractor shall fully inspect shipments for damage and report damage to manufacturer and file claim upon shipper, if necessary.

B. Contractor shall supply overload relay heater ratings that are properly sized and coordinated for each motor starter unit.

3.5 INSTALLATION

A. Contractor shall follow the installation instructions supplied by the manufacturer.

B. Control wiring shall be as shown on the contract drawings except as modified by the approval and submittal process. Interface all local and remote devices into the control wiring and operational systems for each load.

C. As Shown on the contract drawing, Contractor is to provide all DeviceNet trunk and drop cabling with threaded, sealed and keyed device taps external to the MCC.

3.6 FIELD ADJUSTMENTS

A. The Contractor shall perform field adjustments of the short circuit and overload devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, protective device coordination study, manufacturer's instruction leaflets, and the contract documents.

3.7 FIELD TESTING

A. Contractor is responsible for generation of a field report on tests performed, test values experienced, etc., and make the report available to owner upon request.

SECTION 16483

VARIABLE FREQUECY DRIVES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. General: This specification defines the minimum requirements for Variable Frequency Drives (VFD) and accessories for speed control of either constant or variable torque loads.

B. Related Work: None.

1.2 REFERENCES

A. UL 508C

B. CE

C. NEC

D. Canadian Underwrites Laboratory (C_{UL})

E. ISO 9001

F. IEEE519-1992

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Danfoss VLT® AQUA Series VFD (Variable Frequency Drive)

2.2 GENERAL

A. Furnish complete VFD as specified herein or in the equipment schedule for loads designated to be variable speed. VFD's shall be user-selectable for either constant or variable torque loads.

B. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD shall be a six-pulse input design, and the input voltage rectifier shall employ a full wave diode bridge; VFD's utilizing controlled SCR rectifiers shall not be acceptable. The output waveform shall closely approximate a sine wave. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.

C. The VFD shall include a full-wave diode bridge rectifier and maintain a displacement power factor of near unity regardless of speed and load.

D. The manufacturer of the VFD shall demonstrate a continuous period of manufacturing and development of VFD's for a minimum of 40 years. VFD's that are brand-labeled are not acceptable.

E. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.

F. The VFD shall utilize VVC^{PLUS}, an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. VVC^{PLUS} provides rated RMS fundamental voltage from the VFD. This allows the motor to operate at a lower temperature rise, extending its thermal life. VFD's that cannot produce rated RMS fundamental output voltage or require the input voltage to be increased above motor nameplate value to achieve rated RMS fundamental output voltage are not acceptable. VFD's that utilize Sine-Coded PWM or Look-up tables shall not be acceptable.

G. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis, and be capable of running the motor at its nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.

H. The VFD shall offer a programmable motor parameter that allows the total number of poles of a motor to be programmed to optimize motor performance.

I. VFD shall automatically boost power factor at lower speeds.

J. The VFD will be capable of running either variable or constant torque loads. In variable torque applications, the VFD shall provide a CT-start feature and be able to provide full torque at any speed up to the base speed of the motor. In either CT or VT mode, the VFD shall be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.

K. An Automatic Energy Optimization (AEO) selection feature shall be provided in the VFD to minimize energy consumption in variable torque applications. This feature shall optimize motor magnetization voltage and shall dynamically adjust output voltage in response to load, independent of speed. Output voltage adjustment based on frequency alone is not acceptable for single motor VT configurations.

L. For multi-motor variable torque configurations, user-selectable load profile curves including VT-High, VT-Medium, and VT-Low shall be provided to ensure easy commissioning and improved energy efficiency. VFD's requiring the operator to assign load torque data-points to create a V/Hz profile, are not acceptable.

M. An initial ramp function shall be available to provide a user-selectable ramp, up to 60 seconds, for applications requiring a faster or slower ramp than the normal ramp.

N. A Dual Ramp Down feature shall include a Check Valve Ramp Down and a final Ramp feature. The Check Valve Ramp Down shall be programmable to gently seat a check valve and reduce the potential of damage from excess pressure while shutting-down the system. Both time and end speed shall be programmable. On the Final Ramp, the VFD shall be programmable to quickly stop the motor after seating of a check valve or for a more rapid stopping than the normal ramp down setting.

