PROJECT MANUAL

FOR

WATER RECLAMATION FACILITY IMPROVEMENTS

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
CLEAN WATER STATE REVOLVING FUND
PROJECT NO. CS011086-01

Prepared for:

CITY OF SPRINGVILLE
ST. CLAIR COUNTY, ALABAMA

Prepared by:

November 2024

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CITY OF SPRINGVILLE

November 2024

CDG Project Number R954719170

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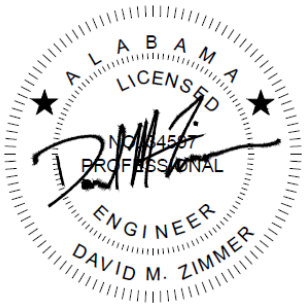

11-14-24

David Zimmer, P.E.
Phone: 678-469-5196
E-Mail: DZimmer@esad-llc.com

DOCUMENT 00105

INVITATION TO BID

Project: Water Reclamation Facility Improvements

Owner: City of Springville

Engineer: CDG, Inc.

Sealed bids will be received, opened, and publicly read by the Owner for the referenced Project. The Owner will receive Bids until 10:00 AM on the 11th day of December 2024. The bid opening will be held at the offices of the City of Springville, located at 160 Walker Drive, Springville, Alabama 35146.

A mandatory Pre-bid Meeting will be held at 10:00 AM on the 26th day of November 2024. Pre-bid Meeting will be held at the offices of the City of Springville, located at 160 Walker Drive, Springville, Alabama 35146.

The Project is generally described as follows: Construction of a mechanical wastewater treatment system adjacent to the City's existing wastewater treatment lagoons. This includes a wastewater lift station, a concrete headworks structure with screening equipment, a sequencing batch reactor system, influent and effluent samplers, an administrative building, and site improvements including grading, piping, and electrical improvements.

The Owner requires the Project to be completed in **380** calendar days from date of Notice to Proceed.

Bidding Documents may be obtained from the office of CDG, Inc., 1962 West Main Street, Dothan, Alabama 36301, (334) 677-9431. Paper copies are available upon receipt of a non-refundable fee in the amount of $**150.00** for one set. PDF electronic copies are available via email at no cost to the bidder.

Bidders will be required to provide Bid security in the form of a Bid Bond or cashier's check in the amount of a sum no less than five (5) percent of the Bid Price but not more than $10,000.00.

All bids must be submitted in a sealed envelope bearing on the outside the name of the bidder, bidder's license number, address and name of the project.

Your Bid will be required to be submitted under a condition of irrevocability for a period of 60 days after submission.

The attention of bidders is called to the provisions of State Law Governing General Contractors, as set forth in Title 34, Chapter 8, Article 1, Code of Alabama of 1975, as amended; and the provisions of said law shall govern bidders insofar as it is applicable. The above-mentioned provisions of the Code make it illegal for the Owner to consider a bid from anyone who is not properly licensed under such code provisions. In addition, bidders must carry the municipal and utility construction classification as listed in the latest edition of the Roster of the State Licensing Board for General Contractors, Montgomery, Alabama. The Owner, therefore will not consider any bid unless the bidder produces evidence that he is so licensed. Neither will the Owner enter into a Contract with a foreign corporation which is not qualified under State Law to do business in the State of Alabama.

The attention of nonresident bidders is called to the provisions of Alabama Law, Title 39, Chapter 3, Code of Alabama 1975, as amended, relating to preference to be given to resident contractors in Alabama over nonresident contractors in the award of contracts in the same manner and to the same extent as provided by the laws of the state of domicile of the nonresident contactor, and to the requirements that the bid documents tendered by any nonresident contractor must be accompanied by "a written opinion of an attorney-at-law licensed to practice law in such nonresident contractor's state of domicile as to the preference, in any or none, granted by the law of that state to its own business entities whose principal places of business are in that state in the letting of any or all public contracts".

Each Bidder, and each Subcontractor, is required to complete and submit Document 00450 – Affidavit of Immigration Compliance along with their E-Verify Program Memorandum of Understanding <u>at the time of the Bid</u>. No Contract will be awarded to any Bidder who does not submit the required Immigration Compliance documents.

Contractor will be required to provide two (2) Owner's Protective Liability Policies. Named Insured shall be as follows:

1. **Owner**
2. **CDG, Inc.**

See Section 00700 - General Conditions for full details.

The Owner reserves the right to accept or reject any or all Bids.

City of Springville

per:

Honorable Dave Thomas
Mayor

enclosures

END OF DOCUMENT

DOCUMENT 00200

INSTRUCTIONS TO BIDDERS

PART 1

1.1 SUMMARY

A. Document Includes:

- Bid submission
- Intent
- Definitions
- Availability of documents
- Examination of documents
- Inquiries and Addenda
- Product substitutions
- Site examination
- Prebid conference
- Bidder qualifications
- Bidder prequalification
- Subcontractors
- Submission procedure
- Bid ineligibility
- Security deposit
- Performance Assurance
- Bid Form requirements
- Bid Form signature
- Additional Bid information
- Selection and award of alternates
- Bid opening
- Duration of offer
- Acceptance of offer
- Laws and Regulations
- Certification of License

1.2 BID SUBMISSION

A. Bids signed, executed, and dated will be received by the Owner at the time and date as stipulated in the Invitation to Bid (Document 00105).

B. Bids submitted after the above time will be returned to Bidder unopened.

C. Amendments to submitted Bids will be permitted when received in writing prior to bid closing and when endorsed by the same party or parties who signed and sealed the Bid.

D. Bidders may withdraw their Bid any time before bid closing.

1.3 INTENT

A. The intent of this Bid request is to obtain an offer to perform work to complete the Project as detailed on the corresponding Plans and Specifications for a Unit Price contract in accordance with the Contract Documents.

B. In the case of a discrepancy between a unit bid price and the extension amount, the unit price shall govern. The sum of the extension amounts will be the contract bid price.

C. The unit price for any Additive Alternates or Deductive Alternates shall be the same as the corresponding unit price in the Base Bid.

1.4 DEFINITIONS

A. Bidding Documents: Contract Documents supplemented with Advertisement for Bids, Invitation to Bid, Instructions to Bidders, Information Available to Bidders, Bid Form, Bid Form Supplements and Appendices, and bid securities, identified.

B. Bid: Executed Bid Form and required attachments submitted in accordance with these Instructions to Bidders.

1.5 AVAILABILITY OF DOCUMENTS

A. Bidding Documents may be obtained as stated in Invitation to Bid.

B. Partial sets of Bidding Documents will not be issued.

C. Bidding Documents are made available only for the purpose of obtaining offers for this Project. Their use does not grant a license for other purposes.

1.6 EXAMINATION OF DOCUMENTS

A. Bidding Documents may be viewed at the office of the Engineer.

B. Upon receipt of Bidding Documents verify documents are complete. Notify Engineer if documents are incomplete.

C. Immediately notify Engineer upon finding discrepancies or omissions in Bidding Documents.

1.7 INQUIRIES AND ADDENDA

A. Direct questions in writing to the office of the Engineer.

B. Verbal answers are not binding on any party.

C. Submit questions not less than 2 days before date set for receipt of Bids. Replies will be made by Addenda.

D. Addenda may be issued during bidding period. Addenda will be sent to known Bidders. Addenda become part of the Contract Documents. Include resultant costs in the Bid Price.

E. Contractor is to indicate receipt of Addenda in Section 5 of the Bid Form (Document 00412).

1.8 PRODUCT SUBSTITUTIONS

A. Requests for Product substitutions may be permitted before execution of Agreement. Refer to Section 01600 for substitution procedures.

B. With each substitution request, provide sufficient information for Engineer to determine acceptability of proposed products.

C. In submission of substitutions to Products specified, Bidders shall include in their request, changes required in the Work, changes to Contract Time and Contract Price to accommodate such approved substitutions. Later claims by the Bidder for an addition to the Contract Time or Contract Price because of changes in Work necessitated by use of substitutions will not be considered.

D. Provide complete information on required revisions to other Work to accommodate each substitution, the value of additions to or reductions from the Bid Price, including revisions to other Work.

E. Provide Products as specified unless substitutions are submitted in this manner and subsequently accepted.

F. Bidder to compensate Engineer for time spent in review of proposed substitutions at the Engineer's standard charge-out rate.

G. Approval to submit substitution requests prior to submission of Bids is not required.

1.9 SITE EXAMINATION

A. Examine Project site before submitting a Bid.

B. Contact Owner to arrange date and time to visit Project site.

1.10 PREBID CONFERENCE

A. If a prebid conference is scheduled it will take place on the date, time and location as referenced in the Invitation to Bid.

B. Representatives of the Owner and the Engineer will be in attendance.

C. Summarized minutes of this meeting will be circulated to attendees. These minutes will not form part of Contract Documents.

D. Information relevant to Bidding Documents will be issued by Addendum.

1.11 BIDDER QUALIFICATIONS

A. To demonstrate qualification for performing Work of this Contract, Bidders may be requested to submit written evidence of financial position, previous experience with Work of similar scope and magnitude to that of this Contract, current commitments, and license to perform work in the State of Alabama. Additionally, the Owner or Engineer may contact references to investigate the Bidder's successful completion of Work of similar scope and magnitude.

1.12 BIDDER PREQUALIFICATION

A. When specifically requested, complete and submit the prequalification form provided to Engineer on or before date referenced in the Invitation to Bid.

B. Unless stated otherwise in the Invitation to Bid, Owner will provide written notice of pre-qualification status within 10 days of deadline for submission of pre-qualification statement.

1.13 SUBCONTRACTORS

A. The Owner reserves the right to reject a proposed Subcontractor for reasonable cause.

B. The General Contractor may not utilize Subcontractors to perform more than 30% of the total Project.

C. Refer to the General Conditions Section 00700 - Articles 1 and 6.

1.14 SUBMISSION PROCEDURE

A. Bidders shall be solely responsible for delivery of Bids in manner and time prescribed.

B. Submit one copy of executed offer on Bid Forms provided, signed and sealed with required bid bond in a closed opaque envelope, clearly identified with Bidder's name, Project name, Alabama General Contractor's License number, and Owner's name on the outside.

C. Required documents to be included in the sealed envelope:
   1. Document 00410 – Bid Bond
   2. Document 00412 – Bid Form
   3. Document 00450 – Affidavit of Immigration Compliance with E-Verify Memorandum of Understanding.

D. Improperly completed information or irregularities in bid bond may be cause the Bid to be declared invalid or informal.

E. An abstract summary of submitted Bids will be made available to all Bidders following bid opening.

1.15 BID INELIGIBILITY

A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, will be declared unacceptable at Owner's discretion.

B. Bid Forms, Appendices, and enclosures which are improperly prepared may be declared unacceptable at Owner's discretion.

C. Failure to provide security deposit, bonds or insurance requirements may invalidate the Bid at the discretion of the Owner.

1.16 SECURITY DEPOSIT

A. Bids shall be accompanied by security deposit as follows:
   1. Unless indicated otherwise in the Invitation to Bid, a Bid Bond shall be provided in the amount of a sum no less than five (5) percent of the bid price but not exceeding $10,000 on standard surety company form.

   2. A certified check in the amount listed above will be accepted in place of a bid bond.

B. Security deposit of accepted Bidder will be returned after delivery to the Engineer of the required Performance and Payment Bonds by the accepted Bidder.

C. Include the cost of security deposit in the Bid Price.

D. After a Bid has been accepted, security deposits will be returned to the respective Bidders, upon request.

E. If no contract is awarded, security deposits will be returned.

1.17 PERFORMANCE ASSURANCE

A. Accepted Bidder: Provide a Performance and Payment bond as described in Document 00700 – General Conditions.

B. Include the cost of performance assurance bonds in the Bid Price.

1.18 BID FORM REQUIREMENTS

A. Complete requested information in the Bid Form and Bid Form Supplements.

B. Refer to Document 00700 – General Conditions for inclusion of taxes, procedures for tax rebate claims by the Owner and tax-exempt Products.

1.19 BID FORM SIGNATURE

A. Sign Bid Form, as follows:

1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. [Affix seal.]
2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. [Affix seal to each signature.]
3. Corporation: Signature of duly authorized signing officers in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the Bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, submit a copy of the by-law resolution of their board of directors authorizing them to do so, with the Bid Form in the bid envelope.
4. Joint Venture: Signature of each party of the joint venture under their respective seals in a manner appropriate to such party as described above, similar to requirements for Partnerships.

1.20 ADDITIONAL BID INFORMATION

A. **Each Bidder, and each Subcontractor, is required to complete and submit Document 00450 – Affidavit of Immigration Compliance along with their E-Verify Program Memorandum of Understanding at the time of the Bid. No Contract will be awarded to any Bidder who does not submit the required Immigration Compliance documents.**

1.21 SELECTION AND AWARD OF ALTERNATES

A. Bids will be evaluated on base Bid Price and awarded to the lowest responsive, responsible bidder. After determination of accepted Bidder, consideration will be given to alternates and Bid Price adjustments.

1.22 BID OPENING

A. Bids will be opened publicly immediately after time for receipt of Bids. Bidders may be present.

1.23 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of 60 days after bid closing date.

1.24 ACCEPTANCE OF OFFER

A. The Owner reserves the right to accept or reject any or all offers.

B. After acceptance by the Owner, the Engineer on behalf of the Owner will issue to the accepted Bidder, a written Notice of Award.

C. Notwithstanding delay in the preparation and execution of the Agreement, accepted Bidder shall be prepared, upon written Notice to Proceed, to commence work within seven days following receipt of official written order of the Owner to proceed, or on date stipulated in such order.

D. The accepted bidder shall assist and cooperate with the Owner to prepare the Agreement, and within 14 days following its presentation shall execute Agreement and return it to the Owner.

1.25 LAWS AND REGULATIONS

A. The bidder's attention is directed to the fact that all applicable Federal and State laws, municipal ordinances and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply.

1.26 CERTIFICATION OF LICENSE

A. All bidders must provide the following information on the outside of the bid envelope before his bid will be considered:

- NAME OF PROJECT
- NAME OF OWNER
- NAME, ADDRESS, AND TELEPHONE NUMBER OF CONTRACTOR
- ALABAMA GENERAL CONTRACTOR'S NUMBER

END OF DOCUMENT

DOCUMENT 00410

BID BOND

BIDDER (Name and Address):

_____

_____

_____

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

_____

_____

_____

OWNER (Name and Address):

City of Springville

160 Walker Drive

Springville, Alabama 35146

BID

BID DUE DATE: _____

PROJECT (Brief Description Including Location):

Water Reclamation Facility Improvements

Springville, Alabama

_____

BOND

BOND NUMBER: _____

DATE (Not later than Bid due date): _____

PENAL SUM: _____ _____

(Words) (Figures)

IN WITNESS WHEREOF, 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: (1) Above addresses are to be used for giving required notice.

(2) Any singular reference to Bidder, Surety, OWNER or other party shall be considered plural where applicable.

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.

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 and 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.

END OF DOCUMENT

DOCUMENT 00412

BID FORM

To: City of Springville

Project: Water Reclamation Facility Improvements

Date: _____

Submitted by:
(full name) _____

(full address) _____

_____

1. OFFER

Having examined the Place of the Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by the Engineer for the above-mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Unit Prices listed in this bid form in lawful money of the United States of America.

We have included the Bid Bond as required by the Instruction to Bidders.

All applicable federal and State of Alabama taxes are included in the Unit Prices.

Explanations of Bid Items are described in Section 01200 - Price and Payment Procedures.

2. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for sixty (60) days from the bid closing date.

If this bid is accepted by the Owner within the time period stated above, we will, unless otherwise allowed by the Owner:

- Execute the Agreement within seven (7) days of receipt of Notice of Award.
- Furnish the required bonds and insurance within fourteen (14) days of receipt of Notice of Award.
- Commence work within seven (7) days after written Notice to Proceed

If this bid is accepted within the time stated, and we fail to commence the Work, or we fail to provide the required bonds, the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

In the event our bid is not accepted within the time stated above, the required security deposit will be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

3. CONTRACT TIME AND LIQUIDATED DAMAGES

If this Bid is accepted:

- The Work will be substantially completed in **three hundred and eighty (380))** calendar days from the Notice to Proceed.
- Liquidated damages of **$500.00** shall be paid by Contractor for each day beyond the agreed upon substantial completion date.

4. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Price.

Addendum No._____ Dated _____

Addendum No._____ Dated _____

5. BID FORM SIGNATURES

The Corporate Seal of

_____
(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____
(Authorized signing officer Title)

(Seal)

_____
(Authorized signing officer Title)

(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

Bid Form
Water Reclamation Facility Improvments
City of Springville
ADEM CWSRF Project No. CS011086-01

BASE BID

NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	EXTENSION PRICE
1.	Mobilization (Not to Exceed 5% of Bid)	LS	1	$	$
2.	Erosion Control, Grassing and Restoration	LS	1	$	$
3.	Headworks	LS	1	$	$
4.	Influent Lift Station	LS	1	$	$
5.	1.8 MGD Sequencing Batch Reactor (SBR) Equipment in Concrete Tanks	LS	1	$	$
6.	Administration Building	LS	1		
7.	Emergency Standby Generator with ATS and Concrete Pad	LS	1	$	$
				TOTAL BASE BID:	$

END OF DOCUMENT

DOCUMENT 00450

AFFIDAVIT OF IMMIGRATION COMPLIANCE

STATE OF _____

COUNTY OF _____

_____ being duly sworn deposes and says:
(print name)

1. I am over the age of twenty-one (21). I am employed as _____
(print title)

with _____
(print company name)

(hereinafter the "Company") who is a contractor, subcontractor, supplier, service provider or vendor with employees in the State of Alabama. In that capacity, I have personal knowledge of the facts stated in this Affidavit and a good faith belief that the Company is in compliance with the Immigration Reform and Control Act of 1986 and Beason-Hammon Alabama Taxpayer and Citizen Protection Act (hereinafter the "Act"). This Affidavit is given in connection with a good faith effort immigration compliance self review or an independent outside review, in accordance with the Immigration Reform and Control Act of 1986, of the Company's immigration compliance.

2. The Company has not and does not knowingly employ, hire for employment, or continue to employ any unauthorized aliens. Further, the Company has no reason to believe that it has employed, hired for employment, or continues to employ and unauthorized aliens. The Company hereby certifies that it has made a good faith effort in accordance with the Immigration Reform and Control Act of 1986 to verify the employment eligibility and identity of all current employees.

3. The Company is presently enrolled in the E-Verify Program and shall verify every employee that is required to be verified according to the Immigration Reform and Control Act of 1986 and the Act. Attached to this Affidavit is the E-Verify Program for Employment Verification Memorandum of Understanding establishing that the Company is enrolled in the E-Verify Program.

4. The Company has, in good faith, complied with the Act with respect to verifying that it has correctly completed an I-9 for each of its current employees and it is in compliance with the Immigration Reform and Control Act of 1986, as well as all other provisions of the Act.

5. The Company affirms that it is providing written notice to its contractors, subcontractors, suppliers, service providers or vendors (hereinafter referred to as "Subcontractors"), who are in any manner involved with the Company's Projects or Contracts in the State of Alabama, of their immigration compliance

obligations and will obtain from each Subcontractor and retain in its files, and Affidavit of Immigration Compliance with the attached E-Verify Program for Employment Verification Memorandum of Understanding establishing that the Subcontractor is enrolled in the E-Verify Program. If requested, the Company will make a copy of each Subcontractors Affidavit of Immigration Compliance available, or as may be required in any audit of the immigration compliance efforts of the Company.

I certify that the above **AFFIDAVIT OF IMMIGRATION COMPLIANCE** is true and correct to the best of my knowledge.

_____
(sign name)

STATE OF _____

COUNTY OF _____

I, the undersigned, Notary Public in and for said County in said State, hereby certify that

_____ who serves in the position of
(print name)

_____ for _____
(print title) (print company name)

has signed the foregoing instrument and who is known to me, acknowledged before me on this day that, being informed of the contents of the instrument, and with full authority, did execute the same voluntarily.

(SEAL) _____
NOTARY PUBLIC

My Commission Expires: _____

END OF DOCUMENT

DOCUMENT 00500

AGREEMENT
BETWEEN OWNER AND CONTRACTOR
ON THE BASIS OF A STIPULATED PRICE

THIS AGREEMENT is by and between the **City of Springville** (hereinafter called OWNER) and _____(hereinafter called CONTRACTOR).

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 - WORK

1.01 CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents.

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: **WATER RECLAMATION FACILITY IMPROVEMENTS.**

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by **CDG, Inc.** who is hereinafter called ENGINEER and 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 TIME

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 **three hundred and eighty (380) calendar days** after the date when the Contract Time commences to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions within **four hundred and ten (410) calendar days** after the date when the Contract Time commences 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 Time specified in paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 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 **$500.00** 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 **$500.00** 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 Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of that item as indicated in the Bid Form (Document 00412):

TOTAL OF ALL UNIT PRICES_____
(use words)

As provided in paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by ENGINEER as provided in paragraph 9.08 of the General Conditions. Unit prices have been computed as provided in paragraph 11.03 of the General Conditions.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. CONTRACTOR shall submit Applications for Payment in accordance with Article 14 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 10th day of each month during performance of the Work as provided in paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established 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, in accordance with paragraph 14.02 of the General Conditions:

a. 95% of Work completed (with the balance being retainage). If the Work has been 50% 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 on account of Work subsequently completed, in which case the remaining progress payments prior to Substantial Completion will be in an amount equal to 100% of the Work completed less the aggregate of payments previously made; and

b. 95% 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 97.5% of the Work completed, less such amounts as ENGINEER shall determine in accordance with paragraph 14.02.B.5 of the General Conditions and less 100% 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 14.07.

ARTICLE 7 - CONTRACTOR'S REPRESENTATIONS

7.01 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 obtained and carefully studied (or assumes responsibility for having done 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 applying the specific means, methods, techniques, sequences, and procedures of construction, if any, expressly required by the Contract Documents to be employed by CONTRACTOR, and safety precautions and programs incident thereto.

E. CONTRACTOR does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Time, and in accordance with the other terms and conditions of the Contract Documents.

F. 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.

G. 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.

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

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

ARTICLE 8 - CONTRACT DOCUMENTS

8.01 *Contents*

A. The Contract Documents consist of the following:

1. CONTRACTOR's Bid;

2. Affidavit of Immigration Compliance;

3. This Agreement;

4. Notice of Award;

5. Documentation submitted by CONTRACTOR prior to Notice of Award;

6. Notice to Proceed;

7. Certificate by Owner;

8. Performance Bond;

9. Payment Bond;

10. Other Bonds;

    a. _____;

    b. _____;

11. General Conditions;

12. Drawings as listed on Cover Sheet Index bearing the Project name;

13. Addenda;

14. Technical specifications as listed in the Table of Contents and any appendices and/or attachments (if any) listed in the Table of Contents.

15. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:

    a. Written Amendments;

    b. Change Order(s).

B. The documents listed in paragraph 8.01.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 8.

D. The Contract Documents may only be amended, modified, or supplemented as provided in paragraph 3.04 of the General Conditions.

ARTICLE 9 - MISCELLANEOUS

9.01 *Terms*

A. Terms used in this Agreement will have the meanings indicated in the General Conditions.

9.02 *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.

9.03 *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.

9.04 *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 duplicate. 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 _____, _____ (which is the Effective Date of the Agreement).

OWNER:	CONTRACTOR:
City of Springville	
By: _____	By: _____
[CORPORATE SEAL]	[CORPORATE SEAL]
Attest _____	Attest _____
Address for giving notices:	Address for giving notices:
160 Walker Drive	_____
Springville, Alabama 35146	_____
(205) 467-6133	_____

END OF DOCUMENT

DOCUMENT 00510

NOTICE OF AWARD

Dated _____

TO _____
(BIDDER)

ADDRESS: _____

_____

PROJECT: **Water Reclamation Facility Improvments**

You are notified that your Bid dated _____ for the above Contract has been considered. You are the apparent Successful Bidder and have been awarded a Contract for

_____
(Indicate total Work, alternates or sections or Work awarded)

The Contract Price of your Contract is

_____

Dollars ($_____).

Four (4) copies of the Agreement accompany this Notice of Award. Each copy of the Agreement and the Notice of Award must be executed and returned to the Engineer. Also enclosed are the requirements for Insurance and the Performance and Payment Bonds for this project.

You must comply with the following conditions precedent within 15 days of the date you receive this Notice of Award.

1. Deliver to the Engineer four (4) fully executed counterparts of all required Documents. Each of the Documents must bear original signatures.

2. Deliver with the executed Contract Documents the Contract security (Bonds) as specified in the Instructions to Bidders (Article 18), and General Conditions (paragraph 5.01).

3. (List other conditions precedent).

_____

_____

_____

_____

Failure to comply with these conditions within the time specified will entitle OWNER to consider your Bid in default, to annul this Notice of Award and to declare your Bid security forfeited.

Within ten days after you comply with the above conditions, OWNER will return to you one fully executed counterpart of the Contract Documents.

City of Springville\

By: _____
Honorable Dave Thomas, Mayor

Accepted By:

_____
(Contractor)

_____
(Authorized Signature)

_____
(Title)

END OF DOCUMENT

DOCUMENT 00520

NOTICE TO PROCEED

DATE: _____

TO: _____
(CONTRACTOR)

ADDRESS: _____

_____

_____

Project: **Water Reclamation Facility Improvements**

CWSRF Project No._____
CDG Project No. R954719170

You are notified that the Contract Time under the above contract will commence to run on _____. By that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 3 of the Agreement, the date of Substantial Completion is _____ and the date of readiness for final payment is_____.

Before you may start any Work at the Site, paragraph 2.05.C of the General Conditions provides that you must deliver to the Owner (with copies to Engineer and other identified additional insured) certificates of insurance which you are required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start any Work at the Site, you must
(add other requirements)

_____

City of Springville
(OWNER)

By: _____
Honorable Dave Thomas

Mayor
(TITLE)

Accepted By:

_____
(Contractor)

_____
(Authorized Signature)

_____
(Title)

END OF DOCUMENT

DOCUMENT 00530

CERTIFICATION BY OWNER

I, the undersigned, Dave Thomas, the duly authorized and acting official representative City of Springville do hereby certify as follows:

This contract was let in compliance with the Alabama Public Works Law and with all other applicable provisions of the law.

_____
Signature

Mayor
Title

_____
Date

END OF DOCUMENT

DOCUMENT 00610

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):
City of Springtville
160 Walker Drive
Springville, Alabama 35146

CONTRACT
Date:
Amount: **$**
Description (Name and Location): **Water Reclamation Facility Improvements Springville, Alabama**

BOND
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and 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: (Corp. Seal)

Signature: _____
Name and Title:

SURETY
Company: (Corp. Seal)

Signature: _____
Name and Title:
(Attach Power of Attorney)

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

CONTRACTOR AS PRINCIPAL
Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY
Company: (Corp. Seal)

Signature: _____
Name and Title:

Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, and the American Institute of Architects.

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

2. If the CONTRACTOR performs the Contract, the Surety and the 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, the Surety's obligation under this Bond shall arise after:

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

3.2. The OWNER has declared a CONTRACTOR Default and formally terminated the CONTRACTOR's right to complete the Contract. Such CONTRACTOR Default shall not be declared earlier than twenty days after the CONTRACTOR and the Surety have received notice as provided in paragraph 3.1; and

3.3. The OWNER has agreed to pay the Balance of the Contract Price to:

3.3.1. The 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 the OWNER has satisfied the conditions of paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

4.1. Arrange for the CONTRACTOR, with consent of the OWNER, to perform and complete the Contract; 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 the OWNER for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the OWNER and the contractor selected with the 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 the OWNER the amount of damages as described in paragraph 6 in excess of the Balance of the Contract Price incurred by the OWNER resulting from the 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 the OWNER and, as soon as practicable after the amount is determined, tender payment therefore to the OWNER; or

4.4.2 Deny liability in whole or in part and notify the OWNER citing reasons therefore.

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

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

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

6.2. Additional legal, design professional and delay costs resulting from the CONTRACTOR's Default, and resulting from the actions or failure to act of the Surety under paragraph 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 the CONTRACTOR.

7. The Surety shall not be liable to the OWNER or others for obligations of the 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 right of action shall accrue on this Bond to any person or entity other than the OWNER or its heirs, executors, administrators, or successors.

8. The Surety hereby waives notice of any change, including changes of time, to the 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 the CONTRACTOR ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the OWNER or the 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 or other legal requirement in the location where the Contract was be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal 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. The Performance Bond shall be reissued by the Contractor’s Surety anytime the Contract amount is increased due to change order. The new Performance Bond shall be equal to the new Contract price as indicated in the Change Order and shall supersede all previous bonds issued.

13. Definitions.

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

13.2. Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

13.3. CONTRACTOR Default: Failure of the CONTRACTOR, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

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

END OF DOCUMENT

DOCUMENT 00620

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):
City of Springville
160 Walker Drive
Springville, Alabama 35146

CONTRACT
Date:
Amount:
Description (Name and Location): **Water Reclamation Facility Improvements**
Springville, Alabama

BOND
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

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

CONTRACTOR AS PRINCIPAL
Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY
Company: (Corp. Seal)

Signature: _____
Name and Title:
(Attach Power of Attorney)

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

CONTRACTOR AS PRINCIPAL
Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY
Company: (Corp. Seal)

Signature: _____
Name and Title:

EJCDC No. 1910-28-B (1996 Edition)
Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, the American Institute of Architects, the American Subcontractors Association, and the Associated Specialty Contractors.

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

2. With respect to the OWNER, this obligation shall be null and void if the CONTRACTOR:

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

2.2. Defends, indemnifies and holds harmless the OWNER from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided the OWNER has promptly notified the CONTRACTOR and the 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 the CONTRACTOR and the Surety, and provided there is no OWNER Default.

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

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

4.1. Claimants who are employed by or have a direct contract with the CONTRACTOR have given notice to the Surety (at the addresses described in paragraph 12) and sent a copy, or notice thereof, to the 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 the CONTRACTOR:

1. Have furnished written notice to the CONTRACTOR and sent a copy, or notice thereof, to the 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 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 the CONTRACTOR, or not received within 30 days of furnishing the above notice any communication from the CONTRACTOR by which the 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 the Surety and sent a copy, or notice thereof, to the OWNER, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the CONTRACTOR.

5. If a notice required by paragraph 4 is given by the OWNER to the CONTRACTOR or to the Surety, that is sufficient compliance.

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

6.1. Send an answer to the Claimant, with a copy to the 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. The 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 the Surety.