O. An Autotuning PI controller output feature shall provide automated PI controller settings. Once the user accepts the settings, the VFD will save the settings to memory.

P. An empty pipe fill mode shall be available to fill an empty pipe in a short period of time, and then revert to the PID controller for stable operation. Pipe fill mode shall have a programmable time to reduce water hammer in the system or fill the pipe at a unit per time rate.

Q. VFD shall offer a motor spinning test that will run the motor at 5 Hz until the OK button is pressed. This feature will allow the user to determine if the motor is running in the correct direction.

R. An embedded cascade pump controller shall be included to provide lead pump alternation and provide control for up to 3 total pumps. The VFD Pump and 2 other pumps can be controlled either by a starter or softstarter.

S. Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.

T. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.

U. An Automatic Motor Adaptation (AMA) function shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to spin the motor shaft or de-couple the motor from the load to accomplish this optimization. Additionally, the parameters for motor resistance and motor reactance shall be user-programmable.

V. The VFD shall have temperature controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life. The VFD shall be equipped with an intelligent heat management system and will remove 85% of the heat losses via finned heat sinks, which transfer the heat to the back-channel cooling air. This back-channel shall be separated from the electronics area by an NEMA 12/IP54 seal in an effort to reduce contamination of the control electronics area, resulting in longer life and higher reliability. The remaining 15% of heat losses shall be removed from the control electronics area using lower-volume door fans. The VFD shall be designed to remove the excess heat from the backchannel to be either dispersed into the control room or it can be directly removed from the building via added ductwork.

W. VFD shall provide full torque to the motor, given input voltage fluctuations of up to +10% to -10% of the rated input voltage (525 to 690VAC, 380 to 480VAC, or 200 to 240VAC). Line frequency variation of ± 2% shall be acceptable.

2.3 HARMONICS

A. The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to increase Capacitor life. VFD's without a DC link reactor shall provide a 5% impedance line side reactor and provide spare capacitors.

B. The VFD shall be provided with line-side harmonic reduction, as required, to insure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met. PCC_1, defined as the low voltage side of the distribution transformer, is used for purposes of calculation and referred, by the turns ratio of the transformer, to the PCC defined by the IEEE Recommended Practices as the Consumer-Utility interface. The tables of limits set forth therein are with reference to the PCC (primary side of the main transformer).

C. Harmonic solutions shall be designed to withstand up to 2% line imbalances with the maximum Current Distortion not to exceed 11% at 100% load.

D. Harmonic solutions shall be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.

E. To ascertain the harmonic contribution of the VFD's at the PCC and to show compliance with IEEE 519-1992, harmonic analysis shall be performed and submitted with the bid package, provided that the VFD vendor is in receipt of the below listed information 10 working days prior to the bid date.
   1. kVA rating of the low voltage distribution transformer(s)
   2. X/R Ratio of utility low voltage distribution transformer(s)
   3. Primary voltage
   4. Secondary voltage
   5. Secondary %IZ (impedance)
   6. Length, size, & number of conductors between transformer LV side and distribution panel
   7. System Single Line Diagram and electrical equipment list showing transformer and VFD detail

8. Total linear load kW to be connected to the distribution transformer
9. Anticipated maximum demand load (15 minute or 30 minute) on the distribution transformer (IEEE 519)

2.4 PROTECTIVE FEATURES

A. VFD shall have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec.

B. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

C. VFD shall auto-derate the output voltage and frequency to the motor if an input phase is lost. This result will maintain operation without decreasing the life expectancy of the VFD. The use of this feature shall be user selectable and export a warning during the event.

D. Printed Circuit boards shall be conformal coated to reduce the corrosion effect from environmental gases and other conditions The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard and the VFD shall have an optional 61721-3-3, Class 3C3 coating available.