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

9. The Surety shall not be liable to the OWNER, Claimants or others for obligations of the CONTRACTOR that are unrelated to the Contract. The OWNER shall not be liable for payment of any costs or expenses of any Claimant 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. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimant 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 Claimant 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 the Surety, the OWNER or the CONTRACTOR shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the OWNER or the 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 or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. 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, the 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 the CONTRACTOR or with a Subcontractor of the 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 the CONTRACTOR and the CONTRACTOR's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

15.2. Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes pthereto.

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

END OF DOCUMENT

DOCUMENT 00700

GENERAL CONDITIONS

TABLE OF CONTENTS

GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

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

2. *Agreement*--The written instrument which is evidence of the agreement between OWNER and CONTRACTOR covering the Work.

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

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

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

6. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

7. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, and the Bid form with any supplements.

8. *Bonds*--Performance and payment bonds and other instruments of security.

9. *Change Order*--A document recommended by ENGINEER which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

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

11. *Contract*--The entire and integrated written agreement between the OWNER and CONTRACTOR concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*--The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions (if applicable), the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and ENGINEER's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by OWNER to CONTRACTOR are not Contract Documents.

13. *Contract Price*--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.03 in the case of Unit Price Work).

14. *Contract Time*--The number of days or the dates stated in the Agreement to: (i) achieve Substantial Completion; and (ii) complete the Work

so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment.

15. *CONTRACTOR*--The individual or entity with whom OWNER has entered into the Agreement.

16. *Cost of the Work*--See paragraph11.01A

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

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

19. *ENGINEER*--The individual or entity named as such in the Agreement.

20. *ENGINEER's Consultant*--An individual or entity having a contract with ENGINEER to furnish services as ENGINEER's independent professional associate or consultant with respect to the Project.

21. *Field Order*--A written order issued by ENGINEER which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Time.

22. *General Requirements*--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

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

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

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

26. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

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

28. *Notice of Award*--The written notice by OWNER to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, OWNER will sign and deliver the Agreement.

29. *Notice to Proceed*--A written notice given by OWNER to CONTRACTOR fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform the Work under the Contract Documents.

30. *OWNER*--The individual, entity, public body, or authority with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

31. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

32. *PCBs*--Polychlorinated biphenyls.

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

33A. *Products*—Materials and equipment that the Contractor furnishes and provides, other than labor and equipment.

34. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.

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

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

37. *Resident Project Representative*--The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.

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

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

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

41. *Specifications*--That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

42. *Subcontractor*--An individual or entity having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the Site.

43. *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.

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

45. *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 any Subcontractor.

46. *Technical Data*—The specific times, locations, and depths/elevations identified in the reports and drawings contained in the Supplementary Conditions.

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

48. *Unit Price Work*--Work to be paid for on the basis of unit prices.

49. *Work*--The entire completed construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

50. *Work Change Directive*--A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the

Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Time but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Time.

51. *Written Amendment*--A written statement modifying the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the non-engineering or non-technical rather than strictly construction-related aspects of the Contract Documents.

1.02 *Terminology*

A. *Intent of Certain Terms or Adjectives*

1. Whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, or 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 action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed 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 shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.10 or any other provision of the Contract Documents.

B. *Day*

1. The word "day" shall constitute a calendar day of 24 hours measured from midnight to the next midnight.

C. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER's recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.04 or 14.05).

D. *Furnish, Install, Perform, Provide*

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

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

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

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

E. Unless stated otherwise in the Contract Documents, words or phrases which 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

A. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish.

2.02 *Copies of Documents*

A. OWNER shall furnish to CONTRACTOR up to three copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Time; Notice to Proceed*

A. The Contract Time will commence on the date established in the Notice to Proceed and continue for the duration of the Project. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement.

2.04 *Starting the Work*

A. CONTRACTOR shall start to perform the Work on the date when the Contract Time commences to run. No Work shall be done at the Site prior to the date of the Notice to Proceed.

2.05 *Before Starting Construction*

A. *CONTRACTOR's Review of Contract Documents:* Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, 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 knew or reasonably should have known thereof.

B. *Preliminary Schedules:* Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for its timely review:

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

2. A preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; 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.

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

2.06 *Preconstruction Conference*

A. Within 20 days after the Contract Time starts to run, but before any Work at the Site is started, a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05.B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

A. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to review for acceptability to ENGINEER as provided below the schedules submitted in accordance with paragraph 2.05.B. CONTRACTOR shall have an additional ten 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 any specified Milestones and the Contract Time. 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 therefore.

2. CONTRACTOR's schedule of Shop Drawing and Sample submittals will be acceptable to ENGINEER if it provides a workable arrangement for reviewing and processing the required submittals.

3. CONTRACTOR's schedule of values will be acceptable to ENGINEER as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

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

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

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

D. Sections of Division 1 – General Requirements govern the execution of the work of all sections of the specifications.

3.02 Reference Standards

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

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

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to OWNER, ENGINEER, or any of ENGINEER's Consultants, agents, or employees any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ENGINEER in writing at once. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity, or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. *Resolving Discrepancies*

1. The precedence for resolving discrepancies within the Contract Documents shall be as follows:

a. Stated dimensions shall govern over scaled dimensions unless determined to be obviously incorrect.

b. Plans shall govern over Specifications.

c. Special Provisions shall govern over Plans and Specifications.

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

a. The provisions of any standard, specification, manual, code, or instruction

(whether or not specifically incorporated by reference in the Contract Documents); or

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

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) ENGINEER's approval of a Shop Drawing or Sample; or (iii) ENGINEER's written interpretation or clarification.

3.05 *Reuse of Documents*

A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not 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 ENGINEER's Consultant, including electronic media editions; and (ii) shall not reuse any of 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. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

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

B. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and OWNER's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

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

4.02 *Subsurface and Physical Conditions*

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

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ENGINEER has used in preparing the Contract Documents; and

2. Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER, or any of ENGINEER's Consultants with respect to:

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

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

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

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. Is of such a nature as to establish that any "technical data" on which CONTRACTOR is entitled to rely as provided in paragraph 4.02 is materially inaccurate; or

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

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

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

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

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

C. *Possible Price and Times Adjustments*

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

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

b. With respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of paragraphs 9.08 and 11.03.

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

a. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Time by the submission of a Bid or becoming bound under a negotiated contract; or

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

c. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.03.A.

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Time, or both, a Claim may be made therefore as provided in paragraph 10.05. However, OWNER, ENGINEER, and ENGINEER's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect

to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities, including OWNER, or by others. Unless it is otherwise expressly provided for elsewhere:

1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

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

a. Reviewing and checking all such information and data,

b. Locating all Underground Facilities shown or indicated in the Contract Documents,

c. Coordination of the Work with the owners of such Underground Facilities, including OWNER, during construction, and

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

B. *Not Shown or Indicated*

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

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

4.05 *Reference Points*

A. OWNER shall provide engineering surveys to establish reference points for construction that in ENGINEER's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the ENGINEER in the preparation of the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER or any of ENGINEER's Consultants with respect to:

1. The completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of

construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or

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

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

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

D. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by paragraph 6.16); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

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

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

G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.E shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

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

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

ARTICLE 5 - BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

A. CONTRACTOR shall furnish performance and payment Bonds as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents. The Performance Bond shall be in an amount at least equal to the Contract Price and the Payment shall be in an amount of 100% of the Contract Price.

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

C. If the surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.01.B, CONTRACTOR shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

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

5.03 *Certificates of Insurance*

A. CONTRACTOR shall deliver to OWNER, with copies to each additional insured, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to purchase and maintain. OWNER shall deliver to CONTRACTOR, with copies to each additional insured, certificates of insurance (and other evidence of insurance requested by CONTRACTOR or any other additional insured) which OWNER is required to purchase and maintain.

5.04 *CONTRACTOR's Liability Insurance*

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

1. Claims under workers' compensation, disability benefits, and other similar employee benefit acts;
2. Claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

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

4. Claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

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

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

B. The policies of insurance so required by this paragraph 5.04 to be purchased and maintained shall:

1. With respect to insurance required by paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified otherwise, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

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

3. Include completed operations insurance;

4. Include contractual liability insurance covering CONTRACTOR's indemnity obligations under paragraphs 6.07, 6.11, and 6.20;

5. Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.03 will so provide);

6. Remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective Work in accordance with paragraph 13.07; and

7. With respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured, to whom a certificate of insurance has been issued, evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).

C. The limits of liability for the insurance required by paragraph 5.04 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 5.04.A.1 and A.2 of the General Conditions shall be in strict accordance with the requirements of the current and applicable Workmen's Compensation Laws of the State. The insurance shall cover all of the Contractor's employees employed or associated with the project; and where any part of the work is subcontracted, the Contractor shall require the subcontractor to provide similar Workmen's compensation and Employer's liability Insurance for all employees of the subcontractor unless such employees are covered by the protection afforded by the Contractor.

2. Contractor's General Liability under paragraphs 5.04.A.3 through A.6 of the General Conditions, which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Contractor:

a. General Aggregate - $2,000,000

b. Products - Completed Operations Aggregate -$1,000,000

c. Personal Injury - $1,000,000

d. Each Occurrence (Bodily Injury and property Damage) - $1,000,000

e. Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.

f. Excess or Umbrella Liability

1) General Aggregate - $2,000,000

2) Each Occurrence -$2,000,000

3. Automobile Liability under paragraph 5.04.A.6 of the General Conditions:

a. Bodily Injury:
Each person - $500,000
Each Accident - $1,000,000

b. Property Damage:
Each Accident - $250,000

c. Combined Single Limit of
$1,000,000

4. The Contractual Liability coverage required by paragraph 5.04.B.4 of the General Conditions shall provide coverage for not less than the following amounts:

a. Bodily Injury:
Each Accident - $500,000
Annual Aggregate - $1,000,000

b. Property Damage:
Each Accident - $250,000
Annual Aggregate - $1,000,000

5. Special Hazards or Perils - The Liability and Property Damage Insurance Coverage of the Contractor's operations shall provide adequate protection against any death, any bodily injury or any property damage resulting from the blasting operations in connection with the Contractors work, or in connection with the work of his subcontractors.

Insurance carried by the Contractor on the insurable portions of the work shall not relieve the Contractor of the responsibility for the protection of all materials and all work until the project has been accepted by the Owner. Any loss suffered on the project by reason of the peril listed in SC-5.06 or in this sub-part of SC-5.04 shall be borne by the Contractor and/or the Insurance Company providing the coverage for the Contractor; and the Owner shall not be liable for any cost of replacement of lost or damaged work or material

6. Protection of the Owner and the Engineers: The Contractor hereby agrees to hold harmless, indemnify and defend the Owner, the Owner's agent, the Consulting Engineer, and the Owner's employees while acting within the scope of their duties from and against any and all liability, claims, damages, and cost of defense arising out of the Contractor's performance of the work described herein but not including the sole negligence of the Owner, its agents or employees. The Contractor will require any and all subcontractors to conform with the provisions of this clause prior to commencing any work.

The Contractor shall furnish two (2) Owner's Protective Liability Policies; Named Insureds shall be as follows:

1. Owner's name
2. CDG, Inc.

This insurance coverage shall be provided in **two (2) different policies separate from the Contractor's insurance policies**, a copy of the policies shall be provided to the Engineer. The limits of liability shall not be less than $1,000,000.00.

5.05 *OWNER's Liability Insurance*

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

5.06 *Property Insurance*

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

1. Include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;

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

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

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

5. Allow for partial utilization of the Work by OWNER;

6. Include testing and startup; and

7. Be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR, and ENGINEER with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.

B. OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

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

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

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

5.07 *Waiver of Rights*

A. OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

B. OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other 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 peril whether or not insured by OWNER; and

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

C. Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against CONTRACTOR, Subcontractors, ENGINEER, or ENGINEER's Consultants and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by paragraph 5.06 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.08.B. OWNER shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

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

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

A. If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

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

required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent thereto who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the Site and shall have authority to act on behalf of CONTRACTOR. All communications given to or received from the superintendent shall be binding on CONTRACTOR.

6.02 *Labor; Working Hour*

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the Work 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, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER's written consent (which will not be unreasonably withheld) given after prior written notice to ENGINEER.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the General Requirements, CONTRACTOR shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for 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. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.07 as it may be adjusted from time to time as provided below.

1. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.07) proposed adjustments in the progress schedule that will not result in changing the Contract Time (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Time (or Milestones) shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.05 *Substitutes and "Or-Equals"*

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

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

a. In the exercise of reasonable judgment ENGINEER determines that: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items

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

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

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

d. CONTRACTOR shall first 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 shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not 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 work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

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

C. *Engineer's Evaluation:* ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.05.A and 6.05.B. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until ENGINEER's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." ENGINEER will advise CONTRACTOR in writing of any negative determination.

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

E. *ENGINEER's Cost Reimbursement:* ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with

OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such proposed substitute.

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

6.06 *Concerning Sub-contractors, Suppliers, and Others*

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

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

C. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Sub-contractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Sub-contractor, Supplier, or other individual or entity any contractual relationship between OWNER or ENGINEER and any such Sub-contractor, Supplier or other individual or entity, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Sub-contractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

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

E. CONTRACTOR shall require all Sub-contractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with ENGINEER through CONTRACTOR.

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

G. All Work performed for CONTRACTOR by a Sub-contractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Sub-contractor or Supplier which specifically binds the Sub-contractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Sub-contractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.06, the agreement between the CONTRACTOR and the Sub-contractor or Supplier will contain provisions whereby the Sub-contractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER's Consultants, and all other individuals or entities to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and Sub-contractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Sub-contractor or Supplier, CONTRACTOR will obtain the same.

H. The CONTRACTOR shall not award work to subcontractor(s) in excess of thirty (30%) percent of the contract price, without prior written approval of the Owner.

6.07 *Patent Fees*

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

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 *Laws and Regulations*

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

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

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

6.10 *Taxes*

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

B. OWNER will obtain an exemption certificate for the CONTRACTOR for taxes and duties on certain Products or items, for purchasing Products or items for the Work.

6.11 *Use of Site and Other Areas*

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

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

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

3. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultant, and the officers, directors, partners, employees, agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, ENGINEER, or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.

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

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

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

6.12 *Record Documents*

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

6.13 *Safety and Protection*

A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

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

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

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

B. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or loss to any property referred to in paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER's Consultant, 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). CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

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

6.15 *Hazard Communication Programs*

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

6.16 *Emergencies*

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

6.17 *Shop Drawings and Samples*

A. CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ENGINEER the services, materials, and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.17.E.

B. CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER as required by paragraph 2.07, 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.

D. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

a. All field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

b. All materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. All information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

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

3. At the time of each submittal, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

E. *ENGINEER's Review*

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

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

3. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of each submittal as required by paragraph 6.17.D.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 approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

F. *Resubmittal Procedures*

1. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.18 *Continuing the Work*

A. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.04 or as OWNER and CONTRACTOR may otherwise agree in writing.

6.19 *CONTRACTOR's General Warranty and Guarantee*

A. CONTRACTOR warrants and guarantees to OWNER, ENGINEER, and ENGINEER's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. 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.

B. 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 acceptance by OWNER or any failure to do so;

6. Any review and approval of a Shop Drawing or Sample submittal or 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.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other 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:

1. 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; and

2. Is caused in whole or in part 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, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.

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

C. The indemnification obligations of CONTRACTOR under paragraph 6.20.A shall not extend to the liability of ENGINEER and ENGINEER's Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them 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.

ARTICLE 7 - OTHER WORK

7.01 *Related Work at Site*

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

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

2. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Time that should be allowed as a result of such other work, a Claim may be made therefore as provided in paragraph 10.05.

B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the other work with OWNER's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, 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 their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

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

7.02 *Coordination*

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

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

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

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

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

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.02 *Replacement of ENGINEER*

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

8.03 *Furnish Data*

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

8.04 *Pay Promptly When Due*

A. OWNER shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. OWNER's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.01 and 4.05. Paragraph 4.02 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by ENGINEER in preparing the Contract Documents.

8.06 *Insurance*

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

8.07 *Change Orders*

A. OWNER is obligated to execute Change Orders as indicated in paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. OWNER's responsibility in respect to certain inspections, tests, and approvals is set forth in paragraph 13.03.B.

8.09 *Limitations on OWNER's Responsibilities*

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

8.10 *Undisclosed Hazardous Environmental Condition*

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

8.11 *Evidence of Financial Arrangements*

A. If and to the extent OWNER has agreed to furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER's obligations under the Contract Documents, OWNER's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *OWNER'S Representative*

A. ENGINEER will be OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER's representative during construction are set forth in the Contract Documents and will not be changed without written consent of OWNER and ENGINEER.

9.02 *Visits to Site*

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

B. ENGINEER's visits and observations are subject to all the limitations on ENGINEER's authority and responsibility set forth in paragraph 9.10, and particularly, but without limitation, during or as a result of ENGINEER's visits or observations of CONTRACTOR's Work ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more extensive observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10. If OWNER designates another representative or agent to represent OWNER at the Site who is not ENGINEER's Consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Clarifications and Interpretations*

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Time, or both, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefore as provided in paragraph 10.05.

9.05 *Authorized Variations in Work*

A. ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Time and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR, who shall perform the Work involved promptly. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Time, or both, as a result of a

Field Order, a Claim may be made therefore as provided in paragraph 10.05.

9.06 *Rejecting Defective Work*

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

9.07 *Shop Drawings, Change Orders and Payments*

A. In connection with ENGINEER's authority as to Shop Drawings and Samples, see paragraph 6.17.

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

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

9.08 *Determinations for Unit Price Work*

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

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

A. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work, the quantities and classifications of Unit Price Work, the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, and Claims seeking changes in the Contract Price or Contract Time will be referred initially to ENGINEER in writing, in accordance with the provisions of paragraph 10.05, with a request for a formal decision.

B. When functioning as interpreter and judge under this paragraph 9.09, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.10 *Limitations on ENGINEER's Authority and Responsibilities*

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

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

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

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

E. The limitations upon authority and responsibility set forth in this paragraph 9.10 shall also apply to ENGINEER's Consultants, Resident Project Representative, and assistants.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

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

B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Time, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefore as provided in paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

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

10.03 *Execution of Change Orders*

A. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:

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

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

3. Changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.18.A.

10.04 *Notification to Surety*

A. If notice 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 Time) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility. The amount of each applicable Bond will be adjusted to reflect the effect of any such change.

10.05 *Claims and Disputes*

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

B. *ENGINEER's Decision:* ENGINEER will render a formal decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any. ENGINEER's written decision on

such Claim, dispute, or other matter will be final and binding upon OWNER and CONTRACTOR unless:

1. An appeal from ENGINEER's decision is taken within the time limits and in accordance with the dispute resolution procedures set forth in Article 16; or

2. If no such dispute resolution procedures have been set forth in Article 16, a written notice of intention to appeal from ENGINEER's written decision is delivered by OWNER or CONTRACTOR to the other and to ENGINEER within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such decision or within 60 days after Substantial Completion, whichever is later (unless otherwise agreed in writing by OWNER and CONTRACTOR), to exercise such rights or remedies as the appealing party may have with respect to such Claim, dispute, or other matter in accordance with applicable Laws and Regulations.

C. If ENGINEER does not render a formal decision in writing within the time stated in paragraph 10.05.B, a decision denying the Claim in its entirety shall be deemed to have been issued 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

D. No Claim for an adjustment in Contract Price or Contract Time (or Milestones) will be valid if not submitted in accordance with this paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

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

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 at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by OWNER.

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

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

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants)

employed for services specifically related to the Work.

5. Supplemental costs including the following:

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

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.

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

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

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

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

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

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

i. When the Cost of the Work is used to determine the value of a Change Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work or caused by the event giving rise to the Claim.

j. When all the Work is performed on the basis of cost-plus, the costs of premiums for all Bonds and insurance CONTRACTOR is required by the Contract Documents to purchase and maintain.

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

1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnerships and sole proprietorships), general managers, 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 11.01.A.1 or specifically covered by paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the CONTRACTOR's fee.

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

3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's

capital employed for the Work and charges against CONTRACTOR for delinquent payments.

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

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

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

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

11.02 *Cash 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 as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

1. The 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 costs, overhead, profit, and other expenses contemplated for the 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.

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

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.

B. 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.

C. OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Price in accordance with paragraph 10.05 if:

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

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

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

ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIME

12.01 *Change of Contract Price*

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

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

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

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

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

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

1. The Agreement identifies the following:

a. Overhead and profit fees applicable to Changes in the Work, whether additions to or deductions from the Work on which the Contract Price is based.

b. Fees for changes in subcontract work (both additions and deductions)

c. The Contractor shall apply fees as noted, to the Subcontractor's gross (net plus fee) costs on additional work.

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

a. For costs incurred under paragraphs 11.01.A.1 and 11.01.A.2, the CONTRACTOR's fee shall be 15 percent;

b. For costs incurred under paragraph 11.01.A.3, the CONTRACTOR's fee shall be five percent;

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

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

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

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

12.02 *Change of Contract Time*

A. The Contract Time (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Time (or Milestones) shall be based on written notice submitted by the party making the claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. Any adjustment of the Contract Time (or Milestones) covered by a Change Order or of any Claim for

an adjustment in the Contract Time (or Milestones) will be determined in accordance with the provisions of this Article 12.

12.03 *Delays Beyond CONTRACTOR's Control*

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

12.04 *Delays Within CONTRACTOR's Control*

A. The Contract Time (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 *Delays Beyond OWNER's and CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Time (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Time (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

12.06 *Delay Damages*

A. In no event shall OWNER or ENGINEER be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. Delays caused by or within the control of CONTRACTOR; or

2. Delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

B. Nothing in this paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inactions of OWNER or anyone for whom OWNER is responsible.

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

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which OWNER or ENGINEER has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

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

13.03 *Tests and Inspections*

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

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

1. For inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;

2. That costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and

3. As otherwise specifically provided in the Contract Documents.

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

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

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation.

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

13.04 *Uncovering Work*

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

B. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefore as provided in paragraph 10.05. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a Claim therefore as provided in paragraph 10.05.

13.05 *OWNER May Stop the Work*

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

13.06 *Correction or Removal of Defective Work*

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

13.07 *Correction Period*

A. If within one year after the date of final payment to the CONTRACTOR or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for CONTRACTOR's use by OWNER or permitted by Laws and Regulations as contemplated in paragraph 6.11.A is found to be defective, CONTRACTOR shall promptly,

without cost to OWNER and in accordance with OWNER's written instructions: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such 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, and all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.

B. 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 or by Written Amendment.

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

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

13.08 *Acceptance of Defective Work*

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

13.09 *OWNER May Correct Defective Work*

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

B. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the Site, take possession of all or part of the Work and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees, OWNER's other contractors, and ENGINEER and ENGINEER's Consultants access to the Site to enable OWNER to exercise the rights and remedies under this paragraph.

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

or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR's defective Work.

D. CONTRACTOR shall not be allowed an extension of the Contract Time (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies under this paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

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

14.02 *Progress Payments*

A. *Applications for Payments*

1. At least 20 days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect OWNER's interest therein, all of which must be satisfactory to OWNER.

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

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

B. *Review of Applications*

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

2. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's observations on the Site 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, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.08, and to 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: (i) inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed

inspections of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents; or (ii) that 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 to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work. Additionally, said review or recommendation will not impose responsibility on ENGINEER to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or 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 referred to in paragraph 14.02.B.2. ENGINEER may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

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

b. The Contract Price has been reduced by Written Amendment or Change Orders;

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

d. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. *Payment Becomes Due*

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

D. *Reduction in Payment*

1. OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

a. Claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work;

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

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

d. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.

2. If OWNER refuses to make payment of the full amount recommended by ENGINEER, OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.

3. If it is subsequently determined that OWNER's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by paragraph 14.02.C.1.

14.03 *CONTRACTOR's Warranty of Title*

A. CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the

Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. Substantial completion of project shall be defined as the time at which all pay items have been completed and OWNER can fully utilize the new facilities.

B. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Promptly thereafter, 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 thereof. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within 14 days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefore. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER's issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

C. After substantial completion there shall be a 30-day maintenance period in which items shall be completed by the CONTRACTOR prior to final payment.

D. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Use by OWNER at OWNER's option of 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, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. 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 therefore. If ENGINEER considers that part of the Work to be substantially complete, the provisions of paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

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

14.06 *Final Inspection*

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

14.07 *Final Payment*

A. *Application for Payment*

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

2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.

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

B. *Advertisement of Closing*

1. The Contractor shall attach to the final payment estimate an affidavit of publication (with clipping) from a newspaper of general circulation in the county where work was done, that completion has been advertised weekly for four consecutive weeks. First notice must be subsequent to completion. Employ the following copy:

"Notice is hereby given that (contractor and address) has completed all work on the (insert name of Project from contract documents). All persons having any claim for labor, materials, or otherwise in connection with this project should immediately notify the above named contractor and the Engineer.

C. *Review of Application and Acceptance*

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

D. *Payment Becomes Due*

1. Thirty days after the presentation to OWNER of the Application for Payment and accompanying documentation, the amount recommended by ENGINEER will become due and, when due, will be paid by OWNER to CONTRACTOR.

2. The 1-year warranty period (work and materials) shall commence on the date of final payment to the CONTRACTOR.

14.08 *Final Completion Delayed*

A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

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

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

2. A waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 *OWNER May Suspend Work*

A. At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to CONTRACTOR and ENGINEER, which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Time, or both, directly attributable to any such suspension if CONTRACTOR makes a Claim therefore as provided in paragraph 10.05.

15.02 *OWNER May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. CONTRACTOR's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.07 as adjusted from time to time pursuant to paragraph 6.04);

2. CONTRACTOR's disregard of Laws or Regulations of any public body having jurisdiction;

3. CONTRACTOR's disregard of the authority of ENGINEER; or

4. CONTRACTOR's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in paragraph 15.02.A occur, OWNER may, after giving CONTRACTOR (and the surety, if any) seven days written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site, and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), 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 finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by OWNER arising out of or relating to completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, and damages incurred by OWNER will be reviewed by ENGINEER as to their reasonableness and, when so

approved by ENGINEER, incorporated in a Change Order. When exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

C. Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.03 *OWNER May Terminate for Convenience*

A. Upon seven days written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):

1. For 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. For expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. For all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. For reasonable expenses directly attributable to termination.

B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *CONTRACTOR May Stop Work or Terminate*

A. If, through no act or fault of CONTRACTOR, the Work is suspended for more than 90 consecutive days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within 30 days after it is submitted, or OWNER fails for 30 days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days written notice to OWNER and ENGINEER, and provided OWNER or ENGINEER do not remedy such suspension or failure within that time, terminate the Contract and recover from OWNER payment on the same terms as provided in paragraph 15.03. In lieu of terminating the Contract and without prejudice to any other right or remedy, if ENGINEER has failed to act on an Application for Payment within 30 days after it is submitted, or OWNER has failed for 30 days to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may, seven days after written notice to OWNER and ENGINEER, stop the Work until payment is made of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.04 are not intended to preclude CONTRACTOR from making a Claim under paragraph 10.05 for an adjustment in Contract Price or Contract Time or otherwise for expenses or damage directly attributable to CONTRACTOR's stopping the Work as permitted by this paragraph.

ARTICLE 16 - DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 - MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last

day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

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

17.05 *Controlling Law*

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

END OF DOCUMENT

DOCUMENT 00800

SUPPLEMENTARY CONDITIONS

1. *General*

1.1 These Supplementary Conditions amend or supplement the General Conditions of the Construction Contract and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings indicated below, which are applicable to both the singular and plural thereof.

2. *Article 5 – Bonds and Insurance*

Replace Paragraph 5.06, A. with the following:

A. Builder's Risk: Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be required by Laws and Regulations). This insurance shall:
    1. Include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;
    2. Be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the General Conditions 00700 - 17 (Rev. 02-15-22);
    3. Include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
    4. Cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER;
    5. Allow for partial utilization of the Work by OWNER;
    6. Include testing and startup; and
    7. Be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR, and ENGINEER with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.

END OF DOCUMENT

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: CS011086-01

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: City of Springville SRF Loan (Project) Number: CS011086-01

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.**))

Honorable Dave Thomas, Mayor
(Printed Name and Title)

GENERAL INFORMATION:

Loan Recipient (Owner) Contact: _____

Loan Recipient (Owner) Phone Number/Email: _____

Consulting Engineer Contact: Carmen Chosie, P.E., CDG, Inc.

Consulting Engineer Phone Number/Email: (334) 677-9431/carmen.chosie@cdge.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 Water Reclamation Facility Improvements
Bid/ Proposal No. CS011086-01	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity:

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)

EPA 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 Water Reclamation Facility Improvments
Bid/ Proposal No. CS011086-01	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity:

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 Water Reclamation Facility Improvements
Bid/ Proposal No. CS011086-01	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity:		

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: City of Springville Loan (Project) Number: CS011086-01

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.**))

Honorable Dave Thomas, Mayor
_____
(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*: Water Reclamation Facility Improvements
(*not **Contract** Name)

SRF Project No.: CS011086-01

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

"General Decision Number: AL20240113 01/05/2024

Superseded General Decision Number: AL20230113

State: Alabama

Construction Type: Heavy

County: St Clair 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

SUAL2015-041 08/02/2017

	Rates	Fringes
CARPENTER, Includes Form Work	$ 20.26	8.59
CEMENT MASON/CONCRETE FINISHER, Includes Water Sewer Lines	$ 12.00 **	0.00
ELECTRICIAN	$ 20.86	4.04
LABORER: Common or General, Includes Water Sewer Lines	$ 13.04 **	1.41
LABORER: Pipelayer, Includes Water Sewer Lines	$ 13.91 **	2.04
OPERATOR: Backhoe/Excavator/Trackhoe, Includes Water Sewer Lines	$ 18.13	3.66
OPERATOR: Loader, Includes Water Sewer Lines	$ 17.64	2.14
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.

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** 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.