E. Automatic "No-Flow Detection" shall be available to detect a no-flow situation in pump systems where all valves can be closed. This shall be functional in closed loop control or when controlled by an external signal.

F. Dry-pump detection shall be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stoppred. A timer shall be included to prevent nuisance tripping.

G. End-of-Pump curve detection shall stop motor when the pump is operating outside of its programmed pump curve.

H. VFD shall provide a flow compensation program to reduce energy by adjusting the Setpoint to match changes in flow (friction loss). Flow compensation shall also operate in Cascade control mode.

I. VFD shall include current sensors on all three-output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

J. VFD shall auto-derate the output voltage and frequency to the motor in the presence of sustained ambient temperatures higher than the normal operating range, so as not to trip on an inverter temperature fault. The use of this feature shall be user-selectable and a warning will be exported during the event. Function shall reduce switching frequency before reducing motor speed.

K. VFD shall auto-derate the output frequency by limiting the output current before allowing the VFD to trip on overload. The speed of the load can be reduced, but not stopped.

L. The VFD shall have the option of an integral RFI filter. VFD enclosures shall be made of metal to minimize RFI and provide immunity.

M. The VFD shall have a motor preheat function with the ability to be programmed to induce a small amount of current to the motor whenever it is at rest. This will prevent condensation inside the motor and help to extend its life without the need for space heaters or other external equipment.

N. The VFD shall be provided with an optional enclosure that is IP-66/Nema 4X rated. A VFD that is mounted in a separate enclosure will not be acceptable. The enclosure shall be suitable for installations that require protection against windblown dust and rain or splashing water. All cast aluminum parts shall be powder-coated with a durable epoxy that is capable of withstanding harsh environments. All circuit boards shall be conformally coated to meet the requirements of the IEC61721-3-3, Class 3C2

specification.

O. Per Addendum No. 3, October 12, 2016 Part 2.4.O shall be added as follows: Due to motor lead lengths dv/dt filters will be required on the output side of VFD.

2.5 INTERFACE FEATURES

A. VFD shall provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD

B. VFD Keypad shall feature an INFO key that, when pressed, shall display the contents of the programming manual for the parameter that is currently viewed on the display. The description shall explain the feature and how the settings can be made by the operator.

C. VFD shall display all faults in plain text; VFD's which can display only fault codes are not acceptable.

D. The keypad shall feature a 6-line graphical display and be capable of digitally displaying up to five separate operational parameters or status values simultaneously (including process values with the appropriate engineering unit) in addition to Hand/Off/Auto, Local/Remote, and operating status.

E. Two lines of the display shall allow "free text programming" so that a site description or the actual name of the equipment being controlled by the VFD can be entered into the display.

F. Keypad shall provide an integral H-O-A (Hand-Off-Auto) and Local-Remote selection capability, and manual control of speed locally without the need for adding selector switches, potentiometers, or other devices.

G. All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.

H. VFD keypad shall be capable of storing drive parameter values in non-volatile RAM uploaded to it from the VFD, and shall be capable of downloading stored values to the VFD to facilitate programming of multiple drives in similar applications, or as a means of backing up the programmed parameters.

I. VFD Display shall have the ability to display 5 different parameters pertaining to the VFD or the load including: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of 92 different user-selectable parameters.

J. VFD display shall indicate which digital inputs are active and the status of each relay.

K. It shall be possible to toggle between three status read-out screens by pressing the [Status] key. Various operating variables, even with different formatting, can be shown in each status screen.

L. VFD display shall indicate the value of any voltage or current signal, including the engineering units of measurement, connected to the analog input terminals.

M. VFD display shall indicate the value of the current at the analog output terminals, including the engineering units of measurement.

N. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

O. Two-level password protection shall be provided to prevent unauthorized changes to the programming of the VFD. The parameters can be locked via a digital input and/or the unit can be programmed not to allow an unauthorized user to change the parameter settings.

P. A quick setup menu with factory preset typical parameters shall be provided on the VFD to facilitate commissioning. Use of macros shall not be required.

Q. A digital elapsed time meter and kilowatt hour meter shall be provided in the display.

R. VFD shall offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses. It shall be possible to program the clock for Daylight Saving Time / summertime, weekly working days or non-working days including 20 exceptions (holidays, etc.). It shall be possible to program a Warning in case the clock has not been reset after a power loss.

S. A battery back-up option shall be provided to maintain internal clock operation during power interruptions. Battery life shall be no less than 10 years of normal operation.

T. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes.

U. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.

V. There shall be six fully programmable digital inputs for interfacing with the systems external control and safety interlock circuitry. Two of these inputs shall be programmable as inputs or outputs.

W. The VFD shall have two analog signal inputs. Inputs shall be programmable for either 0 -10V or 0/4-20 Ma.

X. One programmable analog output shall be provided for indication of the drive status. This output shall be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal shall be 0/4-20 mA.

Y. The VFD shall provide two user programmable relays with 75 selectable functions. Two form 'C' 230VAC/2A rated dry contact relay outputs shall be provided.

Z. Floating point control interface shall be provided to increase/decrease frequency in response to external switch closures.

AA. The VFD shall accept a N.C. motor temperature over-temperature switch input, as well as possess the capability to accept a motor thermistor input.

BB. The VFD shall store in memory the last 10 faults with time stamp and recorded data.

CC. Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until isolation valves, seal water pumps or other types of auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

DD. The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port. Danfoss FC or ModBus RTU communications shall be integrally mounted.

EE. A Windows® compatible software program to display all monitoring, fault, alarm, and status signals shall be available. This software program shall allow parameter changes, storage of all VFD operating and setup parameters, and remote operation of the VFD.

2.6 ADJUSTMENTS

A. The VFD shall have an adjustable output switching frequency.

B. Four complete programming parameter setups shall be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to be programmed for up to four alternate control scenarios without requiring parameter changes.

C. In each programming set up, independent acceleration and deceleration ramps shall be provided. Acceleration and deceleration time shall be adjustable over the range from 0 to 3,600 seconds to base speed.

D. The VFD shall have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature shall offer a Semi-Automatic program to simplify the set-up.

E. VFD shall include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.

F. In each programming setup, independent current limit settings, programmable between 50% and 110% of the drives output current rating, shall be provided.

G. PID parameter settings shall be adjustable while the VFD is operating, to aid in tuning the control loop at start up. The VFD will also be capable of simultaneously displaying set-point reference and feedback values with appropriate engineering units, as well as output frequency, output current, and run status while programming the PID function.

H. The VFD will include a "loss of follower" function to detect the loss of process feedback or reference signals with a live-zero value and a user-selectable choice of responses (go to set speed, min speed, max speed, stop, stop, and trip).

I. A Sleep Mode function shall be provided to reduce wear and heating of the pump and other equipment in periods where system demand is minimal. This function will operate in both open and closed loop modes:
   1. In closed loop process control, when the output speed drops to a user-programmed minimum value ("sleep frequency") for a specified time ("sleep mode timer"), the drive will enter a sleep mode and either go into standby, or boost mode before entering standby. The drive shall automatically restart the motor once the output of the PID processor exceeds a programmable value "wake up frequency".
      a. Boost mode shall prevent short-cycling of the motor by temporarily adjusting the set-point by a user-programmable percentage. Upon reaching this value, the unit will go into standby.
   2. In open loop, the drive shall be capable of entering sleep mode if the input reference drops below a user-programmable value. When the input reference increases above a user-programmable reference, the drive will automatically start.

J. An integral motor alternation function shall be provided to enable the output of the drive to alternate between two motors. The alternation interval shall be user-programmable in hours. This function shall operate external relays as required to control the motor alternation sequence. A dwell time shall be integral to the function and can prevent damage to the motor contactors.

K. The VFD will include a user-selectable Reset function, which enables the selection of between zero and

twenty restart attempts after any self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload), or the selection of an infinite number of restart attempts. The time between restart attempts shall be adjustable from 0 through 600 seconds.

L. An automatic "on-delay" function may be selected from 0 to 120 seconds.

M. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.