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END OF GENERAL DECISION"

XVI – American Iron and Steel Requirement

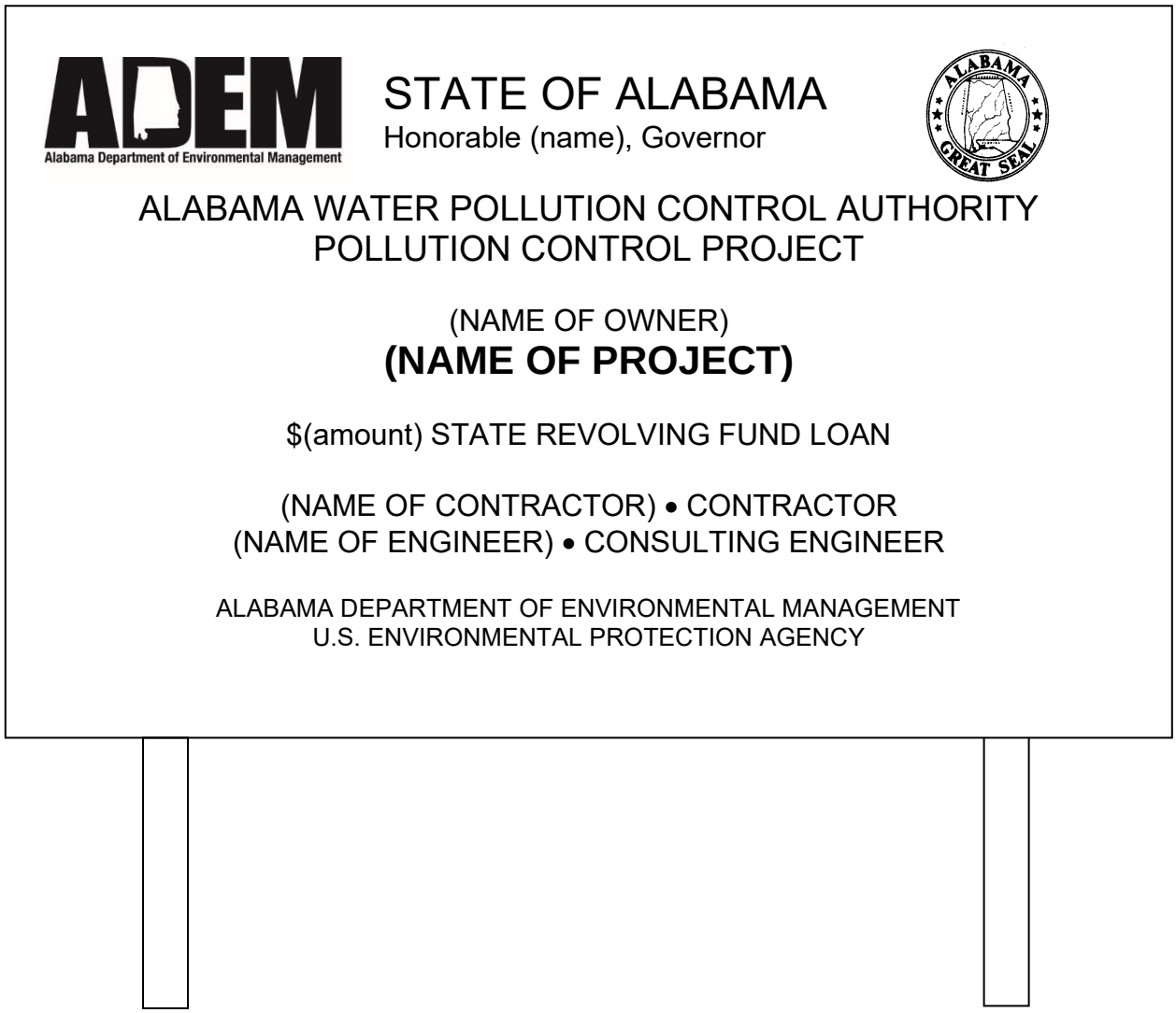
Section 4.13 Compliance with 2014 Appropriations Act. (a) The Loan Recipient agrees to comply with all federal requirements applicable to the Authority Loan (including those imposed by P.L. 113-76, Consolidated Appropriations Act (the "2014 Appropriations Act") and related SRF Policy Guidelines) which 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

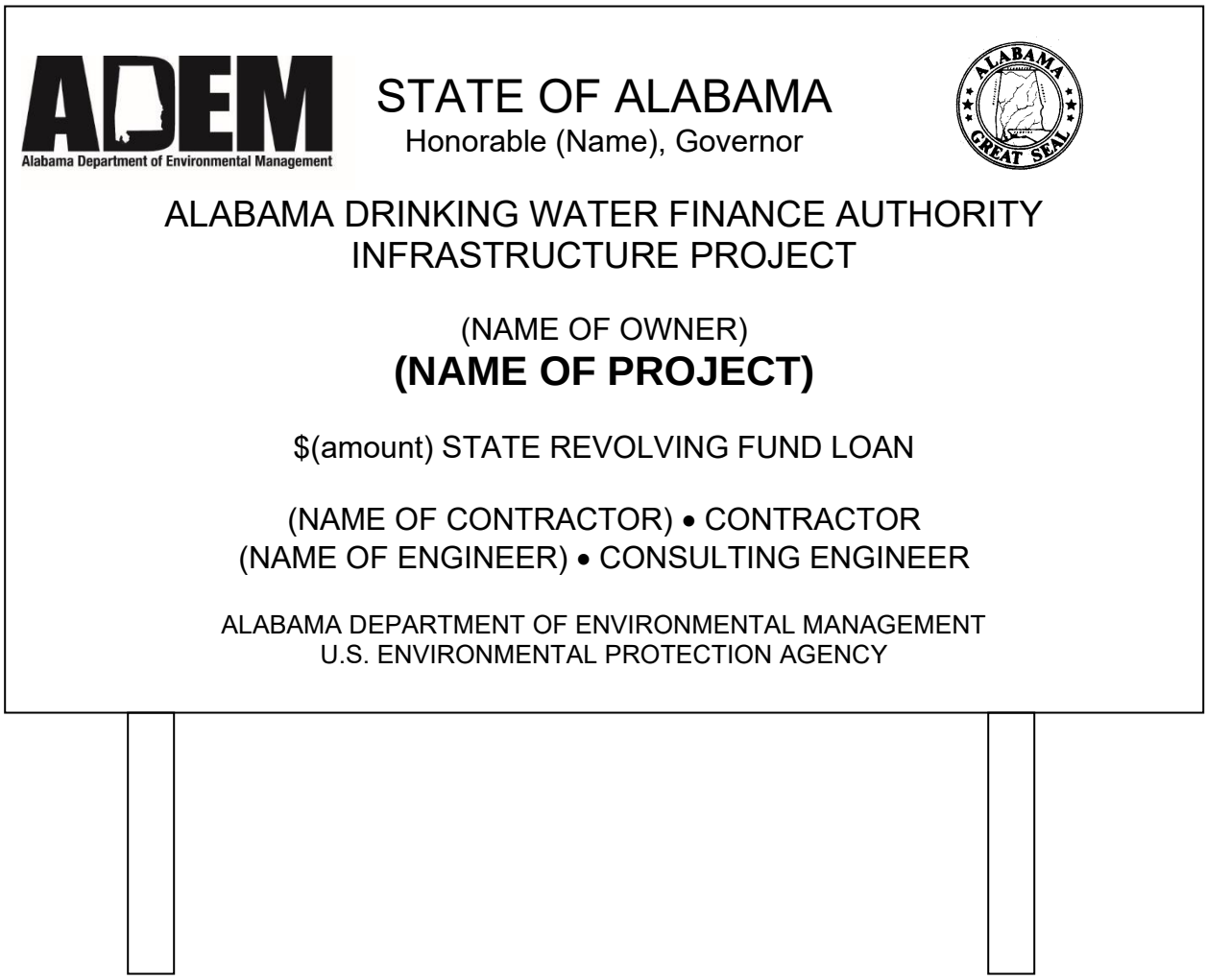
The Contractor acknowledges to and for the benefit of the City of Springville, Alabama ("Purchaser"), and the Alabama Water Pollution Control Authority or the Drinking Water Finance Authority (the "State Authority") that it understands the goods and services under this Agreement are being funded with 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.

XVII – Project Sign Detail - CWSRF



1. Sign is to be constructed of ½" MDO plywood, 4' x 8'. Alternate materials may be used if approved by ADEM prior to use.
2. Paint with two (2) coats oil-base enamel before lettering.
3. Background color white; lettering black.
4. Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.
5. Sign shall be attached to 4" x 4" x 8' treated posts. Alternatives may be used if approved by ADEM prior to use.
6. Sign shall be placed in prominent location, easily readable from existing street or roadway.
7. Sign shall be maintained in good condition until completion of project.

XVIII – Project Sign Detail - DWSRF



1. Sign is to be constructed of ½" MDO plywood, 4' x 8'. Alternate materials may be used if approved by ADEM prior to use.
2. Paint with two (2) coats oil-base enamel before lettering.
3. Background color white; lettering black.
4. Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.
5. Sign shall be attached to 4" x 4" x 8' treated posts. Alternatives may be used if approved by ADEM prior to use.
6. Sign shall be placed in prominent location, easily readable from existing street or roadway.
7. Sign shall be maintained in good condition until completion of project.

STATE OF ALABAMA
Honorable (Name), Governor

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

(NAME OF OWNER)

(NAME OF PROJECT)

$(amount) ARPA Funds
$(amount) State Revolving Fund Loan (if applicable)

(NAME OF CONTRACTOR) • CONTRACTOR
(NAME OF ENGINEER) • CONSULTING ENGINEER

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

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**	
00105-1 to 00105-2	Yes	**Bid Advertisement (including date, time, and location of bid opening).**
00410-1 to 00410-2	Yes	**Bid Bond.**
00610-1 to 00610-2	Yes	**Performance Bond (100%).**
00620-1 to 00620-2	Yes	**Payment Bond (Not less than 50%).**
00500-1	Yes	**Contract Length.**
00500-2	Yes	**Liquidated Damages.**
00700-14 to 00700-18	Yes	**Liability Insurance (including workman's comp, public liability, and builder's risk, if applicable).**
00200-6	Yes	**Method of Award (i.e. lowest, responsive, responsible bidder).**
N/A	N/A	**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: City of Springville Project Number: _____

Project Name: Water Reclamation Facility Improvements

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:

_____

_____

SECTION 01100

SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contract description.

B. Work by Owner.

C. Owner supplied products.

D. Contractor's use of site and premises.

E. Future work.

F. Work sequence.

G. Owner occupancy.

H. Specification Conventions.

1.2 CONTRACT DESCRIPTION

A. Work of the Project is as described in Contract Drawings and Documents.

B. Perform Work of each Contract under separate contract with Owner in accordance with Conditions of Contract.

1.3 WORK BY OWNER OR OTHERS

A. Items to be furnished and installed by Owner and/or Others are as noted in the Drawings.

1.4 OWNER SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Engineer-reviewed Shop Drawings, Product Data, and Samples, to Contractor.
   2. Arrange and pay for delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner-reviewed Shop Drawings, Product Data, and Samples.

2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

C. Products furnished to site and installed by Owner:
1. As noted on Drawings or Special Provisions

D. Items furnished by Owner for installation by Contractor:
1. As noted on Drawings or Special Provisions

1.5 CONTRACTOR'S 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. Access to Site: Limited to construction activities

C. Construction Operations: Limited to work described in the Technical Specifications.

D. Time Restrictions for Performing Work: Limits of the Agreement.

1.6 WORK SEQUENCE

A. Construct Work in stages to accommodate Owner's occupancy requirements during construction period. Coordinate construction schedule and operations with Owner and Engineer. Additional sequences may be indicated in the Drawings.

1.7 OWNER OCCUPANCY

A. The Owner will occupy the site during the entire period of construction for the conduct of normal operations.

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

C. Schedule the Work to accommodate Owner occupancy.

1.8 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01200

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule of values.

B. Applications for payment.

C. Change procedures.

D. Defect assessment.

E. Unit prices.

F. Alternates.

1.2 SCHEDULE OF VALUES

A. Submit printed schedule on Contractor's standard form or electronic media printout.

B. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.

C. Include in each line item, amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.

D. Revise schedule to list approved Change Orders, with each Application for Payment.

1.3 APPLICATIONS FOR PAYMENT

A. Submit four copies of each application on Contractor's electronic media driven form.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment.

D. Payment Period: Contractor to submit Pay Request, with the agreed upon quantities shown, on the first working day of the month for the previous month.

E. Submit with transmittal letter as specified for Submittals in Section 01330.

F. Substantiating Data: When submitting Pay Request that includes a pay request for stored materials, Contractor must also submit a paid invoice for all materials listed for reimbursement.

1.4 CHANGE PROCEDURES

A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions.

C. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors.

D. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation.

E. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on fixed unit price basis.

F. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

G. Correlation Of Contractor Submittals:
1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
3. Promptly enter changes in Project Record Documents.

1.5 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct appropriate remedy or adjust payment.

C. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of Engineer.

D. Defective Work will be partially repaired to instructions of Engineer, and unit sum/price will be adjusted to new sum/price at discretion of Engineer.

E. Individual specification sections may modify these options or may identify specific formula or percentage sum/price reduction.

F. Authority of Engineer to assess defects and identify payment adjustments is final.

G. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from transporting vehicle.
   4. Products placed beyond lines and levels of required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected products.

1.6 UNIT PRICES

A. Authority: Measurement methods are delineated in Section 1.7 of this Specification.

B. Measurement methods delineated in individual specification sections complement criteria of this section. In event of conflict, requirements of individual specification section govern.

C. Take measurements and compute quantities. Engineer will verify measurements and quantities.

D. Unit Quantities: Quantities and measurements indicated in Bid Form are for contract purposes only. Quantities and measurements supplied or placed in the Work shall determine payment.
   1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at unit sum/prices contracted.

E. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of item of the Work; overhead and profit.

F. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Engineer multiplied by unit sum/price for Work incorporated in or made necessary by the Work.

1.7 EXPLANATION OF BID ITEMS

A. **Bid Item No. 1 – Mobilization:** See Specification Section 02050.

B. **Bid Item No. 2 – Erosion Control, Grassing and Restoration:** Includes, but is not limited to, all necessary labor, materials, equipment, purchase, transport, loading/unloading, installation, maintenance and removal of the erosion and sediment control plan/devices. Also includes fine grading, topsoil placement, temporary and permanent seeding, fertilization, mulching, watering, mowing and other necessary maintenance, restoration of all structures damaged or otherwise disturbed by construction to pre-construction

conditions or better. Payment will be made at the contract lump sum price bid and shall include any incidentals necessary to complete the work in accordance with these plans and specifications.

C. **Bid Item No. 3 – Headworks:** Includes all labor, materials and equipment necessary to install screening equipment in a concrete channel in accordance with Section 11331 and refrigerated sampler in accordance with Section 11220. Work shall include screening components including semi-cylindrical screen basket, concentric screw conveyor/dewatering screw, screenings press with drive unit, support structure, weather protection system, electrical control system, concrete channel with removable aluminum grating, refrigerated sampler, ancillary piping and equipment required to provide a complete and properly functioning system. Payment will be made at the contract lump sum price bid and shall include any incidentals necessary to complete the work in accordance with these plans and specifications.

D. **Bid Item No. 4 – Influent Lift Station:** Includes all labor, materials and equipment necessary to install packaged submersible lift station in accordance with Section 11217. Work shall include pre-engineered, factory-built, automatically controlled above ground lift station including station enclosure, station base, wet well, submersible pumps, guide rails and accessories, electrical control system, liquid level control system, valves, piping, pressures gauges, ancillary piping and equipment required to provide a complete and properly functioning system. Payment will be made at the contract lump sum price bid and shall include any incidentals necessary to complete the work in accordance with these plans and specifications.

E. **Bid Item No. 5 – 1.8 MGD Sequencing Batch Reactor (SBR) Equipment in Concrete Tanks:** Includes all labor, materials and equipment necessary to install sequencing batch reactor equipment in concrete tanks in accordance with Section 11390. Work shall include sequencing batch reactor (SBR) equipment including diffuser system, mixing system, decanter system, sludge wasting pumps, valving, level sensors, DO problems, access walkways, electrical control system, ancillary piping and equipment required to provide a complete and properly functioning system. Payment will be made at the contract lump sum price bid and shall include any incidentals necessary to complete the work in accordance with these plans and specifications.

F. **Bid Item No. 6 – Administration Building**: Includes providing all labor and furnishing all equipment and tools to install a pre-engineered metal building with concrete foundation and associated wiring and other appurtenances required to form a complete and functioning system as shown on Drawings. Payment will be made at the contract lump sum price bid and shall include any incidentals necessary to complete the work in accordance with these plans and specifications.

G. **Bid Item No. 7 – Emergency Standby Generator with ATS and Concrete Pad**: Includes providing all labor and furnishing all equipment and tools to install a standby generator system with automatic transfer switch and concrete equipment pad with associated wiring and other appurtenances required to form a complete and functioning system as shown on Drawings. Payment will be made at the contract lump sum price bid and shall include any

incidentals necessary to complete the work in accordance with these plans and specifications.

H. The items in the Bid Form are intended to provide full compensation to the Contractor for providing a complete and functional project. Any major items deemed by the proposed bidder to be missing in the Bid Form shall be called to the attention of the Engineer prior to the bid so that an Addendum can be considered. Payment for any minor items necessary to satisfactorily complete the project which are not listed in the Bid Form shall be included in the prices bid for items in the Bid Form. No additional payment will be made for these minor items.

1.8 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Field engineering.

C. Preconstruction meeting.

D. Progress meetings.

E. Pre-installation meetings.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

A. The Contractor shall employ a Land Surveyor registered in State of Alabama for construction stakeout services. The Engineer can be employed by the Contractor to provide control points if requested.

B. Locate and protect survey control and reference points. Promptly notify Engineer of discrepancies discovered.

C. Control datum for survey is that shown on Drawings.

D. Verify setbacks and easements; confirm drawing dimensions and elevations.

E. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

F. Submit copy of site drawing signed by Land Surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.

G. Maintain complete and accurate log of control and survey work as Work progresses.

H. On completion of foundation walls and major site improvements, prepare certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

I. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

J. Promptly report to Engineer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

K. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

1.4 PRECONSTRUCTION MEETING

A. Owner will schedule meeting after Notice of Award.

B. Attendance Required: Owner, Engineer, and Contractor.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
5. Designation of personnel representing parties in Contract, and Engineer.
6. Procedures and processing of field decisions, submittals, and substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.
8. Scheduling activities of Geotechnical Engineer.

D. Record minutes and distribute copies within five (5) days after meeting to participants, with copies to Engineer, Owner, and those affected by decisions made.

1.5 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Engineer will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

C. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

E. Record minutes and distribute copies within five (5) days after meeting to participants, with copies to Engineer, Owner, and those affected by decisions made.

1.6 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.

B. Require attendance of parties directly affecting, or affected by, Work of specific section.

C. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
2. Review coordination with related work.

D. Record minutes and distribute copies within five (5) days after meeting to participants, with copies to Engineer, Owner, and those affected by decisions made.

PART 2 PRODUCTS

Not Used.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed products list.

D. Product data.

E. Shop drawings.

F. Samples.

G. Design data.

H. Test reports.

I. Certificates.

J. Manufacturer's instructions.

K. Manufacturer's field reports.

L. Erection drawings.

M. Construction photography/videography.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal with Engineer accepted form.

B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

C. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

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

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

F. Provide submittals in both hard copy and electronic media format compatible with Owner and Engineer's viewing software.

G. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

H. Identify variations from Contract Documents and product or system limitations, which may be detrimental to successful performance of completed Work.

I. Allow space on submittals for Contractor and Engineer review stamps.

J. When revised for resubmission, identify changes made since previous submission.

K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

L. Submittals not requested will not be recognized or processed.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedules within 15 days after date established in Notice to Proceed. After review, resubmit required revised data within 10 days.

B. Submit revised Progress Schedules with each Application for Payment.

C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

E. Submit computer generated horizontal bar chart with separate line for each major portion of Work or operation, identifying first work day of each week.

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

G. Indicate estimated percentage of completion for each item of Work at each submission.

H. Submit separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished products and products identified under Allowances, and dates reviewed submittals will be required from Engineer. Indicate decision dates for selection of finishes.

I. Indicate delivery dates for Owner furnished products and products identified under Allowances.

J. Revisions To Schedules:
   1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

1.4 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Owner-Contractor Agreement, submit 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.

1.5 PRODUCT DATA

A. Product Data: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit number of copies Contractor requires, plus four copies Engineer will retain.

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

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01700.

1.6 SHOP DRAWINGS

A. Shop Drawings: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Submit in form of one reproducible transparency.

D. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01700.

1.7 SAMPLES

A. Samples: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Samples For Selection as Specified in Product Sections:
1. Submit to Engineer for aesthetic, color, or finish selection.

2. Submit samples of finishes from full range of manufacturers' standard colors, textures, and patterns for Engineer selection.

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

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

E. Submit number of samples specified in individual specification sections; Engineer will retain one sample.

F. Reviewed samples which may be used in the Work are indicated in individual specification sections.

G. Samples will not be used for testing purposes unless specifically stated in specification section.

H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01700.

1.8 DESIGN DATA

A. Submit for Engineer's knowledge as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.9 TEST REPORTS

A. Submit for Engineer's knowledge as contract administrator or for Owner.

B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Engineer, 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 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

A. Submit reports for Engineer's benefit as contract administrator or for Owner.

B. Submit report within 30 days of observation to Engineer for information.

C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.13 ERECTION DRAWINGS

A. Submit drawings for Engineer's benefit as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

1.14 CONSTRUCTION PHOTOGRAPHY/VIDEOGRAPHY

A. Provide digital photographs and/or video of the site prior to beginning construction and monthly throughout progress of Work.

B. All photo and/or video files shall be saved in a format that is easily read from a Windows-based computer. Each photo/video shall be named or referenced such that their location within the project area is easily identifiable. Additional information provided shall include name of Project, project number, orientation of view, and date and time of view.

C. All files shall be submitted via a thumb drive, a portable hard drive, or an approved cloud-based file storage transfer.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01400

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality control and control of installation.

B. Tolerances

C. References.

D. Mock-up requirements.

E. Testing and inspection services.

F. Manufacturers' field services.

G. Examination.

H. Preparation.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

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1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or workmanship specified by association, trades, or other consensus standards, comply with requirements of 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 of Contract Documents, except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be comparison standard for remaining Work.

D. Where mock-up has been accepted by Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Engineer.

1.6 TESTING AND INSPECTION SERVICES

A. Employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.
   1. CDG can perform the required material testing and geotechnical evaluation for this project.
   2. Prior to start of Work, submit testing laboratory name, address, and telephone number if CDG is not selected.

3. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Engineer.
   1. Laboratory: Authorized to operate in State of Alabama
   2. Laboratory Staff: Maintain full time registered Engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Engineer or Owner.

D. Reports will be submitted by independent firm to Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Price.

H. Agency Responsibilities:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests required by Engineer.
   7. Attend preconstruction meetings and progress meetings.

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I. Agency Reports: After each test, promptly submit two copies of report to Engineer and to Contractor. When requested by Engineer, provide interpretation of test results. Include the following:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.
   4. Date and time of sampling or inspection.
   5. Identification of product and specifications section.
   6. Location in Project.
   7. Type of inspection or test.
   8. Date of test.
   9. Results of tests.
   10. Conformance with Contract Documents.

J. Limits On Testing Authority:
   1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency or laboratory may not approve or accept any portion of the Work.
   3. Agency or laboratory may not assume duties of Contractor.
   4. Agency or laboratory has no authority to stop the Work.

1.7 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and training as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Engineer 30 days in advance of required observations.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Refer to Section 01330 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

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B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

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

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

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

B. Promptly inspect shipments to ensure 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.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

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

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

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

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

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

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 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 one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Engineer will consider requests for Substitutions only within 30 days after date established in Notice to Award and no sooner than 10 days prior to the Notice to Proceed date.

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

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

D. A request constitutes a representation that Contractor:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for 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 and Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.

E. 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 Contract Documents.

F. 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 proposed product equivalence. Burden of proof is on proposer.
   3. Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Starting of systems.

D. Demonstration and instructions.

E. Testing, adjusting and balancing.

F. Protecting installed construction.

G. Project record documents.

H. Operation and maintenance data.

I. Manual for materials and finishes.

J. Manual for equipment and systems.

K. Spare parts and maintenance products.

L. Product warranties and product bonds.

M. Maintenance service.

1.2 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 review.

B. Provide submittals to Engineer required by authorities having jurisdiction.

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

1.3 FINAL CLEANING **(If Applicable)**

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior glass, 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 sanitary condition with cleaning materials appropriate to surface and material being cleaned.

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 site.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer seven days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01330 that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate Project equipment and instructed by qualified manufacturer's representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. Required instruction time for each item of equipment and system is specified in individual sections.

1.6 TESTING, ADJUSTING AND BALANCING

A. Owner will appoint and employ services of independent firm to perform testing, adjusting, and balancing.

B. Reports will be submitted by independent firm to Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.7 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.8 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. 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.

F. Record Drawings : Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   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.

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

1.9 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, capacity expansion binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Originals of warranties.

1.10 MANUAL FOR MATERIALS AND FINISHES

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 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

F. 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.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

H. Additional Requirements: As specified in individual product specification sections.

I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.11 MANUAL FOR EQUIPMENT AND SYSTEMS

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 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. 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 model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; by label machine.

G. Include color coded wiring diagrams as installed.

H. 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 special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

J. Include servicing and lubrication schedule, and list of lubricants required.

K. Include manufacturer's printed operation and maintenance instructions.

L. Include sequence of operation by controls manufacturer.

M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

N. Include control diagrams by controls manufacturer as installed.

O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.

P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

R. Include test and balancing reports as specified in Section 01400.

S. Additional Requirements: As specified in individual product specification sections.

T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.12 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.13 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time Of Submittals:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
   2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.14 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections during warranty period.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02050

MOBILIZATION

DESCRIPTION: Covers the preparatory Work and operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to and from the project site; for the establishment of all offices, buildings, and other facilities necessary for work on the project; and for all other Work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site.

UNIT PRICE - MEASUREMENT AND PAYMENT

A. Basis of Measurement: Lump Sum.

B. Basis of Payment: Partial payments for mobilization are allowed based on the amount bid for mobilization and the total original contract amount for all items of work. Payment will be made at the time, and in the amounts shown in the following schedules.

SCHEDULE OF PARTIAL PAYMENTS FOR MOBILIZATION WHEN BID PRICE FOR MOBILIZATION IS 10% OR LESS OF ORIGINAL CONTRACT AMOUNT (Partial Payments are a % of the Contract Amount for Mobilization)		
TIME OF PAYMENT	AMOUNT OF PAYMENT	ACCUMULATED PAYMENT
At the First Estimate and Upon Completion of 5% of the Original Contract Amount	70% of the Bid Price for Mobilization	70% of the Bid Price for Mobilization
After the First Estimate and Upon Completion of 50% of the Original Contract Amount Including Prior Payment for Mobilization	25% of the Bid Price for Mobilization	95% of the Bid Price for Mobilization
Upon Completion and Readiness for Final Payment.	5% of the Bid Price for Mobilization	100% of the Bid Price for Mobilization

SCHEDULE OF PARTIAL PAYMENTS FOR MOBILIZATION WHEN BID PRICE FOR MOBILIZATION IS GREATER THAN 10% OF ORIGINAL CONTRACT AMOUNT (Partial Payments are a % of the Contract Amount, Except the Final Payment)		
TIME OF PAYMENT	AMOUNT OF PAYMENT	ACCUMULATED PAYMENT
At the First Estimate and Upon Completion of 5% of the Original Contract Amount	6% of the Original Contract Amount	6% of the Total Contract Amount
After the First Estimate and Upon Completion of 50% of the Original Contract Amount Including Prior Payment for Mobilization	4% of the Original Contract Amount	10% of the Total Contract Amount
Final Estimate	Remainder of Contract Amount for Mobilization	100% of Contract Amount for Mobilization

END OF SECTION

SECTION 02060

AGGREGATE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Coarse aggregate materials.
2. Fine aggregate materials.

B. Related Sections:
1. Plans and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Basis of Measurement: Cubic yard or as indicated in the Plans and/or Bid Form

B. Basis of Payment: Includes all labor, materials and equipment for the installation of aggregate including hauling, placing, spreading, grading to the proper level, cleanup and all related items.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Samples: Submit 10-gallon sample of each type of aggregate to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Coarse aggregate shall consist of crushed gravel or stone having hard, strong, durable pieces, free from adherent coatings.

B. Coarse Aggregate Type A1 (ALDOT Aggregate size No. 4) shall be graded in accordance with the following limits:

Sieve Size	Percent Passing
2 inches	100
1-1/2 inch	90 to 100
1 inch	20 to 55
3/4 inch	0 to 15
1/2 inch	-----
3/8 inch	0 to 5
No. 4	-----
No. 8	-----
No. 16	-----
No. 50	-----
No. 200	-----

C. Coarse Aggregate Type A2 (ALDOT Aggregate size No. 57) shall be graded in accordance with the following limits:

Sieve Size	Percent Passing
2 inches	-----
1-1/2 inch	100
1 inch	95 to 100
3/4 inch	-----
1/2 inch	25 to 60
3/8 inch	-----
No. 4	0 to 10
No. 8	0 to 5
No. 16	-----
No. 50	-----
No. 200	-----

D. Coarse Aggregate Type A3 (ALDOT Aggregate size No. 78) shall be graded in accordance with the following limits:

Sieve Size	Percent Passing
2 inches	-----
1-1/2 inch	-----
1 inch	-----
3/4 inch	100
1/2 inch	90 to 100
3/8 inch	40 to 75
No. 4	5 to 25
No. 8	0 to 10
No. 16	0 to 5

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate Type A4 (Concrete Sand): Washed sand; free of loam, friable or soluble materials, and organic matter; non-plastic; graded in accordance with ASTM C136; within the following limits:

Sieve Size	Percent Passing
3/8 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

B. Fine Aggregate Type A5 (Natural Sand): Natural sand; free of loam, friable or soluble materials, and organic matter; non-plastic; graded in accordance with ASTM C136; within the following limits:

Sieve Size	Percent Passing
3/8 inch	100
No. 4	95 to 100
No. 8	----
No. 16	50 to 80
No. 50	20 to 50
No. 100	10 to 25
No. 200	5 to 12

2.3 SOURCE QUALITY CONTROL

A. Section 01400 - Quality Requirements.

B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D1557, ASTM D4318, or ASTM C136.

C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D1557, ASTM D4318, or ASTM C136.

D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate aggregate materials from on-site locations as specified in Section 02300.