N. VFD shall catch a rotating motor operating either in forward or reverse at up to full speed.

2.7 OPTIONS

A. Where required, other options such as soft-start bypass, shall be available as part of the package. Softstarters shall be fully digital, closed-loop (current ramp), with bypass capability, and be the Danfoss MCD Series.

B. Provide a manual bypass consisting of a door interlocked main fused-disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the drive. In the OFF position, the motor and drive are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the drive so that service can be performed. In BYPASS Position, a Danfoss MCD Softstarter will be in the circuit to allow the motor to avoid an across the line start. In the TEST position, the motor is operated at full speed from the AC line power. This allows the drive to be given an operational test while continuing to run the motor at full speed in bypass. Customer supplied normally closed dry contact shall be interlocked with the drives safety trip circuitry to stop the motor whether in DRIVE or BYPASS mode in case of an external safety fault.

C. VFD and all required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect. Semi-conductor rated fuses shall be included to provide additional equipment protection. The VFD shall be rated for 100,000 AIC when the manufacturer's recommended fuses are used. The VFD enclosure will be available as a NEMA 1, NEMA 12, NEMA 3R, or other rating(s) as required by the specification drawings. All enclosures shall be UL Listed, and assembled by the VFD manufacturer in an ISO 9001 registered facility.

D. The VFD shall have an optional pump controller to automatically stage and de-stage up to five (5) pumps in either standard cascade or leader follower mode, utilizing the VFD's PID loop controller feature to regulate either pressure, level, or flow in a system. The controller shall be compatible with systems having multiple VFD's, or with a VFD "master" and either soft starter or across-the-line follower units.

E. The VFD shall have an optional pump controller to automatically stage and de-stage up to eight (8) pumps in either standard cascade or leader follower mode, utilizing the VFD's PID loop controller feature to regulate either pressure, level, or flow in a system. The controller shall be compatible with systems having multiple VFD's, or with a VFD "master" and either soft starter or across-the-line follower units

F. VFD shall offer the ability to have back-up 24 VDC power to keep control logic powered in the event of a power failure. Back-up power shall keep communications, PID Loops, and drive logic operational until power is restored.

G. The VFD shall offer a relay option board that includes three additional Form 'C' 240V relays that are mounted inside the drive.

H. Printed Circuit boards shall be conformal coated to reduce the corrosion effect from environmental gases and other conditions The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard and the VFD shall have an optional 61721-3-3, Class 3C3 coating available..

I. The VFD shall offer an I/O board as an option that adds 3-digital inputs, 2-digital outputs, 2-analog inputs, and 1-analog output.

2.8 SERVICE CONDITIONS

A. The ambient operating temperature of the VFD shall be -10ºC to 50ºC (14 to 122°F), with a 24-hour average not to exceed 45ºC. Storage temperatures shall be -13° F (-25° C) to149/158° F (65/70° C).

B. 0 to 95% relative humidity, non-condensing.

C. Elevation to 3,300 feet (1000 meters) without derating.

D. VFD's shall be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -10% variations. Line frequency variation of ± 2% shall be acceptable.

E. No side clearance shall be required for cooling of the units.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers, catalog information and catalog cut-sheets for all major components.

B. All drawings shall be in an 8.5 X 11" reproducible format, and incorporate the manufacturer's title block on the drawing.

C. This specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

D. Three copies of all submittals shall be provided.

E. Submit a computer generated Harmonic Distortion Analysis for the jobsite location.

3.2 QUALITY ASSURANCE

A. The manufacturer shall be both ISO-9001 and ISO-14001 certified.

B. All products shall be CE marked; UL labeled, and meet the requirements of UL-508C and maintain ULc.

C. To ensure quality and minimize infant-mortality failures on the jobsite, each VFD shall be completely tested by the manufacturer. The VFD shall operate a dynamometer at full load and speed under elevated temperature conditions.

D. All optional features shall be functionally tested at the factory for proper operation.

E. Factory test documentation shall be available upon request.

3.3 EXAMINATION

A. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate EMT conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

B. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

3.4 START-UP AND WARRANTY

A. A factory-authorized service technician shall perform start-up on each drive. ("Start up" shall not include installation or termination of either power or control wiring.) The service technician shall perform start-up on up to 8 drives per day. Start-up costs provided with the bid shall include time and travel for the estimated number of visits required, but shall not be less than at least one half-day with travel. Additional labor or return trips to the site shall be billed at Danfoss' published straight-time rates. Upon completion, a start up service report shall be provided.

B. A 6-year On-site Drive ProTection factory warranty shall be provided such that the owner is not responsible for any warranty costs including travel, labor, parts, or other costs for a full 6 years from the date of manufacture of the Drive. Special one-off and depot warranty is not allowed. Warranty shall cover line anomalies including electrical issues, load anomalies, accidental exposure to elements or other acts of nature. The cost of the warranty shall be included in the bid along with documentation of the warranty program.

SECTION 16670

LIGHTNING PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

1.2 REFERENCES

A. LPI-175 - Lightning Protection Installation Standard.

B. LPI-176 - Lightning Protection System Material and Components Standard.

C. LPI-177 - Inspection Guide for LPI Certified Systems.

D. NFPA 78 - Lightning Protection Code.

E. UL 96 - Lightning Protection Components.

F. UL 96A - Installation Requirements for Lightning Protection Systems.

1.3 SYSTEM DESCRIPTION

Lightning Protection System: Conductor system protecting consisting of air terminals on roofs, roof-mounted mechanical equipment, chimneys and stacks, steeple, parapets, and penthouse roofs; bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors.

1.4 SUBMITTALS FOR REVIEW

A. Section 01300 - Submittals: Procedures for submittals.

B. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

C. Product Data: Provide dimensions and materials of each component, and include indication of listing in accordance with UL 96.

1.5 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Submittals for information.

B. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

C. Submit certificate of compliance from Lightning Protection Institute indicating approval of lightning protection systems.

1.6 PROJECT CLOSEOUT SUBMITTALS

A. Section 01700 - Contract Closeout: Submittals for project closeout.

B. Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 78.

B. Perform Work in accordance with UL 96A.

C. Perform Work in accordance with LPI-175 and provide LPI Certification .

D. Maintain one copy each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum three years documented experience and member of the Lightning Protection Institute.

B. Installer: Authorized installer of manufacturer with minimum three years documented experience and certified by the Lightning Protection Institute.

1.9 REGULATORY REQUIREMENTS

Product Listing: UL 96 and LPI-176.

1.10 FIELD MEASUREMENTS

Verify that field measurements are as indicated on shop drawings.

1.11 COORDINATION

A. Section 01039 - Coordination and Meetings.

B. Coordinate work with roofing and exterior and interior finish installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Advance Lightning Technologies, Inc.

B. Thompson Lightning Protection, Inc.

2.2 COMPONENTS

A. Air Terminals: Copper , solid.

B. Air Terminal for Chimney: Lead-coated copper.

C. Decorations: Ball.

D. Grounding Rods: Solid copper.

E. Ground Plate: Copper.

F. Conductors: Copper cable.

G. Connectors and Splicers: Bronze.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 78, UL 96A, and LPI-175.

B. Connect conductors using mechanical connectors. exothermic welding process. Protect adjacent construction elements and finishes from damage.

C. Bond exterior metal bodies on building to lightning protection system, and provide intermediate level interconnection loops 60 feet on center.

3.2 FIELD QUALITY CONTROL

A. Section 01400 - Quality Assurance: Field inspection, testing, and adjusting.

B. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and labeling of the lightning protection system in accordance with UL 96A.

C. Obtain the services of the Lightning Protection Institute to provide inspection and certification of lightning protection system in accordance with LPI-177.

SECTION 16671

TRANSIENT VOLTAGE SURGE SUPPRESSION (TVS)

PART 1 - GENERAL

1.1 SCOPE

The Contractor shall furnish and install the Transient Voltage Surge Suppression (TVS) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.