B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.2 STOCKPILING

A. Stockpile materials on site.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 02085

VALVES FOR WATER AND SEWER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Tapping Sleeve and Valves
2. Rubber Seated Butterfly Valves
3. Resilient Wedge Gate Valves
4. Eccentric Plug Valves
5. Swing Check Valves
6. Silent Check Valves
7. Insertion Valves
8. Air/Vacuum and Air Release Valves (Including Combination Types)
9. Pilot Operated Control Valves
10. Line Stopping
11. Accessories

B. Related Sections:
1. Plans and general provisions of the Contract including General Conditions, Special Provisions and Technical Specifications.

1.2 REFERENCES

A. American Water Works Association:

1. AWWA C111 / A21.11-17 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
2. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
3. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray-Iron Fittings
4. AWWA C504 – Rubber-Seated Butterfly Valves
5. AWWA C508 – Swing Check Valves for Waterworks Service 2 in through 48 in
6. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service
7. AWWA C512 – Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
8. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water-Supply Service.
9. AWWA C517 – Resilient-Seated Cast Iron Eccentric Plug Valves
10. AWWA C530 – Pilot-Operated Control Valves
11. AWWA C541 – Hydraulic and Pneumatic Cylinder and Vane Type Actuators for Valves and Slide Gates
12. AWWA C542 – Electric Motor Actuators for Valves and Slide Gates
13. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.

14. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. National Sanitation Foundation:
   1. NSF 61 - Drinking Water System Components - Health Effects

1.3 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Tapping Sleeve and Valve Assemblies:
   1. Basis of Measurement: Each, unless otherwise noted in the Plans.
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (includes rock excavation), installation of tapping sleeve and tapping valve, tap of existing line, removal of coupon, installation of associated valve riser (valve box), concrete ring around top of valve box, valve marker, general fill, testing, cleanup and restoration, and all related items.

B. Insertion Valves:
   1. Basis of Measurement: Each, unless otherwise noted in the Plans.
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (includes rock excavation), preparation of pipe at insertion site, and installation of the insertion valve assembly in accordance with the manufacturer's recommendations. Also includes installation of associated valve riser (valve box), concrete ring around top of valve box, valve marker, general fill, testing, cleanup and restoration, and all related items.

C. Water and Sewer Valves:
   1. Basis of Measurement: Each, unless otherwise noted in the Plans or if a portion of an assembly.
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), connection and placement of valve, joint restraints, installation of associated valve riser (valve box), concrete ring around top of valve box, valve marker, general fill, compaction, cleanup and restoration, testing, and all related items.

D. Pilot Operated Control Valve Assemblies:
   1. Basis of Measurement: Per Each or Lump Sum as indicated in the Proposal.
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), valve vault, pilot operated control valve, associated internal and external piping as indicated in the plans, associated isolation valves as indicated in the Plans, drain piping as indicated in the Plans, related site work, general fill, compaction, cleanup and restoration, testing, start-up and commissioning services, and all related items.

E. Air Release and Air/Vacuum Valve Assemblies:
   1. Basis of Measurement: Each, unless otherwise noted in the Plans or if a portion of an assembly
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), vault or manhole for access, air valve assembly, connection to main, connecting internal piping, isolation valves and

valves associated with accessories, drain piping as indicated in the Plans, fill as indicated in the plans, compaction ,cleanup and restoration, testing, and all related items.

F. Line Stopping Assemblies:
   1. Basis of Measurement: Each, unless otherwise noted in the Plans or if a portion of an assembly
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), preparation of pipe at the location to be stopped off, and the installation of a temporary line stopping assembly in accordance with the manufacturer's recommendations. Also includes a concrete line stop support (with pipe wrapped with visqueen or polywrap) according to the manufacturer's requirements, but with minimum dimensions of 2 feet from both ends and sides of the assembly and a depth from the spring line to 2 feet below the main.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawing:
   1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

D. Manufacturer's Certificates: Submit Statement of Compliance and supporting data, from material suppliers stating that equipment and accessories provided meet or exceed AWWA Standards, NSF 61 certification, and specification requirements.

E. For Pilot-Operated Control Valves, provide schematic for pilot system operation.

F. For Insertion Valves or Line Stopping Assemblies, provide proposed procedures.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Project Record Documents: Record actual locations of valves and appurtenances.

C. Provide Operation and Maintenance Data for equipment indicating materials of construction, recommended maintenance activities and intervals, procedures for adjustments and troubleshooting, and sources for procurement of replacement parts.

D. For Pilot-Operated Control Valves, provide certification from manufacturer certifying installation of equipment in accordance with manufacturer's recommendations.

E. Where the Plans or Special Provisions require such, provide spare parts and maintenance materials to Owner.

1.6 QUALITY ASSURANCE

A. All Products for use in potable water systems shall be NSF 61 certified.

1.7 QUALIFICATIONS

A. Manufacturer:
   1. Utilize equipment and materials from Owner's standard list of acceptable manufacturers provided in the Special Provisions. If no such list is provided, utilize equipment and materials from list of acceptable manufacturers provided in these specifications.
   2. Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements.

B. Prepare valves and accessories for shipment according to AWWA Standards and seal valve ends to prevent entry of foreign matter into product body.

C. Store products in accordance with manufacturer's written recommendations and instructions, and in areas protected from weather, moisture, or possible damage; do not store products directly on ground.

D. Handle products in accordance with manufacturer's written recommendations and instructions, and in such a manner as to prevent damage to interior or exterior mechanisms and surfaces.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 PRODUCTS

2.1 BASIC PROVISIONS FOR GATE, PLUG, BUTTERFLY, AND CHECK VALVES

A. End Connections: Mechanical joint, flanged, or wafer type as indicated in the Plans. If no such indication is provided, utilize mechanical joint for buried applications and flanged joints for exposed applications. Mechanical joints shall conform to AWWA C111 and shall be provided with retainer gland devices. Flanged joints shall conform to AWWA C115

ANSI B16.1 CL 150 unless noted otherwise and shall be provided with 316 stainless steel nuts and bolts.

B. Valve operators:
   1. Provide gate, plug, and butterfly valves with open-left (counterclockwise) operation.
   2. Provide gate valves with non-rising stems unless specifically stated otherwise in the plans.
   3. Provide with 2-inch square operating nut for buried applications
   4. Provide with handwheel operator for exposed applications with manual opening, or 2-inch square operating nut where electric or pneumatic actuator is utilized.
   5. Provide side-mounted right-angle gear reducer on plug and butterfly valves 6-inch and larger, and on gate valves 16 inch and larger.

C. Coatings:
   1. Provide fusion-bonded epoxy coating conforming to AWWA C116 on all valves for buried applications.
   2. Provide coating in accordance with specification Section 09900 on all valves for exposed applications where this section is included. If section is not included provide bituminous coating.

D. Provide flow direction arrow on all plug and check valves.

2.2 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:
   1. Stainless steel, full circumferential gasket, flanged outlet.
   2. Manufacturers:
      a. Mueller.
      b. JCM Industries
      c. Ford Meter Box Co.
      d. Substitutions: Section 01600 - Product Requirements.
   3. Outlet Flange Dimensions and Drilling: AWWA C207 Class D, ANSI 150lb. drilling and MSS SP-60.

B. Tapping Valves:
   1. AWWA C515, resilient wedge with non-rising stem. Epoxy coated ductile iron body. Inlet flanges shall conform to ANSI B16.1, Class 150 and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111.
   2. Manufacturers:
      a. Mueller
      b. M and H
      c. American Flow Control
      d. Substitutions: Section 01600 - Product Requirements.

2.3 RUBBER SEATED BUTTERFLY VALVES

A. Manufacturers:
   1. Dezurik
   2. Pratt
   3. Valmatic
   4. Substitutions: Section 01600 – Product Requirements

B. Valve body and disc constructed of ASTM A 536 cast iron (Grade 65-45-12). Valve disc shall be of the solid type.

C. Valve shaft constructed of ASTM A 276 Type 304 stainless steel.

D. Resilient seat constructed of Buna-N mated to Type 316 stainless steel body seat ring. Resilient seat shall be located on the valve disc and shall provide a continuous, uninterrupted seating surface.

E. All retaining hardware constructed of Type 316 stainless steel.

F. 150 psi maximum working pressure rating unless stated otherwise in the plans.

2.4 RESILIENT WEDGE GATE VALVES

A. Manufacturers:
   1. Mueller
   2. M and H Valve Co.
   3. American Flow Control
   4. Substitutions: Section 01600 - Product Requirements.

B. Resilient Wedge Gate Valves: AWWA C515; ductile iron wedge and body.
   1. Resilient seats.
   2. Stem: Non-rising bronze stem.
   3. Wedge: Ductile iron, completely encapsulated with resilient material.
   4. All internal parts shall be accessible without removing the body from the line.
   5. 250 psig maximum working pressure rating standard or 350 psi maximum working pressure rating where indicated on the plans.

2.5 ECCENTRIC PLUG VALVES

A. Manufacturers:
   1. DeZurik
   2. Mueller
   3. Pratt
   4. Substitutions: Section 01600 – Product Requirements

B. Solid, one-piece plug constructed of cast iron conforming to ASTM A 126 Class B or ductile iron conforming to ASTM 536 Grade 65-45-12.

C. Cast iron body conforming to ASTM A 126 Class B with rectangular port. Permanently lubricated sleeve-type bearings constructed of Type 316 stainless steel.

D. Maximum working pressure rating of at least 175 psi for 12-inch and smaller valves, at least 150 psi for larger valves.

2.6 SWING CHECK VALVES

A. Manufacturers:
   1. Dezurik
   2. M and H Valve
   3. Mueller
   4. Pratt
   5. Substitutions: Section 01600 – Product Requirements.

B. Body, disc, and disc arm constructed of ASTM A 536 ductile iron (65-45-12).

C. Shaft shall be a single piece, constructed of Type 304 stainless steel.

D. Valve to be of single disc type with full flow passage.

E. Valve supplied with lever and weight unless plans require oil or air cushioning device.

F. Valve to have bolted removable cover for cleaning and maintenance.

G. 200 psi maximum working pressure rating for 3-inch through 12-inch valves, 150 psi for valves larger than 12-inch, unless noted otherwise in the plans.

2.7 SILENT CHECK VALVES

A. Manufacturers:
   1. Dezurik
   2. Pratt
   3. Val-Matic
   4. Substitutions: Section 01600 – Product Requirements

B. Valve body constructed of ASTM A536 ductile iron (65-45-12).

C. Valve to incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to pipe size.

D. Seat and disc to be cast bronze or aluminum bronze. Compression spring to be Type 316 stainless steel.

E. Valve to have a replaceable guide bushing held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi.

F. Valve disc to be concave to the flow direction.

G. Leakage rate not to exceed one-half the allowable rate for metal seated valves under AWWA C508 or 0.5 oz per hour per inch of valve diameter.

H. 250 psi maximum working pressure rating unless noted otherwise in the plans.

2.8 INSERTION VALVES

A. Manufacturers:
   1. TEAM Industrial Services
   2. Advanced Valve Technologies
   3. Hydra-Stop
   4. Substitutions: Section 01600 – Product Requirements

B. Valve body constructed of ASTM A536 ductile iron (65-45-12).

C. Hardware: 304 Stainless Steel

D. Seat and disc to be cast bronze or aluminum bronze. Compression spring to be Type 316 stainless steel.

E. Valve to have a replaceable guide bushing held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi.

F. Leakage rate not to exceed one-half the allowable rate for metal seated valves under AWWA C508 or 0.5 oz per hour per inch of valve diameter.

G. 250 psi maximum working pressure rating unless noted otherwise in the plans.

2.9 AIR/VACUUM AND AIR RELEASE VALVES

A. Manufacturers:
   1. ARI, Inc
   2. APCO Valve and Primer Company
   3. Crispin Valve
   4. Valmatic Valve Co.
   5. Substitutions: Section 01600 - Product Requirements.

B. Air release and air/vacuum valves shall be specifically designed by the manufacturer for either clean water service (in the case of finished potable water or other non-solids bearing water systems) or sewage service (in the case of sewerage or other potentially solids bearing systems such as raw water service) as indicated in the plans.

C. Provide air/vacuum valves, air release valves, or combination air valves having the following functionality as indicated in the plans.
   1. Air/Vacuum Valves shall open to exhaust large volumes of air in situations such as pipeline filling and shall also open to admit air for the purpose of relieving internal vacuum conditions in situations such as pipeline draining.

2. Air Release Valves shall open to exhaust small pockets of air while the pipeline is operating under pressure.
3. Combination Air Valves shall have the functionality of both air/vacuum valves and air release valves and may be of either the single body or dual body configured.

D. Design Requirements:
1. Provide Air Release and Combination Air Valves with minimum 5/16-inch orifice for exhausting small pockets of air while pipeline is operating under pressure.
2. Provide all air valves and all related accessories with pressure ratings equal to or greater than the maximum pipeline working pressure at the location of the air valve installation.
3. Provide all air valves with low pressure sealing capability equal to or less than 2 psi or, where specifically indicated in the plans, equal to or less than 1 psi.

E. End Connections:
1. 2-inch and smaller valves: Threaded end connections
2. Valves larger than 2-inch: Flanged end connections conforming to ANSI B 16.1 CL 125 unless otherwise indicated in the plans.

F. Accessories:
1. Provide the following accessories with each assembly:
   a. For clean water service applications:
      1) Provide inflow preventing device which prevents entry of external water into the pipeline system through the air inlet / outlet. Device shall allow the entry or exit of air while preventing entry of water.
      2) Provide shut-off valve on the inlet side of the valve which allows isolation of the air valve from the pipeline system. Valve shall have the same or greater pressure rating as the pipeline system.
         a) Utilize bronze ball valves with end connections compatible with air valve inlet connection for 2-inch and smaller air valves.
         b) Utilize gate valve with end connections compatible with air valve inlet connection for air valves larger than 2 inches.
   b. For sewage service applications:
      1) Provide backflushing accessories as follows:
         a) Blow-off / drain connection and shut-off valve.
         b) Clean water supply connection and shut-off valve.
         c) Backwash supply hose with quick disconnect.
         d) All shut-off valves shall be bronze, full-ported ball valves.
      2) Provide shut-off valve on the inlet side of the valve which allows isolation of the air valve from the pipeline system. Valve shall have the same or greater pressure rating as the pipeline system.
         a) Utilize bronze ball valves with end connections compatible with air valve inlet connection for 2-inch and smaller air valves.
         b) Utilize gate valve with end connections compatible with air valve inlet connection for air valves larger than 2 inches.

2.10 PILOT OPERATED CONTROL VALVES

A. Manufacturers:
   1. Bermad
   2. Cla-Val
   3. Watts
   4. Substitutions: Section 01600 - Product Requirements

B. Globe or angle pattern as indicated in the plans with ductile iron body and cover conforming to ASTM A 536. Provide with NSF 61 listed fusion bonded epoxy coating and interior lining. Studs and cover nuts shall be 316 stainless steel.

C. Stainless steel throttling components.

D. All trim shall be stainless steel.

E. Disc and diaphragm assembly shall contain a BUNA-N synthetic rubber seal securely retained on 3-1/2 sides by a disc retainer and disc guide.

F. End Connections:
   1. For main valves larger than 2-inch, provide flanged end connections conforming to ASTM C115 ANSI B16.1 CL 125 unless otherwise indicated in the plans.
   2. For main valves 2-inch and smaller, threaded end connections may be utilized if approved by the Engineer.

G. Pilot system:
   1. Regulators, fittings, and valves shall be constructed of stainless steel. Pilot system tubing shall be constructed of braided, flexible stainless steel tubing. All components of the pilot system shall have a working pressure rating in excess of the anticipated pressure conditions shown on the plans.
   2. Operation range suitable for the pressure range indicated in the plans.
   3. Provide with an external Y-strainer, adjustable opening and closing speed components, and ball-type isolation cock valves.
   4. All wetted surfaces contacted by consumable water shall contain less than 0.25% lead by weight.
   5. Pilot system manufactured and assembled by the same company as the main valve.

H. Accessories:
   1. Provide brass or stainless steel engraved nameplate for each control valve and associated pilot securely affixed to the associated component. Nameplate shall indicate the following information as applicable:
      a. Catalog and serial number
      b. Function, size, material, and pressure rating
      c. Type of pilot control system used and control adjustment range
   2. Where indicated in the plans, provide valve position indicating post.
   3. Where indicated in the plans, provide pressure gauges as follows:
      a. 4-inch diameter, glycerin-filled stainless steel with the pressure measurement range as indicated in the plans.

b. Provide with threaded connections and stainless steel connecting tubing and fittings.
c. Minimum of ½" diameter tap size or larger where indicated in the plans.
d. Provide with quarter-turn ball shut-off valves.
e. Provide with pulsation damper where indicated in the plans.

4. Where indicated in the plans, provide main-line strainer:
   a. Provide the same size as the control valve and installed immediately upstream from the control valve.
   b. Ductile iron body with epoxy coating matching that of the control valve body.
   c. Flanged end connections sized to match those of the associated control valve.
   d. Incorporate stainless steel screen which is removable for replacement or maintenance without removing the strainer body.
   e. NSF-61 certified.
   f. Assembly rated for the same working pressure as the control valve.
5. Where indicated in the plans, provide accessories, trim, and configuration which reduces internal cavitation.
6. Where required for valve function, provide solenoids suitable for operation on 120V single-phase AC power, with NEMA IV enclosure and manual operator unless indicated otherwise in the plans.

I. Control Valve Operations and Functionality:
1. Control valves of the following types shall function through a pilot control system as follows:
   a. Pressure Reducing Valves – Automatically reduce a varying upstream pressure to an operator-adjustable constant downstream pressure set point, regardless of flow rate. A decrease in downstream pressure shall cause the main valve to increase its opening, thereby increasing the downstream pressure toward the set point. An increase in downstream pressure shall cause the main valve to decrease its opening, thereby decreasing the downstream pressure toward the set point. Where specifically indicated in the plans, provide an internal check feature which prevents flow from downstream to upstream via the pilot control system.
   b. Pressure Relief Valves – Remain closed while upstream pressure is below an operator-adjustable set point. Open to exhaust water and relieve pressure when upstream pressure exceeds the set point.
   c. Surge Anticipator Valves – Automatically open a pre-set amount upon upstream pressure falling below an operator adjustable set point in anticipation of oncoming surge. Automatically close upon pressure rising above set point.
   d. Pressure Sustaining Valves – Automatically maintain upstream pressure at an operator-adjustable set point with varying downstream pressure, regardless of flow rate. A decrease in upstream pressure shall cause the main valve to decrease its opening, thereby decreasing the flow rate and increasing upstream pressure toward the set point. An increase in upstream pressure shall cause the main valve to increase its opening, thereby increasing the flow rate and decreasing the upstream pressure toward the set point.

e. Single Acting Altitude Valves – Remain fully open until the water level in a downstream reservoir or tank reaches an operator-adjustable level setpoint, then close fully. Upon the water level in the downstream tank or reservoir falling a pre-set distance, re-open fully. This valve shall be designed for one-way flow only.

f. Double Acting Altitude Valve – Remain fully open until the water level in a downstream reservoir or tank reaches an operator-adjustable level set point, then close fully. Upon either pressure on the upstream side falling below an operator-adjustable set point, or, the water level in the downstream reservoir or tank falling a pre-set distance, re-open fully. This valve shall be designed for two-way flow.

g. Solenoid-Controlled Open / Close Valve – Either open or close pilot system in response to a changing electrical current to the solenoid, which in turn either opens or closes the main valve. Solenoid shall be either normally open (open upon loss of electrical signal) or normally closed (close upon loss of electrical signal) as indicated in the plans.

h. Solenoid-Controlled Booster Pump Control Valve – Pump operation shall begin with the control valve closed. Upon pump start-up, simultaneously energize solenoid and begin opening the main valve slowly, as controlled by the opening speed control. Upon signal to shut-down pump, maintain the pump running, de-energize the solenoid, and begin slowly closing the main valve, as controlled by the closing speed control. Upon main valve reaching the fully-closed position, a limit switch shall release a valve / pump interlock, and the pump shall shut down. Where indicated in the plans an internal check feature shall be provided to prevent reverse flow.

i. Solenoid-Controlled Deep Well Pump Control Valve – Pump operation shall begin with the valve open. Upon pump start-up, simultaneously energize solenoid and begin closing the main valve slowly, as controlled by the closing pump speed control. Upon signal to shut down the pump or upon loss of power, the solenoid is de-energized, and the main valve begins to open slowly, as controlled by the opening speed control. Upon the main valve reaching the fully open position,

2.11 LINE STOPPING ASSEMBLIES

A. Manufacturers:
   1. JCM Industries
   2. Substitutions: Section 01600 – Product Requirements

B. Blind Flange: 150 lb, ASTM A36 Carbon Steel, Epoxy Coated

C. Blind Flange Gasket: Styrene-Butadiene Rubber (SBR) compounded for use with water

D. Gasket: Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000

E. Bolts and Hardware: Stainless Steel 18-8 Type 304

F. Finish: Fusion applied Epoxy Coating per ANSI/AWWA C213 Standard

2.12 ACCESSORIES

A. Valve Boxes for Buried Valves:
   1. 12-inch diameter valves and smaller: Domestic cast iron, two-piece, screw type for height adjustment.
   2. Valves larger than 12-inch: Domestic cast iron, three-piece, screw type for height adjustment.
   3. For either size condition, provide 6-inch ductile iron pipe riser sections as required for additional height where standard is insufficient.
   4. Provide with cast iron lid marked “Water” or “Sewer” as applicable

B. Valve Markers for Buried Valves:
   1. Provide fiberglass marker (either round or flat) or concrete monument as required in the plans. If no such indication is present, provide flat fiberglass marker.
   2. For fiberglass markers, provide either blue color for potable water or green color for sewer. Provide with Owner’s standard labeling information as indicated in the plans or specifications. If no such information is present, provide minimum labeling as follows:
      a. “Warning – Water (Sewer) Pipeline Below”
      b. Notification to contact 811 service before digging
      c. Owner’s emergency contact information.
   3. For concrete markers, provide dimensions as indicated in the plans. Provide with markings as shown in the plans. If no such information is present, provide minimum information as follows:
      a. “Water (Sewer) Valve

C. Valve Operating Nut Stem Extensions:
   1. For buried valves where the valve operating nut is greater than 48-inches below the top of the valve box, provide a stainless steel stem extension designed to fit snugly and securely onto operating nut and with 2-inch square top operating nut designed to fit into standard valve wrench. Provide length as required so that top of operating nut is between 12 and 36 inches below the top of the valve box.
   2. For non-buried valves, provide stainless steel stem extensions and appropriate mounting brackets / guides where indicated in the plans. For applications where electric or pneumatic actuators are utilized, extensions shall be suitably sized to withstand torque imparted by actuator.

D. Post Type Position Indicators:
   1. Manufacturers:
      a. Mueller
      b. M and H Valve
      c. American Flow Control
      d. Substitutions: Section 01600 - Product Requirements.
   2. Vertical Indicator Post designed to operate a non-rising stem gate valve with above ground visual indication of valve position (open or shut).
   3. Indicator post shall feature a telescoping stem that can be adjusted to its final position without field cutting of the stem.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Determine exact location, configuration, features, and size of valves and accessories from the Plans; obtain clarification and directions from Engineer prior to execution of work.

C. Verify invert elevations of existing work prior to excavation and installation.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

3.3 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions.

3.4 EQUIPMENT START-UP AND COMMISSIONING

A. For pilot-operated control valves, provide on-site services of a manufacturer-certified start-up technician to initially establish set points prior to start-up and make adjustments to equipment as necessary following initial start-up. Start-up technician shall instruct Owner's staff on operation, maintenance and adjustments of equipment. Services shall be provided for a minimum of 8 hours on-site per control valve, and additionally as necessary if there are difficulties associated with the start-up, at no additional cost to the Owner.

3.5 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 02516.

END OF SECTION

SECTION 02088

FIRE HYDRANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire Hydrants
2. Post Hydrants

B. Related Sections:
1. Drawings and general provisions of the Contract including General Conditions, Special Provisions and Technical Specifications.

1.2 REFERENCES

A. American Water Works Association:
1. AWWA C111 / A21.11-17 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
2. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
3. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray-Iron Fittings
4. AWWA C502 Dry-Barrel Fire Hydrants
5. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water-Supply Service.
6. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
7. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. National Sanitation Foundation:
1. NSF 61 - Drinking Water System Components - Health Effects

C. National Fire Protection Association
1. NFPA 281 – Recommended Practice for Fire Flow Testing and Marking of Hydrants

1.3 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Fire Hydrant Assemblies:
1. Basis of Measurement: Each, unless otherwise noted in the Plans.
2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (includes rock excavation), gravel bedding, and provision and installation of fire hydrant, main size x 6” anchor tee, 6” isolation valve and associated valve riser (valve box)(or tapping sleeve and valve for installation on existing mains), concrete pad around top of valve box, valve marker, 6” ductile

iron pipe, barrel extensions as required, connection to water main, joint restraints, general fill, testing, cleanup and restoration, and all related items.

B. Flush (Post) Hydrant Assemblies:
   1. Basis of Measurement: Each, unless otherwise noted in the Plans.
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (includes rock excavation), gravel bedding ,and provision and installation of fire hydrant anchor tee, isolation valve and associated valve riser (valve box)(or tapping sleeve and valve for installation on existing mains), concrete pad around top of valve box, valve marker, ductile iron lead piping, barrel extensions as required, connection to water main, joint restraints, general fill, testing, cleanup and restoration, and all related items.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawing:
   1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

D. Manufacturer’s Certificates: Submit Statement of Compliance and supporting data, from material suppliers stating that equipment and accessories provided meet or exceed AWWA Standards, NSF 61 certification, and specification requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Project Record Documents: Record actual locations of hydrants and appurtenances.

C. Provide Operation and Maintenance Data for equipment indicating materials of construction, recommended maintenance activities and intervals, procedures for adjustments and troubleshooting, and sources for procurement of replacement parts.

D. Where required, provide spare parts and maintenance materials to Owner.

1.6 QUALITY ASSURANCE

A. Provide uniform color scheme for fire hydrants in accordance with local authority standards. Where no local authority standard exists, provide uniform color scheme in accordance with NFPA 281.

B. All Products for use in potable water systems shall be NSF 61 certified.

1.7 QUALIFICATIONS

A. Manufacturer:
   1. Utilize equipment and materials from Owner's standard list of acceptable manufacturers provided in the Special Provisions. If no such list is provided, utilize equipment and materials from list of acceptable manufacturers provided in these specifications.
   2. Company specializing in manufacturing Products specified in this section with minimum of three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements.

B. Prepare hydrants and accessories for shipment according to AWWA Standards and seal ends to prevent entry of foreign matter into product body.

C. Store products in accordance with manufacturer's written recommendations and instructions, and in areas protected from weather, moisture, or possible damage; do not store products directly on ground.

D. Handle products in accordance with manufacturer's written recommendations and instructions, and in such a manner as to prevent damage to interior or exterior mechanisms and surfaces.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

A. Manufacturers:
   1. Mueller
   2. M and H Valve
   3. American Flow Control
   4. Substitutions: Section 01600 - Product Requirements.

B. Dry-barrel Break-away Type: AWWA C502; ductile-iron body, compression type valve.
   1. Bury Depth: As indicated on the Drawings.
   2. Inlet Connection: 6 inches.

3. Valve Opening: 5-1/4 inches diameter.
4. Ends: Mechanical Joint or Bell End.
5. Bolts and Nuts: Corrosion resistant.
6. Coating: AWWA C550; interior.
7. Direction of Opening: Counterclockwise unless otherwise indicated.
8. Pressure Rating: 200 psig.

C. Nozzle Requirement: One pumper (4-1/2") and two hose (2").
1. Thread type shall be National Standard.
2. Attach nozzle caps by separate chains.

D. Finish: Primer and two coats of enamel color.

E. Hydrant shall be designed so that, when in place, no excavation will be required to remove the main valve or add extensions.

2.2 FLUSH (POST) HYDRANTS

A. Manufacturers:
1. Mueller
2. M and H Valve
3. Substitutions: Section 01600 - Product Requirements.

B. Dry-barrel Break-away Type: ductile-iron body, compression type valve.
1. Bury Depth: As indicated on the Drawings.
2. Inlet Connection: 2-inch or 3-inch
3. Valve Opening: 2-1/4 inches diameter.
4. Ends: Mechanical Joint.
5. Bolts and Nuts: Corrosion resistant.
6. Coating: AWWA C550; interior.
7. Direction of Opening: Counterclockwise unless otherwise indicated.
8. Pressure Rating: 150 psig.

C. Nozzle Requirement: 2-½" Hose
1. Thread type shall be National Standard.
2. Attach nozzle caps by separate chains.

D. Finish: Primer and two coats of enamel color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Determine exact location, configuration, features, and size of hydrants and accessories from Plans; obtain clarification and directions from Engineer prior to execution of work.

C. Verify invert elevations of existing work prior to excavation and installation.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

3.3 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions.

END OF SECTION

SECTION 02090

SANITARY SEWER VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Valves.
2. Air Release/Vacuum Valves.
3. Valve boxes.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Valves:
1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, valve, valve box, accessories, tests, and backfill.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawing:
1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Provide Operation and Maintenance Data for valves.

1.5 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements.

B. Prepare valves and accessories for shipment according to manufacturer's recommendations and seal valve ends to prevent entry of foreign matter into product body.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.8 MAINTENANCE MATERIALS

A. Furnish one valve wrench or handwheel to Owner; required length.

PART 2 PRODUCTS

2.1 RESILIENT WEDGE GATE VALVES

A. Manufacturers:
1. Mueller Company
2. M and H Valve Company
3. American Flow Control
4. Substitutions: Section 01600 - Product Requirements.

B. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron.
1. Resilient seats.
2. Stem: Non-rising bronze stem.
3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
4. Ends: Flanged, mechanical joint or bell end connections.
5. Coating: Fusion bonded, heat cured, thermo setting material, interior/exterior.
6. Wedge: Cast iron, completely encapsulated with resilient material.
7. All internal parts shall be accessible without removing the body from the line.
8. Sizes 12 inch diameter and smaller: 200 psig working pressure.
9. Sizes 16 inch diameter and larger: 150 psig working pressure.