1.2 RELATED SECTIONS

A. Section 16426 – Switchgear

B. Section 16482 – Motor Control Centers

1.3 REFERENCES

A. The TVS units and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of the following:
   1. ULL Listed under ULL 1449, ULL 1363 and ULL 1283
   2. C.S.A. certified per C.S.A. 22.2

B. The ULL 1449 suppression voltage ratings (SAR) and C.S.A. label shall be permanently affixed to the TVS unit.

1.4 SUBMITTALS

A. The following information shall be submitted to the Engineer.
   1. Provide verification that the TVS device complies with the required ULL 1449 and ULL 1283 SAR.
   2. Provide actual let through voltage test data in the form of oscillograph results for both the ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (ringwave) tested in accordance with ANSI/IEEE C62.45.
   3. Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying the device's noise attenuation exceeds 50 dB at 100 kHz.
   4. For retrofit mounting applications, electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
   5. Provide test report from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted.

B. Submit ten (10) copies of the above information.

1.5 SUBMITTALS – FOR INFORMATION

A. When requested by the Engineer the following product information shall be submitted:
   1. Descriptive bulletins
   2. Product sheets

1.6 SUBMITTALS – FOR CLOSEOUT

A. The following information shall be submitted for record purposes:
   1. Final as-built drawings and information for items listed in Section 1.4

1.7 QUALIFICATIONS

A. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.8 REGULATORY REQUIREMENTS

TVS units shall be Underwriters Laboratories listed.

1.9 DELIVERY, STORAGE AND HANDLING

Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Ten (10) copies of the equipment operation and maintenance manuals shall be provided.

B. Operation and maintenance manuals shall include the following information:
   1. Instruction books and/or leaflets
   2. Recommended renewal parts list
   3. Drawings and information required by Section 1.6

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Innovative Technology

B. Telematic

2.2 TRANSIENT VOLTAGE SURGE SUPPRESSION – GENERAL

A. Transient Voltage Surge Suppression (TVS) equipment shall be Cutler-Hammer type Clipper Power Systems (CPS) or approved equal meeting all ratings and features specified herein.

B. Electrical requirements
   1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
   2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be greater than 115% of the nominal system operating voltage.
   3. Protection Modes -- For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).
   4. ULL 1449 SAR -- The maximum ULL 1449 SAR for the device must not exceed the following:

Models	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	400 V	800 V	1200 V
L-L	800 V	1500 V	2000 V

5. ANSI/IEEE Cat C3 Let Through Voltage -- The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:

Models	208Y/120	480Y/277	600Y/347
L-N	470 V	900 V	1300 V

6. ANSI/IEEE Cat. B3 Let Through Voltage -- Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6kV, 5000 amps) shall be less than:

Models	208Y/120	480Y/277	600Y/347
L-N	150 V	200 V	300 V

C. TVS Design
   1. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating TVS modules which do not provide a balanced impedance path to each MOV shall not be acceptable.
   2. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 55 dB at 100kHz using the MIL-STD-220A insertion loss test method. The unit shall be complimentary listed to ULL 1283. Products not able to demonstrate noise attenuation of 55 dB @100kHz shall be rejected.
   3. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.
   4. Safety and Diagnostic Monitoring – Each unit shall be equipped with 200 kAIC internal fuses. Each unit shall provide the following three levels of monitoring:
      a. Continuous monitoring of fusing system
      b. Internal infrared sensor system for monitoring individual MOVs (including neutral to ground). The system must be capable of identifying open circuit failures not monitored by conventional fusing systems.
      c. Thermal detection circuit shall monitor for overheating in all modes due to thermal runaway.
         1) A green/red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged. Fault detection will activate a flashing trouble light. Units which can not detect open-circuit damage, thermal conditions and over current will not be accepted.
   5. Warranty – The manufacturer shall provide a full five- (5) year warranty from the date of shipment against any TVS part failure when installed in compliance with manufacturer's written instructions and any applicable national or local electric code.
   6. TVS devices shall be mounted such that they are seismically qualified for UBC and California Building Code Zone 4 applications.