2.2 ECCENTRIC PLUG VALVES

A. Manufacturers:
1. DeZurik.
2. Pratt.

3. M and H Valve.
4. Substitutions: Section 01600 - Product Requirements.

B. Plug Valves in vaults, manholes, or otherwise unburied locations.
1. Plug: 316 stainless steel.
2. Operation: Geared actuator with handwheel operator.
3. Ends: Flanged, 125 lb flanges.
4. Coating: Epoxy.
5. Body: Cast iron valve body and bonnet conforming to ASTM A126, Class B

C. Plug Valves in buried locations.
1. Plug: 316 stainless steel.
2. Operation: Geared actuator with 2" operating nut, open left.
3. Ends: Mechanical joint with mega-lug restraint or approved equal.
4. Coating: Epoxy.
5. Body: Cast iron valve body and bonnet conforming to ASTM A126, Class B

2.3 SWING CHECK VALVES

A. Manufacturers:
1. M and H Valve.
2. Mueller.
3. Valmatic.
4. Substitutions: Section 01600 - Product Requirements.

B. Valve to be single disc type with full flow passage.

C. Body of valve to be cast iron with epoxy coating interior and exterior.

D. Valve to have bolted, removable cover for cleaning and maintenance.

E. Valve to have lever and weight arm on swing disc. Disc to be made of vulcanized rubber.

F. Valve may be installed in either vertical or horizontal position.

2.4 AIR RELEASE/VACUUM VALVES

A. Manufacturers:
1. APCO Valve and Primer Company Series 440
2. Crispin Valve Model US20
3. Valmatic Valve Co. Model 801A.
4. Substitutions: Section 01600 - Product Requirements.

B. Cast Iron Body, stainless steel float.

C. Valve to be Combination type valve, single body capable of releasing large volumes of air during filling, releasing small pockets of air during normal use, and capable of allowing air to enter pipeline to prevent vacuums.

2.5 VALVE BOXES

A. 12 inch diameter valves and smaller: Domestic cast iron, two-piece, screw type.

B. Valves larger than 12 inch diameter: Domestic cast iron, three-piece, screw type, round base.

C. Cast iron lid marked “Sewer”.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 1300 – Administrative Requirements.

B. Determine exact location and size of valves from Drawings; obtain clarification and directions from Engineer prior to execution of work.

C. Verify invert elevations of existing work prior to excavation and installation of valves.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
   1. Notify Owner and Engineer not less than two days in advance of proposed utility interruption.

D. Perform trench excavation, backfilling and compaction in accordance with Section 02324.

3.3 INSTALLATION

A. Install valves in conjunction with pipe laying; set valves plumb.

B. Provide buried valves with valve boxes installed flush with finished grade.

C. Provide pipe support for valves located in concrete vaults.

D. Orient valves in upright, horizontal position unless otherwise shown in the Drawings.

E. Contractor to ensure check valve is installed with flow arrow pointing downstream.

3.4 FIELD QUALITY CONTROL

A. Pressure test valves according to Section 02536.

B. Operate each valve from full closed to full open and verify the number of turns necessary to open and close valve match the manufacturer's specifications.

C. Set each valve box plumb and flush with the ground.

D. Replace each valve that is found to be leaking or faulty.

END OF SECTION

SECTION 02225

MINOR DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Demolishing designated building equipment and fixtures.
2. Demolishing designated construction.
3. Cutting and alterations for completion of the Work.
4. Removing designated items for Owner's retention.
5. Protecting items designated to remain.
6. Removing demolished materials.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplementary Conditions, Special Conditions, Technical Specifications, and General Requirements.

1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Basis of Measurement: Lump Sum.

B. Basis of Payment: Includes all labor, materials and equipment associated with the minor demolition and removal of debris from the site as indicated on the Plans.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.

C. Shop Drawings:
1. Indicate demolition and removal sequence.
2. Indicate location of items designated for Owner's retention.
3. Indicate location and construction of temporary work.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.

C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.5 QUALITY ASSURANCE

A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.

1.6 SCHEDULING

A. Schedule Work to coincide with new construction.

B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation.

C. Coordinate utility service interruptions with Owner.
   1. Do not disable or disrupt building existing utility systems without two days prior written notice to Owner.
   2. Schedule tie-ins to existing systems to minimize disruption.

1.7 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Engineer. Do not resume operations until directed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public.

3.2 SALVAGE REQUIREMENTS

A. Coordinate with Owner to identify items and equipment required to be removed and delivered to Owner.

B. Tag components and equipment Owner designates for salvage.

C. Protect designated salvage items from demolition operations until items can be removed.

D. Carefully remove items and equipment indicated to be salvaged.

E. Disassemble as required to permit removal.

F. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Do not close or obstruct roadways or walkways without permits.

C. Cease operations immediately when structure appears to be in danger and notify Engineer.

D. Disconnect and remove designated utilities within demolition areas.

E. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.

F. Demolish in orderly and careful manner. Protect existing facilities.

G. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

H. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

I. Remove temporary Work.

END OF SECTION

SECTION 02230

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removing surface debris.
2. Removing designated paving, curbs, and culverts.
3. Removing designated trees, shrubs, and other plant life.
4. Removing abandoned utilities.
5. Excavating topsoil.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.3 QUALITY ASSURANCE

A. Conform to applicable codes for environmental requirements, disposal of debris, burning debris on site, use of herbicides, and disposal of sludge.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify existing plant life designated to remain is tagged or identified.

3.2 PREPARATION

A. Call Alabama One Call service at 1-800-292-8525 or 811 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain.

C. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.4 CLEARING

A. Clear areas required for access to site and execution of Work to minimum depth of 12 inches.

B. Remove trees and shrubs within indicated areas. Remove stumps, surface rock, and fences.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Partially remove paving, curbs, and gutters. Neatly saw cut edges at right angle to surface.

C. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

D. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

E. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material until disposal.

D. Remove excess topsoil not intended for reuse, from site.

3.7 SITE RESTORATION

A. Restore all areas disturbed by the construction activities to pre-construction conditions or better.

B. Restore areas to satisfaction of Owner and Land Owner if work has occurred on private property.

C. If preconstruction documentation of existing conditions has not been performed, restore areas to complete satisfaction of Owner and Land Owner at no additional cost to Owner.

D. Restore paved or unpaved streets, roads, sidewalks, curbs, etc. disturbed by the construction activities to preconstruction conditions or better using materials and workmanship conforming to requirements of Owner, City or Alabama Department of Transportation, whichever applies.

E. Maintain seeded areas and re-seed as needed until a stand of grass satisfactory to the Owner is established.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparing of subgrade and grading for buildings, slabs, walks, embankments, slopes and pavements.
   2. Excavating and backfilling of utility trenches.

B. Related Documents
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Base Material:
   1. Basis of Measurement: Cubic Yard
   2. Basis of Payment: Includes all labor, material, and equipment associated with placing the specified base material in accordance with the requirements outlined in this Section and/or in the Plans.

B. Aggregate:
   1. Basis of Measurement: Cubic Yard
   2. Basis of Payment: Includes all labor, material, and equipment associated with placing the specified aggregate material in accordance with the requirements outlined in this Section and/or in the Plans.

C. Structural Fill:
   1. Basis of Measurement: Cubic Yard
   2. Basis of Payment: Includes all labor, material, and equipment associated with placing structural fill material in accordance with the requirements outlined in this Section and/or in the Plans.

D. General Fill:
   1. Basis of Measurement: Cubic Yard
      Basis of Payment: Includes all labor, material, and equipment associated with placing general fill material in accordance with the requirements outlined in this Section and/or in the Plans.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO R 18 – Establishing and Implementing a Quality System for Construction Materials Testing Laboratories.

B. ASTM International:
   1. ASTM D 698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D 1556 – Standard Test Method for Density and Unit Weight of Soil in place by the Sand-Cone Method
   3. ASTM D 1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D 2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   5. ASTM D 2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (shallow depth).
   6. ASTM D 2937 – Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
   7. ASTYM D 3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (shallow depth).
   8. ASTM D 4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
   9. ASTM D 4959 – Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating.
   10. ASTM D 6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
   11. ASTM D 7830 Standard Test Method for In-Place Density and Water Content of Soil Using an Electromagnetic Soil Density Gauge

1.4 DEFINITIONS

A. Excavation: Removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

B. Unauthorized excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.
   1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
   2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Engineer.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer, who will evaluate conditions. If Engineer determines that bearing materials at required subgrade are unstable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer. The Contract Sum may be adjusted by an appropriate Contract Modification.
   1. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.

D. Subgrade: The undisturbed soil or rock, or the compacted fill layer immediately below structures, granular base, drainage fill, or topsoil materials.

E. Structures: Buildings, foundations, slabs, tanks, pavements, gravel drives or road, walks, curbs, cut slopes, fill embankments, utilities, or other man-made stationary features occurring above or below ground surface.

F. Structural Areas: Those plan locations containing a structure plus a minimum of 5 feet beyond the outside edge of the structure including appurtenances or as defined elsewhere in the project documents.

G. Structural Fill: Materials placed as fill in Structural Areas.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Materials Source: Submit name of imported materials source.

C. Test Reports: All test reports must be completed under the supervision of a registered engineer, licensed in the state in which the project is located. Contractor will notify testing agency a minimum of 24 hours prior to performing work that requires testing. Submit the following test reports directly to Engineer, with copy to Contractor:

1. Test reports on borrow material. (ASTM D-2487, 4318, 6913)
2. Verification of each foundation bearing surface in accordance with specified requirements.
3. Field reports of in-place density tests.
4. One optimum moisture-maximum density curve for each type of soil encountered. (ASTM D-698 or ASTM D-1557)
5. Subgrade evaluation report for all structural areas prior to fill placement and after establishing final subgrade, but prior to pavement or building slab construction.

1.6 QUALITY ASSURANCE

A. Furnish each soil material from single source throughout the Work.

B. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

C. Testing and Inspection Service: Contractor will employ and pay for a qualified independent geotechnical testing and inspection laboratory in accordance with Section 01200 to perform soil testing and inspection service during earthwork operations. Laboratory shall be selected by the Engineer.

D. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory submitted criteria conforming to AASHTO R18, that it has the experience and capability to conduct the required field and laboratory geotechnical testing.

1.7 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports (if performed) was used for the basis of the design and are available to the Contractor for information only. Conditions noted in the report(s) are not intended as representations or warranties of accuracy or

continuity between soil borings. The Owner and Engineer will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner at no expense to the Owner.

2. Do not interrupt existing utilities serving facilities occupied by Owner or others during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

a. Provide minimum of 48-hour notice to Engineer and receive written notice to proceed before interrupting any utility.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active. Resultant excavations must be backfilled in lifts and tested in accordance with the project requirements.

C. Use of Explosives: Use of explosives is permitted. See Section 02316.

D. Jobsite safety and conformance to applicable codes and guidelines to protect persons and property is solely the responsibility of the contractor.

1. Excavate in accordance with OSHA guidelines. Barricade open excavations.
2. Operate safety barriers, markings and warning lights as required to maintain a safe work environment and as recommended by authorities having jurisdiction.
3. Protect structures, utilities, sidewalks, pavements, and other facilities to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
4. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2 PRODUCTS

A. Base Material: Naturally or artificially graded mixture of crushed gravel or stone, sand or select granular materials conforming to the Department of Transportation requirements for the state in which the project is located.

B. Aggregate: Graded fine or coarse aggregates as specified in Section 02060.

C. Structural Fill: On or off-site soil free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material shall have a liquid limit of 50 or less, a plasticity index of 25 or less, less than 20% rock fragments retained on a ¾" sieve, and a maximum dry density of at least 100 pcf. May also consist of Aggregate Type A2, Type A3 or Crushed Aggregate Base Course.

B. General Fill: On or off-site soil and/or rock which is stable and can be compacted to the specified density. Rock fragments shall be less than 4 inches in largest dimension and blended with sufficient fines to create a dense fill mass free of visible voids.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas as directed by the Engineer.

B. Stockpile excavated material meeting requirements for satisfactory soil materials and topsoil materials.

C. Remove excess excavated material not intended for reuse from site.

D. Excavate to subgrade elevations or cut line as indicated, regardless of character of materials and obstructions encountered, including rock, existing structures, and utilities. Subsurface materials are unclassified.

3.2 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction. Design of retaining structures must be performed, signed and sealed by a registered engineer licensed in the state in which the project is located.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

1. Provide permanent steel sheet piling or reinforced concrete drilled shaft walls wherever subsequent removal of retaining structure might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2'-6" below final grade and leave permanently in place.

3.3 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations or in foundation excavations prior to or following footing construction. Remove water to prevent softening of foundation boring soils, undercutting footings, and soil changes detrimental to stability of the subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.
3. Dewater excavations only as necessary for suitable construction. Do not continue dewatering overnight or for an extended period of time except as required.

3.4 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage. Stabilize in accordance with ADEM and NPDES regulations.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
2. Dispose of excess excavated soil material and materials not acceptable for reuse as backfill or fill.

3.5 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim sides and bottom to required lines and grades. Compact with hand or remote operated equipment to leave solid base to receive other work.
2. For pile foundations, stop excavations from 6 inches to 12 inches above bottom of cap before piles are placed. After piles have been placed, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavations for soil supported foundations must be neat, clean and dry. Remove loose, disturbed and soft soil. Dewater only as necessary for proper construction.

3.6 EXCAVATION FOR PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.7 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 36 inches total width.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on structural fill or undisturbed soil and bedding material. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

1. Where rock is encountered, refer to Section 02316 – Rock Removal. No direct payment will be made for rock removal, unless specified in other sections.
2. For pipes or conduit in all other soil conditions, refer to Section 02324 – Utility Trenching.

3.8 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

B. Do not place frozen soil fill.

3.9 BACKFILL AND FILL

A. General: Place soil material in uniform, horizontal lifts as required to final subgrade elevations. Compact individual lifts uniformly to specified density prior to placing the subsequent lift. For each area classification listed below, use materials specified in Part 2 of the Section.

1. In non-structural areas, use general fill. The final lift shall be the required thickness of topsoil.
2. In structural areas, use structural fill or aggregate. The final lift shall be as indicated on the plans.
3. Under utilities, use aggregate as indicated on the plans in areas determined by the Engineer to be unsuitable for pipe bedding. Shape excavation bottom to fit bottom 90 degrees of cylinder.
4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings or that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
   a. Concrete is specified in Section 03300.
   b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
5. Provide 4-inch-thick concrete base slab support for piping or conduit less than 24” below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway base.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.10 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, topsoil, obstructions, underground structures (foundations, slabs, walls and utilities), and deleterious materials from area prior to placement of fills. Backfill disturbed areas with compacted and tested fill. Contractor shall notify Engineer to evaluate the natural ground prior to fill placement. Where access permits, Contractor shall provide pneumatic-tired equipment capable of producing the pressure equal to that produced by a fully-loaded, tri-axle dump truck for use in evaluation.

1. When existing ground exhibits instability, scarify ground surface, moisture-condition to within 2% of the optimum moisture content, and compact to the project requirements. Alternatively, remove and replace unstable soils with suitable, compacted soils or stabilize at the direction of the Engineer.
2. Bench sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Benches shall consist of alternating horizontal and vertical soil surfaces in the original ground with horizontal benches no more than 5 feet apart vertically.
3. Overbuild slopes and cut back to the desired configuration to ensure the soils at the slope face are properly compacted and tested.

B. In structural areas, place structural fill or aggregate in layers not more than 8 inches in loose thickness for material compacted by heavy compaction equipment, and not more than 4 inches in loose thickness for material compacted by hand-operated tampers. In non-structural areas, place general fill in maximum 24" thick lifts.

C. In structural areas, before compaction, moisten or aerate each layer of fill as necessary to provide moisture content within the fill at ±2% of the optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place structural fill on surfaces that are muddy, frozen, or contain frost or ice.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping

or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.

1. Percentage of Maximum Standard Proctor Density Requirements:
   a. Structural Areas: Compact each individual lift of structural fill and fine aggregate to not less than 98% of the maximum standard Proctor density in accordance with ASTM D-698. Compact each individual lift of coarse aggregate using multiple passes of a vibratory compactor or as directed by the Engineer.
   b. Non-Structural Areas: Compact each individual lift using multiple passes of a compactor designed for the type of soils used as fill or backfill.
2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
   a. Remove and replace, or scarify and air dry soil material that is too wet to permit compaction to specified density.
   b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.11 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition area. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than ½ inch above or below required subgrade elevation.

C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½ inch.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.12 PAVEMENT BASE COURSE

A. General: Base course consists of placing base material in layers of specified thickness, over subgrade surface to support a pavement base course.
   1. Refer to other Division 2 sections for paving specifications.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of base course.

C. Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each base course layer. Compact and roll at least a 12-inch width of shoulder simultaneous with the compaction and rolling of each layer of base course.

D. Placing: Place base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base material during placement operations.
   1. When a compacted base course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches when compacted.
   2. Compact individual lifts of the base to a minimum of 100% of the ASTM D-1557 maximum dry density at ±2% of the optimum moisture content.

3.13 BUILDING SLAB DRAINAGE COURSE

A. General: Drainage course consists of placing aggregate in layers of indicated thickness over subgrade surface to support concrete building slabs.

B. Placing: Place aggregate on prepared subgrade in layers of uniform thickness, conforming to the indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.
   1. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer shall be more than 6 inches or less than 3 inches when compacted.
   2. Compact the individual lifts of the drainage course with a vibratory compactor as directed by the Engineer.

3.14 FIELD QUALITY CONTROL

A. Quality Assurance consisting of testing and observation of a limited sampling of construction materials will be paid for using the testing allowance for acceptance purposes. Passing test results are not a warranty, guarantee, or certification by the testing agency, Engineer, or Owner that all work was performed in conformance with the plans and specifications. Therefore, the Contractor should not rely solely on test results generated by the quality assurance process as an indication of the suitability of the construction.

B. It is entirely the Contractor’s responsibility to perform quality control as necessary to construct the project in conformance with the plans and specifications. Deviations from

the plans and specifications, whether identified during construction or following the completion of construction, must be corrected by the Contractor at no cost to the Owner.

C. Quality Control Testing During Construction: Allow testing service (to be selected by Engineer) to test each subgrade and fill layer before further backfill or construction work is performed.

1. Perform field density tests on each lift of fill in accordance with ASTM D 2937 (Drive Cylinder Method), ASTM D 2922 (Nuclear Method), ASTM D 7830 (Electromagnetic Method), or ASTM D 1556 (sand cone method).

   a. In conjunction with each density test, the natural moisture content shall be determined in accordance with ASTM D 3017 (nuclear method), ASTM D 4959 (direct heating), ASTM D 7830 (electromagnetic method) or other method approved by the Engineer.
   b. If field tests are performed using nuclear or electromagnetic methods, make calibration checks using alternate methods of both density and moisture results on each different type of material encountered and at intervals as directed by the Engineer.

2. Footing Subgrade: For all soil on which footings will be placed, perform tests to verify required design bearing capacities. Engineer shall be notified to observe and approve each footing subgrade. Engineering evaluation may include the excavation of hand augers or test pits. The contractor shall provide suitable equipment to excavate test pits as directed by the Engineer.
3. Paved Areas and Building Slab Subgrade: Perform at least one field density test per lift for every 2,500 sq. ft. of area, but in no case fewer than three tests.
4. Foundation Wall Backfill: Perform at least two field density tests on each lift of fill placed at locations directed by the Engineer.

D. If in opinion of Engineer, based on testing reports or Engineering judgement, subgrade or fill that have been placed are unsuitable, perform additional compaction and testing until specified density is obtained. Do not place additional fill over materials that have not been approved by the Engineer. Work to recompact and retest unsuitable areas will be at the expense of the contractor.

3.15 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction and/or as described in the Plans.

B. Unless otherwise specified in the Plans, the contractor is responsible to apply for and obtain any required permits in the contractor's name associated with current NPDES guidelines. Requirements for implementing and maintaining an acceptable Best Management Practices Plan shall be the responsibility of the contractor. The contractor is responsible to maintain the NPDES permit in good standing with the regulatory authority and comply with applicable NPDES regulations during construction, and terminate permit upon completion and approval at no additional cost to the owner.

3.16 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.
   1. Secure a disposal site and all necessary approvals for use.
   2. Remove excess excavated material, trash, debris, and waste materials and dispose of it off Owner's property.
   3. Excavated material in area noted on plans shall be screened by geotechnical engineer. If classified "contaminated", it shall be stockpiled and monitored by the contractor at no additional cost.

END OF SECTION

SECTION 02324

UTILITY TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating trenches for utilities.
   2. Backfilling and compaction.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Basis of Measurement and Payment shall be as outlined in Sections related to the specific Utility being installed.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
   4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Structures: Buildings, foundations, slabs, tanks, pavements, walks, curbs, cut slopes, fill embankments, utilities, or other man-made stationary features occurring above or below ground surface.

C. Structural Areas: Those plan locations containing a structure plus a minimum of 5 feet beyond the outside edge of the structure including appurtenances or as defined elsewhere in the project documents.

D. Structural Fill: Materials placed as fill in Structural Areas.

1.5 SUBMITTALS

A. Product Data: Submit data for geotextile fabric indicating fabric and construction.

B. Materials Source: Submit name of imported fill materials suppliers.

1.6 QUALIFICATIONS

A. Prepare erosion control plan and submit to Engineer prior to start of construction.

B. Refer to Section 02374, Erosion Control Devices.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General fill: As specified in Section 02300.

B. Aggregate Fill: As specified in Section 02300, Section 02060, and the Plans.

C. Structural Fill: As specified in Section 02300.

D. Concrete: Structural concrete as specified in Section 03300 with compressive strength of 3,000 psi.

E. Lean Concrete: Non-structural concrete with a compressive strength of 2,000 psi.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

C. Maintain proper horizontal alignment of utilities not laid on grade.

3.2 PREPARATION

A. Call Alabama One Call service at 1-800-292-8525 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Erect erosion control devices prior to excavation.

B. Excavate subsoil required for utilities to the depth indicated on the Drawings.

C. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume. Remove larger material as specified in Section 02316.

D. Perform excavation within 24 inches of existing utility in accordance with utility's requirements.

E. Do not advance open trench more than 400 feet ahead of installed pipe.

F. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 12 inches of clearance on each side of pipe or conduit.

G. Remove water or materials that interfere with Work.

H. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil and bedding material. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

I. Do not interfere with 45 degree bearing splay of building foundations or roadbeds.

J. When subsurface materials at bottom of trench are loose or soft, notify Engineer, and request instructions.

K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type A1 and compact to density equal to or greater than requirements for subsequent backfill material.

L. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with concrete as directed by Engineer.

M. Remove excess subsoil not intended for reuse, from site.

N. Maintain trench depth sufficient to provide a minimum cover of 30 inches over utility pipe unless otherwise noted in the Drawings. Maintain a minimum of 36 inches cover under highway ditches.

3.4 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction. Design of retaining structures must be performed, signed and sealed by a registered engineer licensed in the state in which the project is located.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

1. Provide permanent steel sheet piling or reinforced concrete drilled shaft walls wherever subsequent removal of retaining structure might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2’-6” below final grade and leave permanently in place.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Backfill trenches as follows:

1. In non-structural areas, use excavated material to backfill to existing contours and elevations, unless such material does not conform to the requirements of General Fill as outlined in Section 02300. In such instances, borrow material meeting those requirements shall be brought in to backfill the trench. The final lift shall be the required thickness of topsoil.
2. In structural areas, use structural fill as shown on the Plans or as directed by the Engineer. Backfill to elevations reflected on the plans, or to match surrounding grade. The final lift shall be as indicated on the plans. If subgrade is unstable, prepare subgrade beneath pipe in accordance with Section 2300 prior to fill placement.
3. Use aggregate as indicated on the plans in areas determined by the Engineer to be unsuitable for pipe bedding. Shape excavation bottom to fit bottom 90 degrees of cylinder.
4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings or that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
    a. Concrete is specified in Section 03300.
    b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
5. Provide 4-inch-thick concrete base slab support for piping or conduit less than 24” below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway base.

B. Place, moisture condition, and compact fill material in accordance with Section 02300.

C. Employ placement method that does not disturb or damage utilities in trench, or structures near the trench.

D. Do not leave trench open at end of working day.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 02374

EROSION CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Silt Fences.
   2. Diversion Channels.
   3. Rock Energy Dissipater.
   4. Paved Energy Dissipater.
   5. Rock Basin.
   6. Rock Barriers.
   7. Sediment Ponds.
   8. Sediment Traps.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.

C. ASTM International:
   1. ASTM C127 - Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. Precast/Prestressed Concrete Institute:
   1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Product Data: Submit data on joint filler joint sealer and geotextile.

C. Submit Erosion Control Plan along with application for Stormwater NPDES permit to Engineer prior to placement of erosion control devices.

D. Submit manufacturer's catalog sheets and other pertinent information on filter fabrics showing that they meet or exceed the requirements of this specification.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not place grout when air temperature is below freezing.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

D. Silt fence should not be installed across streams, ditches, waterways, or other concentrated flow areas.

PART 2 PRODUCTS

2.1 SILT FENCE MATERIALS

A. Geotextile fabric shall be a 36" wide, nonwoven filter fabric composed of polypropylene, polyethylene, ethylene, or polyamide material.

B. Minimum grab strength shall be 100 lbs. in any direction.

C. Apparent opening size shall be 30 (maximum sieve size).

D. Flow rate shall be 25 gallons/minute/square foot.

E. Ultraviolet ray inhibitors and stabilizers shall provide a maximum of 6 months of expected usable life.

F. Type A silt fence shall include a 36" wide, 12-1/2 gauge galvanized wire fence reinforcement to be placed with the geotextile material. Wire fence shall have openings no larger than 6 inches by 6 inches. Type B silt fence shall be a 36" wide fabric with no wire fence reinforcement.

G. Fence posts shall be minimum 2” x 2” oak, 60” long or steel T-post for Type B silt fence. Steel T-posts or 4” x 4” pressure treated wood posts shall be required for Type A silt fence. Minimum bury depth for wood posts is 24 inches.

2.2 ROCK

A. Rock: Sound, hard and angular shape; well graded; without shale seams, structural defects and foreign substances; with width and thickness greater than one third its length. Refer to Section 02371.

2.3 CONCRETE MATERIALS AND REINFORCEMENT

A. Concrete: As specified in Section 03300.

B. Water: Clean and not detrimental to concrete.

C. Reinforcement Steel: As specified in Section 03200.

2.4 BLOCK, STONE, AGGREGATE, AND SOIL MATERIALS

A. Precast Solid Concrete Block.

B. Soil Backfill: Soil as specified in Section 02300.

2.5 PLANTING MATERIALS

A. Seeding and Soil Supplements: As specified in Section 02924.

B. Mulch: As specified in Section 02924.

2.6 PIPE MATERIALS

A. Pipe: Corrugated Plastic (HDPE).

2.7 SOURCE QUALITY CONTROL (AND TESTS)

A. Section 01400 - Quality Requirements.

B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.

C. Make rock available for inspection at producer’s quarry prior to shipment. Notify Engineer at least seven days before inspection is allowed.

D. Allow witnessing of inspections and testing at manufacturer’s test facility. Notify Engineer at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify location of existing streams, drainage structures and environmentally sensitive areas prior to placing erosion control devices.

C. Verify compacted subgrade, granular base or stabilized soil is acceptable and ready to support devices and imposed loads.

D. Verify gradients and elevations of base or foundation for other work are correct.

3.2 SILT FENCE

A. The silt fence should be purchased in a continuous roll cut to length to avoid the use of joints. When joints are unavoidable, fabric should be spliced together at a post with a minimum 6 inch overlap.

B. Post installation should start at the center of the low point with remaining posts spaced 10 feet apart for Type A and 7 feet apart for Type B fence.

C. Anchor fabric by entrenching the bottom edge in a 6 inch deep trench and backfilling.

D. Hay or straw bales shall be placed at each end of the silt fence.

3.3 DIVERSION CHANNELS

A. Windrow excavated material on low side of channel.

B. Compact to 95 percent maximum density.

C. On entire channel area, apply soil supplements and sow seed as specified in Section 02924.

D. Mulch seeded areas with hay as specified in Section 02924.

3.4 ROCK ENERGY DISSIPATOR

A. Excavate to indicated depth of rock lining or nominal placement thickness as follows. Remove loose, unsuitable material below bottom of rock lining, then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.

NCSA Class	Nominal Placement Thickness
R8	48 inches
R7	36 inches
R6	30 inches
R5	24 inches
R4	18 inches
R3	12 inches

B. Lay and overlay geotextile fabric over substrate. Lay fabric parallel to flow from upstream to downstream. Overlap edges upstream over downstream and upslope over downslope. Provide a minimum overlap of 3 feet. Offset adjacent roll ends a minimum of 5 feet when lapped. Cover fabric as soon as possible and in no case leave fabric exposed more than 4 weeks.

C. Carefully place rock on geotextile fabric to produce an even distribution of pieces, with minimum of voids and without tearing geotextile.

D. Unless indicated otherwise, place full course thickness in one operation to prevent segregation and to avoid displacement of underlying material. Arrange individual rocks for uniform distribution.
   1. Saturate rock with water. Fill voids between pieces with grout, for at least top 6 inches. Sweep surface with stiff broom to remove excess grout.
   2. Moist cure grouted rock for at least 3 days after grouting, using water saturated burlap in accordance with Section 03300.

3.5 PAVED ENERGY DISSIPATER

A. Excavate to the required paving depth. Remove loose, unsuitable material below bottom of paving, and then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.

B. Place forms and hold reinforcement firmly in position during placing of concrete.

C. Mix, place and finish concrete, as specified in Section 03300.

D. Embed stones or blocks 4 inches in plastic concrete at indicated separation on slopes and channel bottom.

E. Pave in uniform 10 foot lengths or sections.

F. Pave in shorter sections as necessary for closures or curves.

G. Place premolded expansion joint filler, 1/2 inch thick, cut to conform to paving cross sections, at ends of curved sections at intervals of not more than 100 feet, at end of day's work, and where paving is adjacent to rigid structure. Use joint filler with depth of 1/2 inch less than paving depth and press firmly against adjacent concrete.

H. Form intermediate joints between sections, with two thicknesses of bituminous paper cut neatly to paving cross section.

3.6 ROCK BASIN

A. Construct generally in accordance with rock energy dissipator requirements to indicated shape and depth. Rock courses may be placed in several operations but minimum depth of initial course must be 3 feet or greater.

3.7 ROCK BARRIER

A. Determine length required for ditch or depression slope and excavate compact and foundation area to firm, even surface.

B. Produce an even distribution of rock pieces, with minimum voids to the indicated shape, height and slope.

C. Construct coarse aggregate filter blanket against upstream face of rock barrier to the indicated thickness.

3.8 SEDIMENTATION POND

A. Clear and grub storage area and embankment foundation area site as specified in Section 02230.

B. Excavate key trench for full length of dam. Excavate emergency spillway in natural ground.

C. Install pipe spillway, with anti-seep collar attached, at location indicated.

D. Place forms and reinforcing for concrete footing at bottom of riser pipe with trash rack and anti-vortex device, as specified in Section 03200. Construction of embankment and trench prior to placing pipe is not required.

E. Mix, place, finish, and cure concrete, as specified in Section 03300.

F. Do not use coarse aggregate as backfill material around pipe. Backfill pipe with suitable embankment material to prevent dam leakage along pipe.

G. Construct rock basin at outlet end of pipe, as specified in this Section. Place embankment material, as specified in Section 02300. When required, obtain borrow excavation for formation of embankment, as specified in Section 02300.

H. On entire sedimentation pond area, apply soil supplements and sow seed as specified in Section 02924.

I. Mulch seeded areas with hay as specified in Section 02924.

3.9 SEDIMENT TRAPS

A. Clear site, as specified in Section 02230.

B. Construct trap by excavating and forming embankments as specified in Section 02300.

C. Place coarse aggregate or rock at outlet as indicated on Drawings.

D. Place geotextile fabric, as specified for rock energy dissipater.

E. When required, obtain borrow excavation for formation of embankment, as specified in Section 02300.

F. On entire sediment trap area, apply soil supplements and sow seed as specified in Section 02924.

G. Mulch seeded areas with hay as specified in Section 02924.

3.10 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
1. During non-germinating periods, apply mulch at recommended rates.
2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 02924 at 90 percent of permanent application rate with no topsoil.
3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 02924 permanent seeding specifications.

D. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.11 FIELD QUALITY CONTROL

A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

B. Sediment should be removed from behind silt fence once it has accumulated to one-half the original height of the barrier. Fabric should be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced (approximately six months).

C. Hay bales shall be replaced every 6 months regardless of condition.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Do not damage structure or device during cleaning operations.

F. Do not permit sediment to erode into construction or site areas or natural waterways.

G. Clean channels when depth of sediment reaches approximately one half channel depth.

END OF SECTION

SECTION 02513

WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Water distribution piping.
2. Water service connections.
3. Valves and Boxes.
4. Fire Hydrants.
5. Master Water Meter.
6. Positive displacement meters.
7. Underground pipe markers.
8. Aboveground pipe markers.
9. Precast concrete vault.
10. Meter Boxes.
11. Pipe Supports and Anchoring.
12. Pile Support Systems.
13. Concrete Encasement and Cradles.
14. Mechanical Join Restraint.
15. Flange Adaptor.
16. Bolt-through Adaptor.
17. Restrained Coupling.
18. Bedding and cover materials.
19. Finishing - Steel.
20. Adjustable Roller Hanger

B. Related Sections:
1. Plans and general provisions of the Contract including General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Water Distribution Piping:
1. Basis of Measurement: Linear Foot.
2. Basis of Payment: Includes all labor and equipment associated with excavating (including rock excavation), installation water main at locations shown on Plans, installation of detector wire and tape, bedding, backfill with excavated material, concrete for thrust blocks, mechanical restraints, restrained coupling, compaction, supply and installation of blue pipeline markers as requested by Engineer/Owner, disinfection and testing, cleanup, traffic control, and all related items. Also includes erosion control to the satisfaction of the Engineer if no additional pay items exist. Payment shall be per linear foot of water main laid, based on the size, material, special coating (if required), and joint type shown on the Plans and reflected on the Bid Form.

B. Wet Connection:
   1. Basis of Measurement: Per Each.
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation unless otherwise stated), coordination of service outages, isolation of system by closing valves, cutting of existing pipe, dewatering, removal of cut pipe, any necessary piping/fittings to make the connection, bedding, native soil backfill, testing, cleanup, and all related items. Also includes erosion control to the satisfaction of the Engineer if no additional pay items exist.

C. Compact Ductile Iron Fittings:
   1. Basis of Measurement: Per Pounds or Tons as indicated on the Bid Form.
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation (including rock excavation), installation of ductile iron fittings, installation of transition fittings, "mega-lug" retainer glands, concrete thrust blocks, backfill, compaction, testing, cleanup, and all related items.

D. Master Meters:
   1. Basis of Measurement: Per Each.
   2. Basis of Payment: Includes all labor, material, and equipment associated with excavation, master meter, meter box/vault, testing, backfill, cleanup and all related items.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

C. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A242 – Standard Specification for High-Strength Low-Alloy Structural Steel.
   4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
   5. ASTM A674 – Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids.
   6. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   7. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   8. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   9. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

10. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
11. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
12. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
13. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. American Water Works Association:
1. ANSI/AWWA C104/A21.4 - Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105/A21.5 - Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. ANSI/AWWA C110/A21.10 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm), for Water.
4. ANSI/AWWA C111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115/A21.15 - Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. ANSI/AWWA C116/A21.16 – Standard for Protective Fusion-bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
7. ANSI/AWWA C150/A21.50 - Standard for the Thickness Design of Ductile-Iron Pipe.
8. ANSI/AWWA C151/A21.51 - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
9. ANSI/AWWA C153/A21.53 - Standard for Ductile-Iron Compact Fittings for Water Service.
10. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
11. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
12. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.
13. AWWA C206 - Field Welding of Steel Water Pipe.
14. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
15. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
16. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
17. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
18. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
19. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.
20. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
21. AWWA C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
22. AWWA C606 - Grooved and Shouldered Joints.
23. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
24. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.

25. AWWA C702 - Cold-Water Meters - Compound Type.
26. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
27. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm Through 300 mm), for Water Distribution.
28. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.
29. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
30. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

E. Manufacturer's Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

F. National Fire Protection Agency:
1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawings: Indicate piping layout, including piping specialties.

C. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

D. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves, hydrants, and accessories provided meet or exceed AWWA Standards and specification requirements.

E. Fusion Technician Qualification: HDPE or Fusible PVC pipe manufacturer or pipe supplier qualification to butt-fuse pipe products.

1.5 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.6 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Deliver and store materials in shipping containers with labeling in place.

C. Block individual and stockpiled pipe lengths to prevent moving.

D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

E. Store polyethylene and PVC materials out of direct sunlight.

F. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.8 MAINTENANCE MATERIALS

A. Furnish one valve tee wrench and one fire hydrant wrench to Owner.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION PIPING

A. Ductile Iron Pipe: AWWA C151.
   1. Coatings and Lining:
      a. Outside: Bituminous coating, 1-mil minimum.
         1) Zinc outside coating if indicated in the Plans and/or Bid Form. ISO 8179-1
      b. Inside: Cement-mortar lining with Sealcoat, ANSI/AWWA C104/A21.4.
         1) Cement-mortar, double thickness if indicated in the Plans and/or Bid Form.
   2. Pipe Class: AWWA C151, for nominal thickness, rated water working pressure and maximum depth of cover. Pressure Classification as required on drawings for normal installation. Class 56 for pipe installation on river channel bottom.
   3. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
      a. Coating and Lining:
         1) Bituminous Coating: AWWA C110.
         2) Cement Mortar Lining: AWWA C104, double thickness.
         3) Fusion-bonded Epoxy if indicated in the Plans and/or Bid Form: AWWA C116.

4. Joints:
    a. Mechanical and Push-On Joints: AWWA C111.
    b. Flanged Joints: AWWA C115.
    c. Restrained Joints: Refer to Section 2.14.
    d. Gaskets: Manufacturer's standard for push-on joint pipe. Refer to Section 2.15.
5. Encasement: AWWA C105 polyethylene encasement, 10 mil minimum thickness.

B. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, Pressure Class 200:
1. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
    a. Coating and Lining:
        1) Bituminous Coating: AWWA C110.
        2) Cement Mortar Lining: AWWA C104, double thickness.
        3) Fusion-bonded Epoxy if indicated in the Plans and/or Bid Form: AWWA C116.
2. Joints:
    a. ASTM D3139 PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.

C. Polyvinyl Chloride (PVC): ASTM D2241, SDR-21 for 200 psig rating:
1. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
    a. Coating and Lining:
        1) Bituminous Coating: AWWA C110.
        2) Cement Mortar Lining: AWWA C104, double thickness.
        3) Fusion-bonded Epoxy if indicated in the Plans and/or Bid Form: AWWA C116.
2. Joints:
    a. ASTM D3139 PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.
    b. Butt-fusion, per pipe supplier's written instructions and qualified fusion technician.

D. Fusible PVC: Refer to Section 02511

E. High Density Polyethylene (HDPE): Refer to Section 02514

F. Steel Pipe: AWWA C200 Fabricated Pipe, minimum wall thickness 0.375 inches for pipe diameters up to 8 inches and 0.50 inches for pipe diameters greater than 8 inches.
1. Fittings and Special Sections: AWWA C208.
2. Flanges: AWWA C207 slip-on.
3. Field Welding Materials:
    a. Pipe: AWWA C206.
    b. Joints: AWWA C205.
4. Interior Cement Mortar Lining: AWWA C205.
5. Buried Steel Pipe Exterior Lining:
    a. AWWA C213, fusion-bonded epoxy coating.

2.2 WATER SERVICE CONNECTIONS

A. Furnish materials and install in conformance with Section 02515.

2.3 VALVES AND BOXES

A. Furnish materials and install in conformance with Section 02085.

2.4 FIRE HYDRANTS

A. Furnish materials and install in conformance with Section 02088.

2.5 MASTER WATER METER

A. Manufacturers:
   1. Neptune HP Turbine
   2. Badger Meter Turbo Series
   3. Substitutions: Section 01600 – Product Requirements.

B. Water meters: Inline horizontal-axis type. AWWA Class II meeting NSF/ANSI 61 and NSF/ANSI 372 requirements.
   1. Operating flow range: 100% $\pm$ 1.5% based on meter size.
   2. Maximum Operating Temperature: 120° F (49° C).
   3. Accuracy: Within 1.5%
   4. 150 psig maximum working pressure or as reflected on the Plans.
   5. Strainer: Integral or flanged in-line.
   6. Straightening Vane: Directly upstream.
   7. Housing and Head Material: Lead-free allow
   8. Flanges: U.S. ANSI B16.1/AWWA Class 125
   9. Register shall be in gallons unless stated elsewhere.
   10. Encoder: If specified, meter shall be equipped with encoder remote registers per AWWA C707 and meet all AWWA C701 performance standards.
   11. Meter size: As Shown on Plans or the Bid Form.

2.6 POSITIVE DISPLACEMENT METERS

A. Furnish materials and install in conformance with Section 02515.

2.7 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed with "Water Service" in large letters, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire (for non-metallic pipe): No. 12 gauge copper clad steel (CCS) reinforced with blue plastic covering, imprinted.

2.8 ABOVEGROUND PIPE MARKERS

A. Manufacturer:
   1. Markers to Locations: Furnish at valves, casing ends, major bends, and other locations requested by Engineer or Owner.

B. Marker: Install according to manufacturer’s instructions. Color and markings shall be blue unless otherwise indicated.

2.9 PRECAST CONCRETE VAULTS

A. Precast Concrete Vaults: Conform to Section 02086.

2.10 METER BOXES

A. Furnish materials in conformance with Section 02515.

2.11 PIPE SUPPORTS AND ANCHORING

A. Metal for pipe support brackets: Structural steel, thoroughly coated with epoxy paint.

B. Metal tie rods and clamps or lugs: Galvanized steel sized in accordance with NFPA 24.

2.12 PILE SUPPORT SYSTEMS

A. Pipe piers shall be field cast, 4000 psi, 28-day mix, as detailed in the Plans.

B. Timber Piles: Conform to Section 02643.

C. Timber for Cradle: Southern Yellow Pine well-seasoned conforming to Section 06100 and surfaced on all sides with preservative treatment.

D. Preservative Treatment for Timber: Conform to Section 02463.

2.13 CONCRETE ENCASEMENT AND CRADLES

A. Concrete: Conforming to Section 03300, 4,000 psi 28-day reinforced concrete, rough troweled finish.

B. Concrete Reinforcement: Conform to Section 03200.

2.14 STEEL CASING AND TUNNER LINER

A. Refer to Section 02444 – Casing Pipe and Tunnel Liner.

2.15 JOINT RESTRAINT

A. Type I: Mechanical Joint Restraint
   1. Restraint devices for nominal pipe sizes 3” – 36” shall consist of multiple gripping wedges incorporated into a retainer gland meeting the requirements of ANSI/AWWA C111/A21.11, except for HDPE pipe.
   2. The devices shall have a working pressure rating equal to that of the pipe on which it is used. Ratings are for water pressure and must include a minimum safety factor of 2:1 in all sizes.
   3. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron.
   4. Mechanical joint restraint shall be as follows:
      a. Series 2000PV by EBAA Iron, Inc. or equal for connecting PVC to mechanical joint fittings.

b. Series 1100 by EBAA Iron, Inc. or equal for connecting ductile iron pipe to mechanical joint fittings.

5. HDPE shall be fully restrained with fused-on flange adaptors, MJ adaptors, or other approved method or fitting. All recommendations and instructions for fitting from manufacturer shall be followed. No gripper-style restraints will be allowed.
6. HDPE connections shall be longitudinally restrained per the design by restrained fittings, anchor blocks, or other approved method.

B. Type II: Restrained Joint Pipe
1. Restrained Joint Pipe: AWWA C111.
2. Flexible restrained push-on type equivalent to "TR Flex" as manufactured by U.S. Pipe, or "Flex-Ring" as manufactured by American Cast Iron Pipe Company.
3. Restrained Joint Pipe shall be stored, installed, and tested in accordance with manufacturer's instructions.

C. Type III: Restraining Gaskets
1. Restraining Gaskets: ANSI/AWWA C111/A21.11
2. Push on joint pipe specified with restraining gaskets shall incorporate gaskets equivalent to "Field-Lok 350 Gaskets" as manufactured by U.S. Pipe, or "Fast-Grip Gaskets" as manufactured by American Cast Iron Pipe Company.
3. Restraining Gaskets shall not be used at pipe end terminations.
4. Restraining Gaskets shall be stored, installed, and tested in accordance with manufacturer's instructions.

2.16 FLANGE ADAPTOR

A. Flange adaptors may be used in lieu of threaded or welded flanges of plain end ductile pipe where allowed by the Engineer. These shall not be used with HDPE.

B. The restraints shall be manufactured of ductile iron conforming to ASTM A536.

C. The bolt circles and bolt holes shall conform to ANSI/AWWA C110/A21.10.

D. The restraint shall be Series 1000-EZ Flange as manufactured by EBAA Iron, Inc. or equal.

2.17 BOLT-THROUGH ADAPTOR

A. A bolt-through mechanical adaptor may be used or required in lieu of standard flange adaptors. These shall not be used with HDPE.

B. The restraints shall be manufactured of ductile iron conforming to ASTM A536.

C. The bolt circles and bolt holes shall conform to ANSI/AWWA C110/A21.11 and ASTM A242.

D. The adaptor shall be the "Foster" adaptor as manufactured by Infact Corporation or equal.

2.18 RESTRAINED COUPLING

A. Restrained couplings are used for joining and restraining two plain end pipes of the same or dissimilar materials.

B. Coupling shall be capable of being used on ductile iron, steel, PVC or HDPE pipe.

C. Coupling shall be constructed of ASTM A536 ductile iron and designed with a 2:1 safety factor.

D. Internal pipe wall stiffeners must be used when restraining HDPE.

E. The restraint mechanism shall incorporate a plurality of individually actuating gripping surfaces to maximize restraint capability and have torque limiting twist off nuts to insure proper actuating of the restraint devices.

F. The restraint devices shall be coated using fusion bonded epoxy approved for potable water contact.

G. The coupling sleeve internal surface (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.

H. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

I. The restrained joining system shall meet the applicable requirements of AWWA C219, ANSI/AWWA C111/A21.11, and ASTM D2000.

J. The restrained coupling system shall be Series 3800 manufactured by EBAA Iron, Inc. or and approved equal.

2.19 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A2 as specified in Section 02060.

B. Cover: Fill Type as specified in Section 02300 and the Plans.

C. Soil Backfill from Above Pipe to Finish Grade: Soil as specified in Section 02300.

2.20 ACCESSORIES

A. Concrete for Thrust Restraints: Conform to Section 03300.

B. Steel rods, bolts, lugs and brackets: ASTM A36/A36M or ASTM A307 carbon steel.

C. Protective Coating: Bituminous coating.

2.21 FINISHING - STEEL

A. Galvanizing: ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication.

2.22 ADJUSTABLE ROLLER HANGER

A. Material: carbon steel axle with cast iron roller and socket ends.

B. Finish: electro-galvanized.

C. Service: designed for the suspension of pipe where longitudinal movement may occur due to expansion/contraction. Vertical adjustment is required.

D. Rods shall be installed into existing concrete bridge deck according to manufacturer's recommendations. Wedge type or epoxy type anchors shall be used to attach the rods to the bridge deck. Anchors shall be capable of supporting four (4) times the dead load of the pipe plus the water.

E. Each hanger shall have a lower and upper roller, fully adjustable.

F. Manufacturer:
1. Empire Industries, Inc.
2. Cooper B-Line
3. National Pipe Hanger Corporation
4. Substitutions: Section 01600 – Product Requirements

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify existing utility water main size, location, and type is as indicated in the Plans.

C. Determine exact location and size of valves and hydrants from the Plans; obtain clarification and directions from Engineer prior to execution of work.

D. Verify invert elevations of existing work prior to excavation and installation of valves and fire hydrants.

E. All pipe and fittings must be inspected for damage from prior to installation. Any damaged piping must be replaced prior to installation.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe material being cut. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

D. Do not interrupt existing utilities without permission and without arranging to provide temporary utility services.
   1. Notify Owner and Engineer not less than two days in advance of proposed utility interruption.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 02300 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated in the Plans.

B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.

3.4 INSTALLATION - PIPE

A. Install pipe in accordance with AWWA C600. Trenching shall be in accordance with Section 02324. Directional boring shall be in accordance with Section 02448.

B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated in the Plans.

C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

D. Maintain a minimum of 5 feet horizontal separation of water main from sewer piping.

E. Install ductile iron piping and fittings to AWWA C600.

F. Weld pipe in accordance with AWWA C206. Weld joints in accordance with AWWA C205.

G. Flanged Joints: Not to be used in underground installations except within structures.

H. Route pipe in straight line. Relay pipe that is out of alignment or grade.

I. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Engineer.

J. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.

K. Prevent foreign material from entering pipe during placement.

L. Install pipe to allow for expansion and contraction without stressing pipe or joints.

M. Close pipe openings with watertight plugs during work stoppages.

N. Install access fittings to permit disinfection of water system performed under Section 02516.

O. Establish elevations of buried piping with not less than three feet of cover. Measure depth of cover from final surface grade to top of pipe barrel.

P. Install plastic ribbon tape continuous 12 inches below final grade of surface.

Q. Install trace wire continuous 12 inches above any non-metallic pipe.

3.5 POLYETHYLENE ENCASEMENT

A. Encase piping in polyethylene where indicated on the Plans to prevent contact with surrounding backfill material or concrete thrust blocks.

B. Install in accordance with AWWA C105 and ASTM A674.

C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

3.6 THRUST RESTRAINT

A. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks, Type I, II, or III restraint as indicated in the Plans. For concrete thrust blocks, pour against undisturbed earth. Locate thrust blocks such that pipe and fitting joints will be accessible for repair.

B. Install tie rods, clamps, set screw retainer glands, concrete anchors or restrained joints as indicated in the Plans. Protect metal restrained joint components against corrosion, when in contact with concrete, by applying a bituminous coating, or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.

C. Install thrust blocks, tie rods, and type I or II joint restraint at dead ends of water main as shown in the Plans.

3.7 SERVICE CONNECTIONS

A. Install service connections in accordance with Section 02515.

3.8 BACKFILLING

A. Backfill around sides and to top of pipe with cover fill in maximum lifts of 6 inches, tamp in place and compact in accordance with the Plans and Specifications. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.

B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.9 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 02516.

3.10 FIELD QUALITY CONTROL

A. Refer to Section 02514 for pressure test requirements for high density polyethylene (HDPE) piping.

B. In piping systems with multiple material types, HDPE piping must be pressure tested separately from ductile iron and/or PVC piping, unless otherwise indicated by the Engineer. Following an approved test for HDPE piping, the connections can be made, and the entire system can be tested as described below.

C. Pressure test system to the greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Repair leaks and re-test.

1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.
2. Provide all equipment required to perform leakage and hydrostatic pressure tests including water storage means, acceptable water volume measurement means, pumps, piping, calibrated pressure gauges, and chart recorder. Upon request of Engineer, provide certification of calibration of equipment acceptable to Engineer.
3. Test Pressure: The greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Obtain working pressure from Engineer.
4. Conduct hydrostatic test for at least six-hour duration.
5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, apply test pressure. At conclusion of tests, close and permanently seal resulting piping openings.
6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
7. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
8. Maintain test pressure within +/- 5 psi throughout test duration by pumping additional water into the test segment. Accurately record test segment pressure continuously on chart recorder and volume of additional water supplied to test segment. Additional water supplied shall be designated as the leakage.
9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

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

L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches

p= average test pressure during leakage test, in pounds per square inch gauge
C = 133,200

10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

END OF SECTION

SECTION 02515

WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for domestic water service connections to buildings.
   2. Corporation stop assembly.
   3. Curb stop assembly.
   4. Meter setting equipment.
   5. Water meters.
   6. Backflow preventers.
   7. Underground pipe markers.
   8. Bedding and cover materials.

B. Related Sections:
   1. Plans and general provisions of the Contract including General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Service Connection:
   1. Basis of Measurement: Each.
   2. Basis of Payment: Includes all labor, material and equipment associated with excavation, tapping into new water main, new corporation stop, testing, backfill, cleanup and all related items. Payment shall be per Service Connection installed.

B. Service Reconnection:
   1. Basis of Measurement: Each.
   2. Basis of Payment: Includes all labor, material and equipment associated with excavation, tapping into new water main, new corporation stop, reconnection of customer's existing meter or plumbing line, testing, backfill, cleanup and all related items. Payment shall be per Service Reconnection installed.

C. Service Relocation:
   1. Basis of Measurement: Each.
   2. Basis of Payment: Includes all labor, material and equipment associated with excavation, connection to existing service line, relocation of existing meter, reconnection of customer's existing plumbing line, testing, backfill, cleanup and all related items. Payment shall be per Service Relocation completed.

D. Service Line:
   1. Basis of Measurement: Linear Feet.
   2. Basis of Payment: Includes all labor, material and equipment associated with installation of service line, backfill, compaction, disinfection, testing, cleanup, traffic control, erosion and sediment control, and all related items. Payment shall be per linear foot of service line, based on the size, material and installation type (open-cut or bored) shown on the Plans and/or reflected in the Bid Form.

E. Water Meter Assembly:
   1. Basis of Measurement: Each.
   2. Basis of Payment: Includes all labor, material and equipment associated with excavation, new curb stop, transition fittings, backflow preventer, meter box/vault, testing, backfill, cleanup and all related items. Payment shall be per Water Meter Assembly installed, based on the size and meter box type shown on the Plans and/or reflected in the Bid Form.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. American Society of Sanitary Engineering:
   1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
   2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

D. ASTM International:
   1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
   2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
   3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   4. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
   5. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   6. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   7. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   8. ASTM F2164 Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.
   9. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

10. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
11. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
12. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
13. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
3. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
4. AWWA C702 - Cold-Water Meters - Compound Type.
5. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
6. AWWA C800 - Underground Service Line Valves and Fittings.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
8. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.

C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Copper Tubing: ASTM B88, Type K, annealed:
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or AWS A5.8, BCuP silver braze.

B. PVC Pipe: SDR-21 for 200 psig rating:
   1. Fittings: SDR-21 PVC.
   2. Joints: Compression. Solvent weld not acceptable.

C. Polyethylene Pipe: 200 psig pressure rating:
   1. Fittings: AWWA C901, molded.
   2. Joints: Compression.

D. Cross-linked Polyethylene (PEX) Tubing
   1. Pipe to be manufactured using the high-pressure peroxide (Engel) method of cross-linking.
   2. Pipe to have a co-extruded PE shield made from UV resistant high-density polyethylene, color blue.
   3. Pipe to be Municipex as manufactured by REHAU or approved equal.
   4. Tubing to be produced in SDR 9 copper tube sizes (CTS).
   5. Fittings: Compression joint with stainless steel inserts.

2.2 CORPORATION STOP ASSEMBLY

A. Manufacturers:
   1. Mueller Company.
   2. Ford Meter Box Co.
   3. A. Y. McDonald Manufacturing.
   4. Substitutions: Section 01600 - Product Requirements.

B. Corporation Stops:
   1. Manufactured in accordance with AWWA C 800 and ASTM B584.
      a. Any brass part of the fitting or valve which may possibly contact potable water shall be manufactured of "no-lead brass" constructed of either UNC Copper Alloy C 89520 or C 89833.
      b. Any brass part of the fitting which will not possibly contact potable water shall be manufactured of brass constructed of UNS Copper Alloy C 83600 meeting the requirements of ASTM B 62.
   2. Inlet end threaded for tapping.
   3. Outlet end suitable for service pipe material as recommended by the manufacturer.

C. Service Saddles:
   1. Double strap type, designed to hold pressures in excess of pipe working pressure.

2.3 CURB STOP ASSEMBLY

A. Manufacturers:
   1. Mueller Company.
   2. Ford Meter Box Co.
   3. A. Y. McDonald Manufacturing.
   4. Substitutions: Section 01600 - Product Requirements.

B. Curb Stops:
   1. Manufactured in accordance with AWWA C 800 and ASTM B584.
      a. Any brass part of the fitting or valve which may possibly contact potable water shall be manufactured of "no-lead brass" constructed of either UNC Copper Alloy C 89520 or C 89833.
      b. Any brass part of the fitting which will not possibly contact potable water shall be manufactured of brass constructed of UNS Copper Alloy C 83600 meeting the requirements of ASTM B 62.
   2. Brass or red brass alloy body conforming to ASTM B62.
   3. Ball valve type with padlock wings. End connections shall be appropriate for the service pipe material as recommended by the manufacturer

2.4 METER BOX

A. Precast Concrete Meter Box
   1. 20"x 14"x 12" tall.
   2. Concrete lid with cast iron reader.
   3. Provide box extensions where required.

B. Plastic Meter Box
   1. 16" x 10" x 18" tall.
   2. Black with cast iron reader lid.
   3. UV resistant.
   4. Provide box extensions where required.

2.5 WATER METERS

A. Manufacturers:
   1. Neptune.
   2. Rockwell/Sensus.
   3. Badger.
   4. Substitutions: Section 01600 - Product Requirements.

B. Furnish materials in accordance with utility company standards.

C. AWWA C700, positive displacement disc type suitable for fluid with bronze case and cast iron frost-proof, breakaway bottom cap, hermetically sealed register.

D. Meter: Brass body with magnetic drive register.
   1. Service: Potable Water.
   2. Size: 5/8 inch x 3/4 inch or as indicated in the Plans and/or Bid Form.
   3. Unit of Measure: U.S. Gallons unless stated otherwise.
   4. Maximum Operating Pressure: 150 psi.
   5. Accuracy: 1/4 gpm @ 95% accuracy.
   6. Register Type: Direct or Remote Read.

2.6 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Mueller Company.
   2. Ford Meter Box Company.
   3. A. Y. McDonald Corporation.
   4. Substitutions: Section 01600 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
   1. Comply with ASSE 1013.
   2. Bronze body, with bronze internal parts and stainless steel springs.
   3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

C. Double Check Valve Assemblies: Comply with ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Engineer.

B. Provide service clamps for mains other than of cast iron or ductile iron mains.

C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.

D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.

E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Architect/Engineer.

3.4 BEDDING

A. Excavate pipe trench in accordance with Section 02300 for Work of this Section.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.

C. Backfill around sides and to top of pipe in accordance with Section 02300.

D. Place fill material in accordance with Section 02300.

3.5 INSTALLATION - PIPE AND FITTINGS

A. Group piping with other site piping work whenever practical.

B. Route pipe in straight line.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints.

D. Install access fittings to permit disinfection of water system.

E. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

F. Backfill trench in accordance with Section 02300.

3.6 INSTALLATION - CURB STOP ASSEMBLY

A. Set curb stops on gravel bed and connect to inlet side of meter.

B. Center and plumb meter box over meter/curb stop assembly. Set box cover 1” above finished grade.

3.7 INSTALLATION - WATER METERS

A. Install positive displacement meters in accordance with AWWA M6, with isolating valves on inlet and outlet.

3.8 INSTALLATION - BACKFLOW PREVENTERS

A. Install backflow preventer on outlet side of each meter and in accordance with manufacturer's instructions.

3.9 SERVICE CONNECTIONS

A. Install water service in accordance with utility company requirements with double check valve backflow preventer and pressure reducing valves where line pressure exceeds 80 psi.

B. Install water meter and backflow preventer in meter box located on site.

C. Flush and pressure test service line prior to connection of meter.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 02516.

3.11 FIELD QUALITY CONTROL

A. Perform pressure test on water distribution system in accordance with Section 02513.

END OF SECTION

SECTION 02516

DISINFECTION OF POTABLE WATER SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.

B. Related Sections:
1. Plans and general provisions of the Contract including General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Water Works Association:
1. AWWA B300 - Hypochlorites.
2. AWWA B301 - Liquid Chlorine.
3. AWWA B302 - Ammonium Sulfate.
4. AWWA B303 - Sodium Chlorite.
5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
6. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

C. Test Reports: Indicate results comparative to specified requirements.

D. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Disinfection Report:
1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

B. Bacteriological Report:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
   6. Coliform bacteria test results for each outlet tested.
   7. Certify water conforms, or fails to conform, to bacterial standards of Alabama Department of Environmental Management.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

1.6 QUALIFICATIONS

A. Testing Firm: Company specializing in testing potable water systems.

B. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify piping system has been cleaned, inspected, and pressure tested.

C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Provide and attach required equipment to perform the Work of this section.

B. Perform disinfection of water distribution system and installation of system and pressure testing. Refer to Section 02513.

C. Introduce treatment into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements.

B. Disinfection, Flushing, and Sampling:
   1. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted
   2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
   3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
   4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.

END OF SECTION

SECTION 02536

FORCE MAINS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Force mains.
2. Bedding and cover materials.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Pipe and Fittings:
1. Basis of Measurement: By linear foot.
2. Basis of Payment: Includes hand trimming excavation, backfill, bedding, thrust restraints, pipe, and fittings.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
3. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
4. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
5. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
6. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
7. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. American Water Works Association:
   1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
   2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
   3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

D. Ductile Iron Pipe Research Association:
   1. DIPRA Section 1X, Thrust Restraint.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Submit shop drawings for ductile iron pipe. Indicate piece numbers and locations and restrained joint locations.