7. The unit must be equipped with transient event counter and audible alarm.
8. Remote Status Monitor – The TVS device must include from C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three monitoring systems described detect a fault condition.
9. Push-To-Test Feature – Each suppression unit shall incorporate an integral test feature which verifies the operational integrity of the unit's monitoring system.

2.3 SYSTEM APPLICATION

A. The TVS applications covered under this section include distribution and branch panel locations, bus plugs, motor control centers (MCC), switchgear, switchboard assemblies and motors. The branch panel located TVS shall be tested and demonstrate they are suitable for ANSI/IEEE C62.41 Category C1 environments.

B. Surge Current Capacity – The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Application	Minimum Surge Current Per Phase	Minimum Surge Current Per Mode*
Service Entrance (Switchboards Switchgear, MCC Main Entrance)	250 kA	240 kA
Distribution Panelboards	160 kA	160 kA
High Exposure Roof Top Locations	160 kA	80 kA
Branch Locations (Panelboards, MCC's, Busway)	120 kA	80 kA

*L-G, L-N and N-G (WYE system);
L-L, L-G (Delta system)

C. Panelboard and Bus Plug Requirements
1. The TVS application covered under this section include distribution, branch panel and bus plug locations. The TVS units shall be tested to demonstrate suitability for ANSI/IEEE C62.41 Category C1 environments.
2. Withstand – Each unit must be capable of surviving more than 2500 category C1 transients without failure or degradation of ULL 1449 Suppression Voltage Rating.
3. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.
4. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 1,000 amperes RMS symmetrical.
5. Panelboards shall be labeled with a ULL short-circuit withstand rating. When series ratings are applied with integral or remote upstream devices, a label shall be provided. Series ratings shall cover all trip ratings or installed frames. It shall state the conditions of the ULL series ratings including:
   a. Size and type of upstream device
   b. Branch devices that can be used
   c. ULL series short-circuit rating
6. Branch panels shall be ULL labeled as "suitable for non-linear loads".
7. Distribution and panel suppressors shall be installed inside the panelboards or bus plugs at the

manufacturer's factory.

8. A direct bus bar connection shall be used to mount the TVS component to the panelboard bus bar or the bus plug disconnect to reduce the impedance of the shunt path.
9. The TVS panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and TVSS device is not acceptable). TVS units that use a wire connection do not meet the intent of this specification.
10. Suppression shall be included and mounted within the panelboard and bus plug by the manufacturer of the panelboard or bus way.

D. Retrofit Installation (externally mounted suppressor)
Maximum conductor lead length between breaker and suppressor shall not exceed 14 inches. Comply with manufacturer's recommended installation and wiring practices.

E. Switchgear, Switchboard and MCC Requirements
1. The TVS application covered under this section is for switchboard locations. The service entrance TVS shall be tested and suitable for ANSI/IEEE C62.41 Category C3 Environments.
2. Service entrance suppressor shall be installed by assembly manufacturer.
3. Withstand. Each unit must be capable of surviving more than 2500 ANSI/IEEE C62.41 Category C1 transients without failure or degradation of ULL 1449 Suppression Voltage Rating.
4. Service entrance suppressors shall be installed in the assembly.
5. Locate suppressor on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.
6. Provide a 30-amp disconnect. The disconnect shall be directly integrated to the suppressor and assembly bus using bolted bus bar connections.

2.4 MODELS

A. The model numbers are Innovative Technology surge suppressor numbers.

B. Single phase circuit – Model 770-30A (120V and 277V)

C. Single phase circuit – Model 770-10A (120V)

D. Distribution panels, MCC and individual equipment up to 800 Amps – Model ItD252C (120/208V and 277/480V)

E. Distribution panels and MCC up to 2000 Amps Model ITD434C (120/208V and 277/480V)

F. Distribution panels up to 4000 Amp – Model ITD616E (2400/4160V)

G. Medium voltage switches and panels – Model ITD 616E (2400/4160V)

H. The model numbers specified are intended to be a part of a complete surge suppression system for the Valley Creek WWTP.