C. Product Data: Submit data indicating pipe material used, pipe accessories, restrained joint details and materials.

D. Design Data: Submit restrained joint design data and calculations for ductile iron pipe establishing lengths of restrained joint piping required.

E. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record location of pipe runs, connections, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Design ductile iron pipe restrained joints in accordance with DIPRA Section 1X Standards.

1.7 PRE-INSTALLATION MEETINGS – **Not Required**

A. Section 01300 - Administrative Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Do not place materials on private property without written permission of property owner.

C. During loading, transporting and unloading, exercise care to prevent damage to materials.

D. Do not drop pipe or fittings.

E. Avoid shock or damage to pipe.

F. Take measures to prevent damage to exterior surface or internal lining of pipe.

G. Do not stack pipe higher than recommended by pipe manufacturer.

H. Store gaskets for mechanical and push-on joints in cool, dry location out of direct sunlight and not in contact with petroleum products.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate the Work of connection to existing sewer force mains, manholes, or other facilities with Owner.

PART 2 PRODUCTS

2.1 FORCE MAIN

A. Ductile Iron Pipe: AWWA C151; standard cement mortar lining (AWWA C104) or Ceramic Epoxy lining (Protecto 401), outside coated.
   1. Pipe - 3 Inches to 12 Inches: Pressure Class - 350 psi.
   2. Pipe - 14 Inches to 24 Inches: Pressure Class - 250 psi.
   3. Pipe - 30 Inches to 48 Inches: Pressure Class - 150 psi.

B. Ductile Iron Fittings:
   1. AWWA C110; - 350 psi pressure rating.
   2. Fitting to be cement mortar or ceramic epoxy lined and outside coated as for ductile iron pipe.

C. Joints: AWWA C111, where not specifically indicated on Drawings.
   1. Type: Mechanical joint or push-on joint.

D. Rubber Gaskets, Lubricants, Glands, Bolts and Nuts: AWWA C111.

2.2 POLYVINYL CHLORIDE (PVC) PIPE

A. PVC Pressure Sewer Pipe and Fittings - 12" Nominal Pipe Size and Smaller:
   1. ASTM D2241, PVC 1120; SDR 26.

2.3 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Sewage Force Main" in large letters.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A2 as specified in Section 02060.

B. Cover: As specified in Section 02300.

C. Soil Backfill from Above Pipe to Finish Grade: As specified in Section 02300.

2.5 CONCRETE

A. Concrete in accordance with Section 03300.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify project is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Correct over excavation with coarse aggregate.

B. Remove large stones or other hard matter capable of damaging pipe or impeding consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 02300.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with Drawings.

B. Route piping in straight line.

C. Refer to Section 02300 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

D. Connect to municipal sewer system as shown on the Drawings.

E. Install detectable underground utility marking tape continuous over top of pipe.

3.5 INSTALLATION - THRUST RESTRAINT

A. Provide pressure pipeline with restrained joints or concrete thrust blocking at bends, tees, and changes in direction; construct concrete thrust blocking in accordance with Drawings.

3.6 INSTALLATION - CRADLES AND ENCASEMENT

A. Provide concrete cradles and encasement for pipeline where indicated on Drawings as specified in Section 03300.

3.7 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements, 01700 - Execution Requirements.

B. Pressure test system to the greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Repair leaks and re-test.
   1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.
   2. Provide all equipment required to perform leakage and hydrostatic pressure tests including water storage means, acceptable water volume measurement means, pumps, piping, calibrated pressure gauges, and chart recorder. Upon request of Engineer, provide certification of calibration of equipment acceptable to Engineer.
   3. Test Pressure: The greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Obtain working pressure from Engineer.
   4. Conduct hydrostatic test for at least six-hour duration.
   5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, apply test pressure. At conclusion of tests, close and permanently seal resulting piping openings.

6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
7. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
8. Maintain test pressure within +/- 5 psi of specified test by pumping additional water in to the test segment. Accurately record test segment pressure continuously on chart recorder and volume of additional water supplied to test segment. Additional water supplied shall be designated as the leakage.
9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

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

L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
p = average test pressure during leakage test, in pounds per square inch gauge
C = 133,200

10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

C. Request inspection prior to and immediately after placing bedding.

D. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

3.8 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02539

SANITARY SEWER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewer pipe and fittings.
2. Connection to existing manholes.
3. Manholes.
4. Wye branches and tees.
5. Sanitary Laterals.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
4. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
5. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
6. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
7. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
10. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
11. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
12. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

13. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
14. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
15. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
16. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
17. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
18. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
19. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
20. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
21. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
22. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - ANSI Standard for the Thickness Design of Ductile Iron Pipe.
6. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
7. AWWA C153 - American National Standard for Ductile-Iron Compact Fittings for Water Service.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Product Data: Submit catalog cuts and other pertinent data indicating proposed materials, accessories, details, and construction information.

C. Submit reports indicating field tests made and results obtained.

D. Manufacturer's Installation Instructions:
1. Indicate special procedures required to install Products specified.
2. Submit detailed description of procedures for directional drilling installation.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Alabama Department of Environmental Management standard.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum years documented experience.

1.7 PRE-INSTALLATION MEETINGS – **Not Required**

A. Section 01300 - Administrative Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Deliver and store valves in shipping containers with labeling in place.

C. Block individual and stockpiled pipe lengths to prevent moving.

1.9 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate the Work with Owner and Public Works Department.

C. Notify affected utility companies minimum of 72 hours prior to construction.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPE AND FITTINGS

A. Ductile Iron Pipe: AWWA C150, AWWA C151 and ASTM A746, Class 50 or above, bell and spigot ends.
   1. Manufacturers:
      a. U.S. Pipe and Foundry.
      b. American Cast Iron Pipe Company.
      c. McWane, Inc.
      d. Substitutions: Section 01600 - Product Requirements.
   2. Outside Coating: AWWA C151, asphaltic coating, 1 mil uniform thickness.
   3. Lining: Cement mortar lined in accordance with AWWA C104 or Ceramic Epoxy Lining (Protecto 401).
   4. Polyethylene encasement: AWWA C105. **(Not Used)**
   5. Fittings: AWWA C153 or AWWA C110, ductile iron, Class 50 or above, cement mortar lined in accordance with AWWA C104.
   6. Mechanical Joints: AWWA C111, rubber gasket joint devices.

B. Plastic Pipe: ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; bell and spigot style rubber ring sealed gasket joint.
   1. Standard Dimension Ratio: 26
   2. Fittings: ASTM D-2321, PVC.
   3. Joints: ASTM F477, elastomeric gaskets.

C. High Density Polyethylene Pipe: ASTM D3350
   1. Manufactured from materials conforming to the requirements of PE 3408 meeting cell classification 345464E for striped pipe.
   2. Sizes 1-1/4" – 3": AWWA C901-96 and ASTM D3035.
   3. Sizes 4" IPS and larger: ASTM F714 and AWWA 906-99.
   4. Fittings: ASTM D 3261 and AWWA 906-99.
   5. All polyethylene pipe and fittings shall be DR 11 (Pressure class 160 PVC equivalent).
   6. All pipes shall be black in color with a green stripe indicating sanitary sewer pipe.

D. Ribbed Plastic Pipe: ASTM F794, bell and spigot style joint.
   1. Interior: Smooth.
   2. Exterior Ribs: Perpendicular to pipe axis
   3. Pipe Stiffness: 60 psi for 8"-12" pipe
      46 psi for 15"-30" pipe.

2.2 MANHOLES

A. Manholes: As specified in Section 02082; precast concrete, 48 inch diameter, eccentric conical top, cast iron frames and covers, cover inscribed with SANITARY SEWER."

2.3 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A2, as specified in Section 02060.

B. Cover: Fill to top of pipe with Type A2 aggregate, as specified in Section 02060.

C. Soil Backfill from top of pipe to Finish Grade: Soil with no rocks over 6 inches in diameter, frozen earth or foreign matter. See Section 02300.

D. If pipe is under a paved surface, it is to be backfilled entirely with Type A2 aggregate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Correct over excavation with coarse aggregate.

B. Remove large stones or other hard matter capable of damaging pipe or impeding consistent backfilling or compaction.

C. Protect and support existing sewer lines, utilities and appurtenances.

D. Maintain profiles of utilities. Coordinate with other utilities to eliminate interference. Notify Engineer where crossing conflicts occur.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 02324.

B. Excavate to lines and grades shown on Drawings or required to accommodate installation of encasement.

C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

D. Provide sheeting and shoring in accordance with Section 02324.

E. Place bedding material at trench bottom, level materials in continuous layer not exceeding 8 inches compacted depth; compact to 90 percent.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings; with maximum variation from indicated slope of 1/8 inch in 20 feet. Begin at downstream end and progress upstream.

C. Assemble and handle pipe in accordance with manufacturer's instructions except as modified on the Drawings or by Engineer.

D. Keep pipe and fittings clean until work is completed and accepted by Engineer. Cap open ends during periods of work stoppage.

E. Lay bell and spigot pipe with bells upstream.

F. Polyethylene Pipe Encasement: AWWA C105.

3.5 INSTALLATION - CONNECTION TO EXISTING MANHOLE

A. Core drill existing manhole to clean opening. Using pneumatic hammers, chipping guns, sledge hammers, is not permitted.

B. Install watertight Link-Seal type gasket and seal with non-shrink concrete grout.

C. Prevent construction debris from entering existing sewer line when making connection.

3.6 INSTALLATION - MANHOLES

A. Install manholes in accordance with Section 02082.

3.7 INSTALLATION - WYE BRANCHES AND TEES

A. Install wye branches or pipe tees at locations indicated on Drawings concurrent with pipe laying operations. Use standard fittings of same material and joint type as sewer main.

B. Maintain minimum 5 feet separation distance between wye connection and manhole.

C. Use saddle wye or tee with stainless steel clamps for taps into existing piping. Mount saddles with solvent cement or gasket and secure with metal bands. Layout holes with template and cut holes with mechanical cutter.

3.8 INSTALLATION - SANITARY LATERALS

A. Construct laterals from wye branch to terminal point at right-of-way.

B. Where depth of main pipeline warrants, construct riser type laterals from wye branch.

C. Maintain 2 feet minimum depth of cover over pipe.

D. Maintain minimum 5 feet separation distance between laterals.

E. Install cleanout and watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral. Install temporary marker stake extending from end of lateral to 12 inches above finished grade. Paint top 6 inches of stake with fluorescent orange paint.

3.9 BACKFILLING

A. Backfill around sides and to top of pipe in accordance with Section 02300.

B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.10 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements.

B. Pressure Test: Test in accordance with Section 02952.

C. Infiltration Test: Test in accordance with Section 02952.

D. Deflection Test: Test in accordance with Section 02952.

E. Request inspection prior to placing bedding.

F. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

3.11 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02821

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts.
4. Manual gates and related hardware.
5. Privacy slats.
6. Twisted strand barbed wire.
7. Electric operator.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Chain Link Fencing:
1. Basis of Measurement: Linear feet of fence at ground level.
2. Basis of Payment: Includes all labor, equipment and materials associated with the installation of chain link fencing at the locations indicated on the plans. Includes grading, excavation for post footings, concrete, posts, backfill, chain link fence fabric, ties, wire, bracing, barbed wire, privacy slats, and all related appurtenances.

B. Gates:
1. Basis of Measurement: Linear feet of gate from post to post at ground level for each type of gate.
2. Basis of Payment: Includes all labor, equipment and materials associated with the installation of gates at the size and locations indicated on the plans. Includes grading, excavation for post footings, concrete, posts, backfill, chain link fence fabric, ties, wire, bracing, barbed wire, privacy slats, drop retainer rod, rollers, wheels, hinges, hasps, electric operators, keypads, key pad post, remote openers and all related appurtenances.

1.3 REFERENCES

A. ASTM International:
1. ASTM A121 - Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

4. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
5. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
6. ASTM A585 - Standard Specification for Aluminum-Coated Steel Barbed Wire.
7. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
8. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
9. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
10. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
11. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
12. ASTM F668 - Standard Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Chain Link Fence Fabric.
13. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
14. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
15. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
16. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
17. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.

B. Chain Link Fence Manufacturers Institute:
1. CLFMI - Product Manual.

1.4 SYSTEM DESCRIPTION

A. Fence Height: As indicated on Drawings.

B. Line Post Spacing: At intervals not exceeding 10 feet on straight sections and 8 feet on curved sections.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

B. Operation and Maintenance Data: Procedures for submittals.

1.7 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.

B. Perform installation in accordance with ASTM F567.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer's name.

D. Store fence fabric and accessories in secure and dry place.

PART 2 PRODUCTS

2.1 MATERIALS

A. Framing (Steel): ASTM F1083 Schedule 40 galvanized steel pipe, welded construction, minimum yield strength of 25 ksi; coating conforming to ASTM F1043 Type A on pipe exterior and interior.

B. Fabric Wire (Steel): ASTM A392 zinc coated wire fabric.

C. Barbed Wire: ASTM A121 galvanized steel with galvanized steel barbs; 12 gauge thick wire, 3 strands, 4 points at 3-inch oc.

D. Concrete: Type specified in Section 03300.

2.2 COMPONENTS

A. Line Posts: 2.375 inch outside diameter, commercial quality.

B. Corner and Terminal Posts: 3.0 inch outside diameter, commercial quality.

C. Gate Posts: 4.0 inch outside diameter, commercial quality for all gates with an opening greater than 6 feet. Openings less than 6 feet shall require 3.0 inch outside diameter posts.

D. Top and Brace Rail: 1.625-inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.625-inch diameter for welded fabrication.

F. Fabric: 2 inch diamond mesh interwoven wire, 11gauge thick, top salvage knuckle end closed, bottom selvage knuckle end closed.

G. Tension Wire: 7 gauge thick steel, single strand.

H. Tie Wire: Aluminum alloy steel wire.

2.3 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; aluminum.

C. Extension Arms: Cast steel galvanized, to accommodate 3 strands of barbed wire, single arm, sloped to 45 degrees.

D. Gate Hardware: Fork latch with gravity drop; Center gate stop and drop rod; Mechanical keepers; two 180-degree gate hinges for each leaf and hardware for padlock.

2.4 GATES

A. General:
1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
2. Factory assemble gates.
3. Design gates for operation by one person.

B. Swing Gates:
1. Fabricate gates to permit 180-degree swing.
2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

C. Sliding Gates:
1. Framing and Posts: ASTM F1184, Class 2 for internal rollers.
2. Rollers for overhead and cantilever sliding gates: Bearing type. Furnish non-sealed bearings with grease fitting for periodic maintenance.
3. Secure rollers to post or frame without welding.

D. Cantilever Sliding Gates:
1. Fabricate gate leaf frames and tracks of aluminum conforming to ASTM B429 alloy 6063-T6 or as required to meet performance requirements of ASTM F1184.
2. Frame Members: Minimum 2 inches 0.91 lb/ft aluminum tubing welded assembly forming rigid, one-piece unit.
3. Install fabric securely stretched and held in center of tubing.

4. Brace cantilever overhang frames with 3/8-inch brace rods. For gate leaf sizes greater than 23 feet, fabricate with additional lateral support rail welded adjacent to top and bottom horizontal rails.
5. Provide minimum overhang for each leaf opening size as follows:

Opening	Overhang
Up to 10'-0"	6'-6"
10'-0" -14'-0"	7'-6"
14'-1" -22'-0"	10'-0"
22'-1" - 30'-0"	12'-0"

6. Track: Combined, integral track and rail.
7. Rail: Aluminum extrusion; minimum total weight of 3.72 lb/ft; designed to withstand reaction load of 2,000 lbs.
8. Roller Track Assembly: Two swivel type, zinc, die cast trucks having four, sealed lubricant ball bearing wheels minimum 2 inches diameter by 9/16 inches width designed for same reaction load as rail. Provide two side-rolling wheels for each gate leaf to maintain alignment of truck in track.
9. Fasten trucks to post brackets by minimum 7/8-inch diameter, 1/2-inch shank ball bolts.
10. Provide galvanized steel guide wheel assemblies consisting of two rubber wheels of minimum 4-inch diameter with oil-impregnated bearings for each supporting post.
11. Attach guide wheel assembly to post so bottom horizontal member rolls between wheels and permitting adjustment to maintain plumb gate frames and proper alignment.

2.5 PRIVACY SLATS

A. Privacy Slats: Vinyl strips, flat configuration, sized to fit fence fabric, color as selected.

2.6 FINISHES

A. Components and Fabric: Galvanized to ASTM A123/A123M for components; ASTM A153/A153M for hardware; ASTM A392 for fabric; 1.2 oz/sq ft coating.

B. Components and Fabric: Vinyl coating, color in accordance with ASTM F934 as selected.

C. Vinyl Components: color to match fabric as selected.

D. Hardware: Galvanized to ASTM A153/A153M, 1.8 oz/sq ft coating.

E. Accessories: Same finish as fabric.

2.7 ELECTRIC OPERATOR

A. Heavy duty, weather resistant, all welded enclosure with powder coat finish. Post mount.

B. 1/2 horsepower, 208 volt, 3-phase motor with adjustable limit switches, adjustable torque limiter and manual disconnect.

C. Operator shall have magnetic reversing starter, delay on reversal and warning beeper.

D. Operator shall be easily convertible from right hand to left hand operation.

E. Operator shall be fully compatible with card readers, loop detectors, radio controls and automatic closing devices.

F. Opening control shall be by post mounted keypad or by remote control. Closing control shall be by loop detector. Provide a minimum of three (3) loop detectors (one automatic exit loop and two safety loops). Provide a minimum of six (6) RF wireless remote controls (fully integrated/programmed with associated gate).

G. Provide IR beam safety system to prevent closing of gate when obstructions are present.

2.8 KEYPAD

A. Keypad shall have stainless steel plate and painted metal housing rated for outdoor/wet locations. Keys to be metal with lighted numerals.

B. Keypad shall be mounted to gooseneck post on concrete base and shall be capable of 100 separate codes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Set intermediate, terminal, gate, and all other posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

C. Line Post Footing Depth Below Finish Grade: ASTM F567, 2.0 feet.

D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567, 3.0 feet.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

F. Install top rail through line post tops and splice with 6-inch-long rail sleeves.

G. Install center and bottom brace rail on corner gate leaves.

H. Place fabric on outside of posts and rails.

I. Do not stretch fabric until concrete foundation has cured 7 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

K. Position bottom of fabric 2 inches above finished grade.

L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

N. Install bottom tension wire stretched taut between terminal posts.

O. Install support arms sloped outward and attach barbed wire; tension and secure.

P. Support gates from gate posts. Do not attach hinged side of gate from building wall.

Q. Install gate with fabric and barbed wire overhang to match fence. Install three hinges on each gate leaf, latch, catches, drop bolt.

R. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

S. Connect to existing fence at existing terminal post.

T. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.

U. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.

V. Center and align posts. Place concrete around posts and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

W. Locate keypad approximately 10 feet from the gate and facing the incoming traffic lane. Install on concrete pedestal.

3.2 PRIVACY SLATS

A. Install slat inserts in diagonal pattern woven through fence fabric.

B. Fasten slats according to manufacturer’s instructions.

3.3 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements.

B. Maximum Variation from Plumb: 1/4 inch.

C. Maximum Offset from Indicated Position: 1 inch.

D. Minimum distance from property line: 12 inches.

END OF SECTION

SECTION 02923

LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Final grade topsoil for finish landscaping.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Samples: When requested by the Engineer, submit, in air-tight containers, 5 lb sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials source.

1.3 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

PART 2 PRODUCTS

2.1 MATERIAL

A. Topsoil: Fill type as specified in Section 02300.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify building and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding, and planting, is required to nominal depth of 4 inches. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate 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 plant material, building, and trees to prevent damage.

E. Remove surplus subsoil and topsoil from site.

F. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus 1/2 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 01700 - Execution Requirements.

B. Prohibit construction traffic over topsoil.

END OF SECTION

SECTION 02926

SEEDING AND SODDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation of subsoil
2. Placing topsoil
3. Fertilizing
4. Seeding
5. Laying Sod
6. Hydroseeding
7. Mulching
8. Soil testing and fertilizer
9. Maintenance

B. Related Sections:
1. Plans and general provisions of the Contract including General Conditions and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Grassing and Restoration:
1. Basis of Measurement: Lump Sum or Per Acre.
2. Basis of Payment: Includes all labor, material, and equipment required to finish grading to smooth surface, applying topsoil in 4" minimum thickness, either saved from initial stripping operations, or provided from offsite locations, applying fertilizer, seeding of all areas disturbed by the construction activities, applying mulch to seeded areas, watering, and maintenance of disturbed areas until stand of grass acceptable to Engineer and/or Owner is established.

B. Solid Sodding:
1. Basis of Measurement: Square Yard.
2. Basis of Payment: Includes all labor, material, and equipment required to finish grading to smooth surface, applying topsoil in 4" minimum thickness, either saved from initial stripping operations, or provided from offsite locations, placing solid sodding in locations reflected on the Plans or as directed by the Owner or Engineer, soil amendments, rolling, watering, and maintenance of sod until its rooting is acceptable to Engineer and/or Owner.

1.3 REFERENCES

A. ASTM International:
1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. Turfgrass Producers International:
   1. TPI - Guideline Specifications to Turfgrass Sodding.

C. Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction (SSHC), Latest Edition:
   1. Section 652 - Ground Preparation, Vegetation Establishment and Mowing
   2. Section 654 – Solid Sodding
   3. Section 860 - Roadside Improvement Materials

1.4 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Product Data:
   1. Submit data for seed mix, fertilizer, mulch, and other accessories.
   2. Submit data for sod grass species, fertilizer, mulch, and other accessories.

1.6 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.7 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Provide sod capable of supporting its own weight without tearing when suspended vertically by holding upper two corners. Sod must be alive or dormant when placed.

1.8 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum five years of experience.

B. Sod Producer: Company specializing in manufacturing Products specified in this section with minimum five years of experience.

C. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver sod on pallets. Protect roots from dehydration.

D. Do not deliver more sod than can be laid within 48 hours.

E. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate with installation of underground sprinkler system piping and watering heads.

1.11 MAINTENANCE SERVICE

A. Section 01700 - Execution Requirements.

B. Maintain seeded and/or sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

PART 2 PRODUCTS

2.1 SEED PLANTING SCHEDULE

A. Established lawns and residential areas shall utilize the following schedule:

RATE – (LB/ACRE)	FROM	TO	SEED
30	March 1	May 1	Kentucky 31
20	April 1	August 1	Common Bermuda
30	August 1	November 1	Kentucky 31 Fescue and Unhulled Bermuda
20	November 1	March 1	Annual Rye

B. Unimproved areas may utilize the following schedule:

Planting Dates	March 1 to May 15	May 16 to August 1	March 1 to May 15	Sept. 1 to Nov. 15
Hulled Bermuda Grass	15	20	10	-
Unhulled Bermuda	10	-	10	-
Tall Fescue	-	-	50	50
Annual Lespedeza	-	30	-	-
Reseed Crimson Clover	-	-	30	-

2.2 SOD

A. Reference Section 654 of the ALDOT SSHC, Latest Edition.

2.3 SOIL MATERIALS

A. 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; pH value of minimum 5.4 and maximum 7.0. May be excavated from site or from offsite locations.

2.4 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: Commercial grade; recommended for type of grass used; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: Nitrogen 13 percent, phosphoric acid 13 percent, soluble potash 13 percent.

C. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

D. Erosion Fabric: SC150 BN by North American Green or Equal,
1. 70% straw, 30% coconut fiber mat.
2. Longevity: up to 18 months.
3. Blanket covered top and bottom with 100% biodegradable woven natural fiber netting.
4. Shall meet type 3.8 Specification of Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.17.

E. Stakes/Pegs: Softwood lumber, chisel pointed. Of sufficient size and length to anchor sod on slopes.

F. String: Inorganic fiber.

G. Plastic Mesh: Interwoven hexagonal plastic mesh of 2-inch size.

H. Edging: Painted steel.

2.5 HARVESTING SOD

A. Reference Section 654 of the ALDOT SSHC, Latest Edition.

2.6 SOURCE QUALITY CONTROL

A. Section 01400 – Quality Requirements

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH values.

C. Provide recommendation for fertilizer and lime application rates for specified seed or sod species.

D. Testing is not required when recent tests are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify 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.

B. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

C. Remove foreign materials, weeds and undesirable plants and their roots.

D. Remove contaminated subsoil.

E. Scarify subsoil to depth of 4 inches where topsoil is to be placed.

F. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 4 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 and/or sodded areas in straight lines to consistent depth.

3.4 FERTILIZING

A. Apply fertilizer at application rate recommended by soil analysis.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine used to apply seed.

D. Mix fertilizer thoroughly into upper 2 inches of topsoil.

E. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.5 SEEDING

A. Apply seed at rate of 5.5 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. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

D. Immediately following seeding, apply mulch to thickness of 1/4 inches. Maintain clear of shrubs and trees.

E. Apply water with fine spray immediately after each area has been mulched. Saturate top 4 inches of soil.

3.6 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod within 48 hours after harvesting to prevent deterioration.

C. Lay sod tight with no open joints and no overlapping. Stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.

D. Lay smooth. Align with adjoining grass areas.

E. Place top elevation of sod ½ inch below adjoining paving and/or curbs.

F. On slopes 6 inches per foot and steeper, lay sod perpendicular to slope and secure every row with wooded pegs at a maximum 3 feet on center. When using “big roll”, lay sod parallel to slope. Drive pegs flush with soil portion of sod.

G. Do not place sod when temperature is lower than 40 degrees F.

H. Prior to placing sod, on slopes exceeding 8 inches per foot or where indicated on Drawings, place mesh over topsoil. Securely anchor wire mesh in place with wood pegs sunk firmly into ground.

I. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.

J. After sod and soil have dried, roll sodded areas to bond sod to soil and to remove minor depressions and irregularities.

3.7 MAINTENANCE OF SOD

A. Mow grass at regular intervals to maintain a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each 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 of sod to prevent irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately replace sod or re-seed areas showing deterioration or bare spots.

H. Protect sodded areas with warning signs or tape during maintenance period.

3.8 HYDROSEEDING

A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at rate established by manufacturer.

B. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.9 SEED PROTECTION

A. Cover seeded slopes where grade is 3:1 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch-deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36-inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

END OF SECTION

SECTION 02950

MAINTAINING WASTEWATER FLOW

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Maintaining flow in sanitary sewers.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Submit equipment proposed for bypass pumping to Owner and Engineer for approval. Submit written plan outlining provisions and precautions to be taken to adequately route wastewater flow around the work area and prevent overflow or other spillage of wastewater.

C. Submit data on equipment showing flow capacities and heads for pumps; capacities and number of tanker trucks; lengths, sizes and materials of hoses and sizes and materials of plugs. List all equipment available for bypass pumping.

D. Submit written back-up plan for maintaining wastewater flow should primary equipment fail.

1.3 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Demonstrate ability of equipment to adequately bypass flow without back-ups or surcharging.

1.4 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

B. Notify Owner and Engineer not less than 48 hours prior to commencing work where wastewater flow control or bypass pumping will be required.

C. Coordinate work with users connected to system.

D. Notify homeowners and businesses at least twenty-four hours in advance of expected disruption of sanitary service.

PART 2 PRODUCTS

2.1 PUMPS

A. Fully automatic self-priming units which do not require the use of foot-valves or vacuum pumps in the priming system.

B. Provide pumps with automatic start/stop controls and discharge piping adequate to prevent spillage of wastewater.

C. Provide sufficient engine silencers to limit noise where diesel units are utilized.

D. Provide pumping system with on-line back-up pump isolated from primary system by valve.

E. Pumping System capable of operating 24 hours per day and capable of running dry for long periods of time.

2.2 PLUGS

A. Restrained inflatable type pneumatic plugs capable of releasing wastewater back-up slowly without surges.

2.3 HOSES

A. Hoses of suitable material for laying on the ground and capable of being run over by vehicular traffic without breaking. Provide hoses free from pinholes or other means of leakage.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify pumping system is adequate to convey peak and wet-weather sewer flow rates without back-ups or surcharging.

C. Verify downstream sewers have adequate capacity to handle by-passed wastewater flow without back-ups, surcharges or overflows.

3.2 DEPTH OF FLOW

A. Control depth of flow in upstream sewer using by-pass pumping to the following depths whenever the following work is occurring.

Maximum Depth of Flow as Percentage of Pipe Diameter					
Television Inspection		**Joint Testing and Sealing**		**Pipe Lining**	
Pipe Diameter	**Max. % Depth of Flow**	**Pipe Diameter**	**Max. % Depth of Flow**	**Pipe Diameter**	**Max. % Depth of Flow**
6-10 inch	20%	6-12 inch	25%	6-10 inch	20%
12-24 inch	25%	15-24 inch	30%	12-24 inch	25%
Larger than 27 inch	30%	Larger than 27 inch	35%	Larger than 27 inch	30%

3.3 BYPASS PUMPING

A. Submit a specific detailed description of proposed bypass pumping system to include written description of plan and addressing quantity, capacity, and location of pumping equipment. Submit spill plan to address any spills that might occur.

B. Plug outgoing side of manhole upstream from work area and bypass pump wastewater from plugged manhole to manhole downstream of work area. Do not allow wastewater to surcharge in plugged manhole or back-up into upstream sewer.

C. If no adequate downstream sewer is available, provide tanker trucks of sufficient number and capacity to haul wastewater to location approved by Owner.

D. Place equipment in location suitable to permit traffic flow and access to homes and business.

E. Route hose through trenches backfilled with crushed aggregate base materials where hoses must cross streets. Do not route hoses through storm drainage pipes or drainage ditches.

F. Protect public and private property water resources, wetlands and other natural resources from damage from spills or back-ups.

G. Pay all clean-up costs and/or fines incurred by Owner on account of wastewater overflows or back-ups caused by operation of the bypass pumping system.

H. Notify Owner and Engineer immediately of leaks or spills and implement emergency containment procedures.

END OF SECTION

SECTION 02952

SEWER AND MANHOLE TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing Manholes:
      a. Vacuum Test.
   2. Testing Gravity Sewer Piping:
      a. Low-pressure Air Test.
      b. Infiltration Test.
   3. Hydrostatic Testing Pressure Piping.
   4. Deflection Testing Plastic Piping.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
   2. ASTM D2122 - Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Submit the following prior to start of testing:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   4. Provisions for disposal of flushing and test water.
   5. Certification of test gauge calibration.
   6. Deflection mandrel drawings and calculations.

C. Test Reports: Indicate results of manhole and piping tests.

PART 2 PRODUCTS

2.1 VACUUM TESTING EQUIPMENT

A. Vacuum pump.

B. Vacuum line.

C. Vacuum tester base with compression band seal and outlet port.

D. Shut-off valve.

E. Stop watch.

F. Plugs.

G. Vacuum gauge, calibrated to 0.1 inch Hg

2.2 AIR TEST EQUIPMENT

A. Air compressor.

B. Air supply line.

C. Shut-off valves.

D. Pressure regulator.

E. Pressure relief valve.

F. Stop watch.

G. Plugs.

H. Pressure gauge, calibrated to 0.1 psi.

2.3 INFILTRATION TEST EQUIPMENT

A. Weirs.

2.4 HYDROSTATIC TEST EQUIPMENT

A. Hydro pump.

B. Pressure hose.

C. Water meter.

D. Test connections.

E. Pressure relief valve.

F. Pressure gauge, calibrated to 0.1 psi.

2.5 DEFLECTION TEST EQUIPMENT

A. Go, No-Go mandrels.

B. Pull/retrieval ropes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify manholes and piping are ready for testing.

C. Verify trenches are backfilled.

D. Verify pressure piping concrete reaction support blocking or mechanical restraint system is installed.

3.2 PIPING PREPARATION

A. Plug outlets, wye-branches and laterals; brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements.

B. Testing Gravity Sewer Piping:
   1. Low-pressure Air Test:
      a. Test each section of gravity sewer piping between manholes.
      b. Introduce air pressure slowly to approximately 4 psig.
         1) Determine ground water elevation above spring line of pipe for every foot of ground water above spring line of pipe, increase starting air test pressure by 0.43 psig; do not increase pressure above 10 psig.
      c. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or increased test pressure as determined above when ground water is present. Start test.
      d. Test:
         1) Determine test duration for sewer section with single pipe size from the following table. Do not make allowance for laterals.

AIR TEST TABLE

Minimum Test Time for Various Pipe Sizes

Pipe Dia. (inches)	T(time), min/ 100 feet
3	0.2
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
36	6.0

2) Record drop in pressure during test period; when air pressure has dropped more than 1.0 psig during test period, piping has failed; when 1.0 psig air pressure drop has not occurred during test period, discontinue test and piping is accepted.

3) When piping fails, determine source of air leakage, make corrections and retest; test section in incremental stages until leaks are isolated; after leaks are repaired, retest entire section between manholes.

2. Test pipe larger than 36 inches diameter with exfiltration test not exceeding 100 gallons for each inch of pipe diameter for each mile per day for each section under test. Perform test with minimum positive head of 2 feet.

3. Infiltration Test:
   a. Use only when gravity piping is submerged in ground water minimum of 4 feet above crown of pipe for entire length being tested.
   b. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter for each mile per day for section under test, include allowances for leakage from manholes. Perform test with minimum positive head of 2 feet.

C. Testing Pressure Sewer Piping:
   1. Hydrostatic Leakage Test:
      a. Hydrostatically test each portion of pressure piping, including valve section, at 1.5 times working pressure of piping based on elevation of lowest point in piping corrected to elevation of test gauge.
      b. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled and raise pressure to specified test pressure.
      c. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.

d. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

e. Compute maximum allowable leakage by the following formula:

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

L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
p = average test pressure during leakage test, in psig
C = 133,200

When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

f. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

D. Deflection Testing of Plastic Sewer Pipe:

1. Perform vertical ring deflection testing on PVC and ABS sewer piping, after backfilling has been in place for at least 30 days but not longer than 12 months.
2. Allowable maximum deflection for installed plastic sewer pipe limited to 5 percent of original vertical internal diameter.
3. Perform deflection testing using properly sized rigid ball or 'Go, No-Go' mandrel.
4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe as determined by ASTM standard to which pipe is manufactured. Measure pipe in compliance with ASTM D2122.
5. Perform test without mechanical pulling devices.
6. Locate, excavate, replace and retest pipe exceeding allowable deflection.

E. Testing Manholes:

1. General: Test using air whenever possible prior to backfilling to assist in locating leaks. Make joint repairs on both outside and inside of joint to ensure permanent seal. Test manholes with manhole frame set in place.
2. Vacuum test in accordance with ASTM C1244 and as follows:
   a. Plug pipe openings; securely brace plugs and pipe.
   b. Inflate compression band to effect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.
   c. Test:
      1) Determine test duration for manhole from the following table:

VACUUM TEST TABLE

Manhole Diameter	Test Period
4 feet	60 seconds
5 feet	75 seconds
6 feet	90 seconds

2) Record vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.

3) When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing bars.
   2. Welded wire fabric.
   3. Reinforcement accessories.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 318 - Building Code Requirements for Structural Concrete.
   3. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
   1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   3. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   6. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
   7. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   8. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   9. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
   10. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
   11. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   12. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

13. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society:
1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules.

C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

D. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice and ACI 301.

1.5 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade; deformed billet steel bars, unfinished.

B. Reinforcing Steel Plain Bar and Rod Mats: ASTM A704/A704M, ASTM A615/A615M, Grade 60; steel bars or rods, unfinished.

C. Stirrups Steel: ASTM A82, unfinished.

D. Welded Steel Wire Fabric: ASTM A497 Deformed Type; in flat sheets or coiled rolls; galvanized 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 retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic tipped steel type; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Exothermic welding type; full tension and compression; sized to fit joined reinforcing.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice.

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 retarder.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcement as follows:

Item	Coverage
Concrete in contact with soil	3 inches
Exterior concrete	
Bars larger than No. 5	2 inches
No. 5 bars and smaller	1-1/2 inches
Interior concrete	
Bars larger than No. 11	1-1/2 inches
No. 11 bars and smaller	3/4 inch
Stirrups	1-1/2 inches

E. Conform to applicable code for all other conditions.

F. Splice reinforcing in accordance with splicing device manufacturer’s instructions.

G. Lap length shall be as follows unless otherwise noted on the Drawings:

Bar Size	Lap Length
No. 3	12 inches
No. 4	12 inches
No. 5	15 inches
No. 6	18 inches
No. 7	24 inches
No. 8	30 inches

3.2 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements; Section 01700 - Execution Requirements.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Cast-in-place concrete.
2. Formwork.
3. Reinforcing.
4. Mix Design.
5. Control, expansion and contraction joint devices.
6. Placement procedures.
7. Finishes.
8. Testing requirements.

B. Related Documents:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Cast-in-Place Structures:
1. Basis of Measurement: Cubic Yard or Lump Sum.
2. Basis of Payment: Includes all labor, material, and equipment required to construct the concrete structures shown on the Plans and/or reflected in the Bid Form. Includes placing and compacting of base material, formwork, underground piping, drains, conduit, reinforcement, pouring and finishing of concrete, removal of forms, water stops, water proofing, expansion and control joints, cleanup and all related items.

B. Concrete Driveway Replacement:
1. Basis of Measurement: Square Yard or Cubic Yard.
2. Basis of Payment: Includes all labor, materials, and equipment required to place concrete surface at the thickness and cured strength shown in the Plans and/or reflected in the Bid Form. Includes saw cutting and removal of existing surface, backfill materials per the Plans, wire mesh, pouring and finishing concrete drive, cleanup and all related work. Also, shall include coordination with any residents to provide an alternate entrance to their driveway while concrete is curing. The maximum width for payment shall be as noted on the Plans.

C. Minor Concrete Structures:
1. Basis of Measurement: Cubic Yard.
2. Basis of Payment: Includes all labor, material, and equipment required to replace or construct any minor or miscellaneous structures as indicated in the Plans, directed by the Engineer, and/or reflected in the Bid Form. Items could include curb and gutters, sidewalks, and small slabs.

1.3 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 305 - Hot Weather Concreting.
   3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   4. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM C33 - Standard Specification for Concrete Aggregates.
   3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
   4. ASTM C150 - Standard Specification for Portland Cement.
   5. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   6. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
   7. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
   8. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
   9. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
   10. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
   11. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   12. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
   13. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
   14. ASTM D1190 - Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type.
   15. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   16. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
   17. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
   18. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Product Data: Submit data on joint devices, attachment accessories, and admixtures.

C. Design Data:
   1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:

a. Hot and cold weather concrete work.
b. Air entrained concrete work.

2. Identify mix ingredients and proportions, including admixtures.

D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY CONTROL / QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of each document on site.

C. Acquire cement and aggregate from one source for Work.

D. Conform to ACI 305 when concreting during hot weather.

E. Conform to ACI 306.1 when concreting during cold weather.

F. Concrete Testing Service: Contractor shall employ CDG to provide quality assurance testing during construction. Contractor is responsible to provide suitable quality control of materials, procedures, and of the mix design process to ensure the concrete conforms to the project plans and specifications. Submit quality control plan and proposed concrete mix designs to Engineer prior to concrete placement.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 “A-C or B-B High Density Overlaid Concrete Form”, Class 1.

2. Use plywood complying with U.S. Product Standard PS-1 “B-B (Concrete Form) Plywood”, Class 1, Exterior Grade or better, mill-oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for a tight fit.

C. Form Coatings: Provide commercial formulation form coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory fabricated, adjustable length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Welded Wire Fabric: ASTM A185 welded steel wire fabric.

C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar type supports complying with CRSI specifications.
1. For slabs-on-grade use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, class 1) or stainless steel protected (CRSI, class 2).
3. For sand blasted or intentionally roughened concrete surfaces, provide supports of stainless steel (CRSI, class 2).

D. Reinforcing Bars to be Welded: ASTM A706, “Specifications for Low Alloy Steel Deformed Bars for Concrete Reinforcement”.

E. Bar and Rod Mats: ASTM A184 “Specifications for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement”.

F. Threaded Dowels: Continuous Threaded high-strength steel bars. Provide inserts compatible with dowels, designed for ultimate pull-out force indicated on the Drawings.

G. Mechanical Splices: Equal to “Cadweld Rebar Splices”, as manufactured by Erico Products, Inc., “C” Series, for developing 125% of minimum ASTM specified yield strengths, unless otherwise noted on Drawings.

H. Steel Shapes, Plates and Rods: Conform to ASTM A36 “Specifications for Structural Steel”.

I. Do not weld reinforcing steel unless specifically noted on Drawings. If welding is shown, conform to latest revision of AWS D12.1, “Reinforcing Steel Welding Code of the

American Welding Society". Perform all welding with certified welders qualified per AWS.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I – Normal, Portland type for all applications other than structures used in conjunction with wastewater projects. All wastewater related structures shall use Type V – Sulfate Resistant, Portland Cement.

B. Fly Ash: ASTM C618, Type C or Type F.
   1. Limit use of fly ash to not exceed 20 percent of cement content by weight.

C. Normal Weight Aggregate: ASTM C33 and as herein specified. Provide aggregates from a single source for exposed concrete.
   1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

D. Water: Clean, potable.

E. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.

F. Air-Entraining Admixtures: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

G. Water Reducing Admixtures: ASTM C494, Type A.

H. High Range Water Reducing Admixtures (Super Plasticizer): ASTM C494, Type F or Type G.

I. Water Reducing, Non-Chloride Accelerating Admixture: ASTM C494, Type E.

J. Water Reducing, Retarding Admixture: ASTM C494, Type D.

K. All admixtures shall be supplied by the same manufacturer.

2.4 ACCESSORIES

A. Vapor Retarder: ASTM E1745 Class A; 6 mil thick fabric-reinforced plastic film, 0.03 perms; rated for below grade application. Furnish joint tape recommended by manufacturer.

B. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

C. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength 130 ksi; toughness 15 ksi; 3/4 inch long fibers, 34 million/lb fiber count.

D. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as shown on the Drawings.

E. Granular Base: Evenly graded mixture of fine and course aggregates to provide, when compacted, a smooth and even surface below slabs on grade.

F. Sand Cushion: Clean, manufactured or natural sand.

G. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as abrasive aggregate for nonslip finish. Material shall be factory graded, rustproof, non-glazing, and is unaffected by freezing, moisture, and cleaning materials.

H. Colored Wear Resistant Finish: Packaged, dry, combination of materials consisting of Portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides, interground with cement. Color as selected by Engineer.

I. Bonding Compound: Polyvinyl acetate or acrylic base.

J. Epoxy Adhesive: ASTM C881, two-component material suitable on dry or damp surfaces. Provide material type, grade and class to suit project requirements.

2.5 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: ASTM D994; Asphalt impregnated fiberboard or felt, thickness as indicated on the drawings; tongue and groove profile.

B. Joint Filler Type B: ASTM D1751; cellular bonded fiber material, non-extruding, resiliency recovery of 70 percent if not compressed more than 50 percent of original thickness.

C. Construction Joint Devices: Integral galvanized steel, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.

D. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient neoprene filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum of longest manufactured length at each location, flush mounted.

E. Joint Sealant: ASTM C920, Type S; single component, self leveling, premium grade polyurethane sealant, equal to Sikaflex-1C SL.

2.6 CONCRETE MIX

A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.

B. Select proportions for normal weight concrete in accordance with ACI 301 trial mixtures.

C. Provide concrete to the following criteria:

Unit	Measurement
Compressive Strength (f'c at 28 day)	As Indicated in Plans
Aggregate Size (maximum)	1 inch
Air Entrainment	4 to 6 percent
Slump	3 to 5 inches

D. Prepare design mixes for each type and strength of concrete by either laboratory trial mixture or field experience methods as specified in ACI 318-89 Section 5.3.

E. Mix design based on historical performances in accordance with ACI 318-89 Section 5.3, may be provided by a qualified concrete supplier or precast concrete manufacturer for concrete designs. Mix design shall be certified by an independent testing laboratory.

F. All concrete mix designs shall include the following information:
1. Proportions of cement, fine and course aggregates and water.
2. Water/cement ratio, design strength, slump and air content.
3. Type and source of cement and aggregates.
4. Type and dosage of all admixtures.
5. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.

G. Engineer to review and approve mix designs prior to start of concrete production.

H. Design mixes to provide normal weight concrete.

I. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer.

J. All mix design information and data shall not be older than 18 months from the date of the submittal.

2.7 ADMIXTURES

A. Use water reducing admixture or high range water reducing admixture (superplasticizer) in concrete as required for placement and workability.

B. Use high range water reducing admixture in pumped concrete, concrete required to be watertight, and concrete with water/cement ratio below 0.50.

C. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.

D. Use air-entraining admixture in concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete having an air content of 4% to 6% at the point of placement.

E. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

F. Temperature Limit: Do not place concrete if the concrete temperature exceeds 90ºF or the ambient temperature is 40ºF or less and falling.

G. Slump Limit: Proportion and design mixes to result in concrete slump of 3 to 5 inches at point of placement.

2.8 CONCRETE MIXING

A. Provide batch ticket for each batch used on the project. Batch ticket must indicate project name, contractor's name, date, mix type, mix time, batch time, quantity, and amount of water introduced.

B. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as specified.
1. Addition of water to batch for material with insufficient slump will be permitted in accordance with ACI 301.
2. When air temperature is between 85 degrees F. and 90 degrees F., reduce mixing and delivery time from 1-1/2 hours to 75 minutes. When air temperature exceeds 90 degrees F. reduce mixing and delivery time to 60 minutes.
3. Concrete shall only be placed when the air temperature is above 40 degrees F. and rising.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads.

B. Maintain formwork construction tolerances complying with ACI 301 Table 4.3.1.

C. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, chamfers, blocking, bulkheads, anchorages, and other features required in work.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar.

F. Chamfer exposed edges and corners as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.

3.3 VAPOR BARRIER

A. General: Following leveling and tamping of granular base for slabs-on-grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.

B. Lap joints 6 inches and seal vapor barrier joints with manufacturer's recommended mastic and pressure-sensitive tape.

C. After placement of vapor barrier, cover with sand cushion and compact to depth as shown on Drawings.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
   1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

B. Clean reinforcement of loose rust and mill scale, earth ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls, slabs, beams and between walls and footings.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

F. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

G. Contraction (Control) Joints in Slabs-On-Grade: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by 1/4 slab depth or approved inserts, unless otherwise indicated. Make saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregates.
   1. With prior approval from Engineer contraction joints may be formed by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
   2. Refer to drawings for scoring pattern as shown. If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible.

3.6 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

B. Coat contact surfaces of forms with an approved, noresidual, low-VOC, form-coating compound before reinforcement is placed. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.7 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in.

B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."

C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

E. Consolidate full depth of placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
   1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or derbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations
   3. Maintain reinforcing in proper position during concrete placement.

H. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When placing concrete in cold weather, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
   2. Concrete shall only be placed when the air temperature is above 40 degrees F. and rising.
   3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   4. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

I. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Engineer.

3.8 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched. Fins and other projections exceeding 1/4 inch in height shall be rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaced, which have received smooth form finish treatment, not later than one day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish to scheduled concrete surfaces that have received smooth form finish treatment.

1. Combine one part Portland dement to 1-1/2 parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to consistency of thick paint. Blend standard Portland cement and white Portland cement, amount determined by trial patches, so that final color of dry grout will match adjacent surfaces.
2. Thoroughly wet concrete surfaces apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture

matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

F. Unless otherwise noted on the Drawings, all exposed surfaces shall receive a smooth rubbed finish.

3.9 SLAB FINISHES

A. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (Fl) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushed, brooms, or rakes, as required.

B. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes as hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and as otherwise indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessibly to power units. Check and level surface plane to tolerances of Ff 18-Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. Being final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20-Fl 17. Grind smooth surface defects that would telegraph through applied floor covering system.

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

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

E. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.

F. After completion of float finishing and before starting trowel finish, uniformly spread 25 lbs. of dampened nonslip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

G. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose nonslip aggregate.

3.10 CONCRETE CURING AND PROTECTION

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

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.

C. Curing Methods: Perform curing of concrete by curing and sealing compound, b moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

D. Provide moisture curing by following methods.
   1. Keep concrete surface continuously wet by covering with water.
   2. Use continuous water-fog spray.
   3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

3.11 REMOVAL OF FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed until approved by the structural engineer.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.12 CONCRETE SURFACE REPAIRS

A. General: No surface shall be patched or repaired until the Engineer had reviewed the defective condition and approved the Contractor's submitted repair and/or patching materials and procedures.

B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.
   1. Cut of honeycomb, rock pockets, and voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of

less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.

2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry-pack mortar, or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

D. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.

1. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 in wide or that penetrate to reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, when acceptable to Engineer by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method when acceptable to Engineer. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2

parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

F. Perform structural repairs with prior approval of Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.13 FIELD QUALITY ASSURANCE, CONTROL AND TESTING DURING CONSTRUCTION

A. General: The Owner may employ the Engineer or another professional firm to perform quality assurance testing during construction. The Contractor will notify the Engineer at least 24 hours prior to requiring tests. The Contractor is responsible to provide equipment to allow sampling and testing of the concrete at the point of placement.

B. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94. Perform the following tests.

1. Slump: ASTM C 143; one test at point of placement for each set of compression test specimens; additional tests when concrete properties appear to have changed.
2. Air Content: ASTM C 173 (volumetric method for lightweight or normal weight concrete) or ASTM C 231 (pressure method for normal weight concrete); one test at point of placement for each set of compression test specimens; additional tests when concrete properties appear to have changed.
3. Concrete Temperature: ASTM C 1064; test hourly when air temperature is 40ºF and below or 80ºF and above, and each time a set of compression test specimens is made.
4. Compression Test Specimen: ASTM C 31; one set of 4 cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.
5. Compressive Strength Tests: ASTM C 39; one set for each 50 cubic yards or fraction thereof for each concrete class placed in any one day. One specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing, if required.
6. When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

C. Test results will be reported in writing to Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete supplier and testing agency, concrete type and class, location of concrete placed in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but **shall not** be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been

attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

F. Quality Assurance consisting of testing and observation of a limited sampling of construction materials will be provided by the Owner for acceptance purposes. Passing test results are not a warranty, guarantee, or certification by the testing agency, Engineer, or Owner that all work was performed in conformance with the plans and specifications. Therefore, the Contractor should not rely solely on test results generated by the quality assurance process as an indication of the suitability of the construction.

G. It is entirely the Contractor's responsibility to perform quality control as necessary to construct the project in conformance with the plans and specifications. Deviations from the plans and specifications, whether identified during construction or following the completion of construction, must be corrected by the Contractor at no cost to the Owner.

3.14 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 Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

SECTION 03600

GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: This Section specifies the grouting of the annular space between the host pipe and the new liner and the grouting of the space left void in the abandonment of the existing pipelines and structures. The Work consists of furnishing all labor, equipment and materials, and performing all Work connected with the placement of the cementaceous grout to fill the void.

1.2 QUALITY ASSURANCE

A. Grouting shall be performed by a crew under the direct supervision of a superintendent that has experience in grouting of this nature.

B. Storage, mixing, handling and placement shall be in accordance with manufacturer's instructions and specifications.

1.3 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. In addition, the following shall be submitted to the County for review and acceptance prior to construction.

1. A detailed description of equipment and operational procedures to accomplish the grouting operation.
2. Grout mixture design data, grout mixer type, grout samples, and test data.
3. A detailed description of the grouting time schedule.

PART 2 - PRODUCTS

2.1 GENERAL

2.2 GROUT MATERIAL

A. The grout shall be a "flowable fill" consisting of a mixture of Type 1 Portland Cement, Type "F" Flyash (ASTM 618), sand and water.

The following is a suggested trial grout mixture for a 1-cubic yard yield:

Cement:	500-pounds
Fly Ash:	500-pounds

Water: 350-pounds (42-gallons)
Sand: 2,248-pounds
Darex (W.R. Grace): 3-ounces (Air Entrainment Additive or equivalent)

The actual grout mixture to be used shall meet the minimum requirements specified below.

B. The mixture shall contain a minimum of 500-pounds cement and minimum of 400-pounds flyash per cubic yard of grout.

C. Samples of the grout mixture when set aside in a standard concrete test mold shall show less than 1% of the mixture height of free water on the surface after standing not less than 12-hours.

D. One (1) set of 3 (three) 3-inch by 6-inch sample test cubes shall be made for each mix preparation. The minimum 28-day strength shall be no less than 1,000-psi. The minimum required slump is 5-inches. The maximum allowable slump is 9-inches. Slump should be as low as practical to maintain viscosity, proper flow, and still retain the ability to pump.

2.3 EQUIPMENT

A. All grout shall be mixed with a high shear, high-energy colloidal type mixer to achieve the best uniform density.

B. The grout shall be pumped with a non-pulsating centrifugal or tri-plex pump.

C. The mixer shall be capable of continuous mixing. Batch mixing shall not be permitted.

PART 3 - EXECUTION

3.1 GROUTING OF ABANDONED PIPE

A. Where utility pipes are to remain in place (inactive) they shall be filled with a sand/cement grout as specified herein.

B. The grouting program shall consist of pumping sand-cement grout with suitable chemical additives at pressures necessary to fill the pipe sections in order to prevent the potential for future collapse.

C. Grouting of pipes shall be in sections not exceeding 300 linear feet.

D. Grout shall be placed in a maximum of 3 stages, with the initial stage volume equal to or greater than 50% of the total volume for that section of pipe being grouted. The maximum time wait between grouting stages shall be 24-hours.

E. For each stage, mix and pump the material in one continuous process so as to avoid partial setting of some grout material during that stage; thus, eliminating voids and possible subsequent surface damage due to cave-ins.

F. Each section shall be grouted by injecting grout from the lowest point and allowing it to flow toward the highest point to displace water from the annulus and assure complete void-free coverage. Grout shall be placed through tubes installed in the bulkheads at the insertion pits or manholes. Grout tubes shall be at least 2-inch nominal diameter.

G. After the ends of each section of pipe are exposed, the entire space, not to exceed 300 linear feet end to end, shall be sealed by controlled pumping of grout until it flows from the pipe at the opposite end of the grouting. Grouting shall be carried out until the entire space is filled. The ends of these sections shall be capped and/or plugged.

H. Grout pressure in the void space is not to exceed 5-psi above maximum hydrostatic groundwater level. An open ended, highpoint tap or equivalent vent must be provided and monitored at the bulkhead opposite to the bulkhead through which grout is injected. This bulkhead will be blocked closed as grout escapes to allow the pressuring of the annular space.

3.2 FIELD QUALITY CONTROL

A. The quality of the grout, application of the equipment, and installation techniques are the responsibility of the Contractor. The review and acceptance or approval of specific mix design, equipment, or installation procedures shall in no way relieve the Contractor of his obligation to provide the final product as specified herein.

B. The County may stop the grouting operations at any time if the operation does not comply with these Specifications.

END OF SECTION

SECTION 05511

ALUMINUM STAIRS AND LADDERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes aluminum stair frame of structural sections, with Open or Closed risers, open grate, integral balusters, and aluminum hand railing.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

B. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A283/283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
6. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
7. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
8. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
9. ASTM A501. - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
10. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
11. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
12. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

C. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

D. National Association of Architectural Metal Manufacturers:
   1. NAAMM AMP 510 - Metal Stairs Manual.
   2. NAAMM MBG 531 - Metal Bar Grating Manual.

E. National Ornamental & Miscellaneous Metals Association:
   1. NOMMA Guideline 1 - Joint Finishes.

F. SSPC: The Society for Protective Coatings:
   1. SSPC - Steel Structures Painting Manual.
   2. SSPC SP 1 - Solvent Cleaning.
   3. SSPC SP 10 - Near-White Blast Cleaning.
   4. SSPC Paint 15 - Steel Joist Shop Paint.
   5. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 DESIGN REQUIREMENTS

A. Fabricate stair assembly to support uniform live load of 100 lb/sq ft and concentrated load of 300 lb/sq ft with deflection of stringer or landing framing not to exceed 1/180 of span. Minimum width of steps shall be 36 inches.

B. Railing assembly, wall rails, and attachments to resist a uniform load of 75 lbs at any point in any direction without damage or permanent set. Assembly must also withstand a concentrated load of 200 lbs applied at any point in any direction. Minimum height of rail shall be 42 inches with on intermediate rail 18 inches below the top rail.

C. Fabricate stair assembly to NAAMM AMP 510, Class Industrial.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

C. Shop Drawings: Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Design Data: Submit design calculations.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM E985 - Permanent Metal Railing Systems and Rails for Buildings.

B. Perform work in accordance with NAAMM Metal Bar Grating Manual designated ANSI/NAAMM MBG 531 for Aluminum and light duty steel and Stainless-Steel Gratings, and MBG 532 for Heavy Duty Steel Gratings.

C. Finish joints in accordance with NOMMA Guideline 1.

D. Perform Work in accordance with State of Alabama Public Work's standard.

1.6 QUALIFICATIONS

A. Prepare Shop Drawings under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Alabama.

B. Welders' Certificates: Submit under provisions of Section 01300, certifying welders employed on the Work, verifying AWS qualification within previous 12 months.

1.7 PRE-INSTALLATION MEETINGS – **Not Applicable**

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 ALUMINUM STAIRS

A. Manufacturers:
1. Benko Products, Inc.
2. Lapeyre Stair.
3. The Sharon Co., Inc.
4. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Aluminum Sections: ASTM B221, Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubing.

B. Steel Sections if required: ASTM A36/A36M.

C. Steel Tubing If required: ASTM A500, Grade B

D. Plates if Required: ASTM A283/A283M.

E. Pipe if Required: ASTM A53/A53M, Grade B, Schedule 40.

F. Landing Concrete Reinforcement: Welded Wire Mesh type unfinished.

G. Bolts, Nuts, and Washers: ASTM A325 [galvanized to ASTM A153/A153M for galvanized components].

H. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.

I. Welding Materials: AWS D1.1; type required for materials being welded.

J. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic or Type II Organic, zinc rich.

K. Gratings: NAAMM MBG 531, welded type.

L. Concrete: Type specified in Section 03300.

2.3 FABRICATION

A. Fit and shop assemble components in largest practical sections, for delivery to site.

B. Fabricate components with joints tightly fitted and secured.

C. Continuously seal joined pieces 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 Welded Joints: NOMMA Guideline 1 Joint Finish.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

H. Accurately form components required for anchorage of stairs, landings, and railings to each other and to building structure.

2.4 FABRICATION - PAN STAIRS AND LANDINGS – **Not Applicable**

A. Fabricate stairs and landings with closed risers and treads of metal pan construction, ready to receive concrete.

B. Form treads and risers with minimum 11 gage sheet steel stock.

C. Secure tread pans to stringers with clip angles; bolted in place.

D. Form stringers with rolled steel channels, 12 inches deep. Weld facia plates to channels using 14gage steel sheet across channel toes.

E. Form landings with minimum 11 gage sheet stock. Reinforce underside with metal T's to attain design load requirements.

F. Form balusters with 1.5” inch diameter steel sections, welded to stringers.

2.5 FABRICATION - CHECKERED PLATE STAIRS AND LANDINGS – **Not Applicable**

A. Form treads with minimum 11 gage checkered steel plate; galvanized finish. Bolt to stringer support clips. Bend nosing to 4 inch radius and return down 4 inch.

B. Form stringers with rolled steel channels, 12 inches deep; galvanized finish.

C. Form landings with minimum 11 gage checkered steel plate; galvanized finish. Reinforced underside with metal T's to attain design load requirements.

D. Form balusters with 1.5” inch diameter steel sections, welded to stringers; galvanized finish.

2.6 FABRICATION - OPEN GRATING STAIRS AND LANDINGS

A. Fabricate treads 1 inch I-Bar in accordance with NAAMM MBG 531, of welded Aluminum bars, welded to supports with mill finish.

B. Form hollow stringers with rolled Aluminum channels with mill finish.

C. Form landings in accordance with NAAMM MBG 531 Aluminum mill finish. Reinforce underside with angles to attain design load requirements.

D. Form balusters with 11/4 inch diameter sections, welded to stringers with mill finish.

2.7 FABRICATION - UNIT STAIR TOWERS – **Not Applicable**

A. Fabricate self-supporting steel stair towers with formed treads and risers; steel channel stringers; landing platforms; sectioned for transport; corner structural support members designed to support full weight of complete stair tower plus design live load; with steel railings, and balusters.

B. Fabricate stair towers to height not exceeding 40 feet for transportation purposes; designed for stacking to height of building as self-supporting structure.

2.8 SHOP FINISHING

A. Prepare surfaces to be primed in accordance with SSPC SP 2.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Do not prime surfaces in direct contact with concrete or where field welding is required.

D. Prime paint items with two coats.

E. Galvanize items to minimum 1.25 oz/sq ft zinc coating in accordance with ASTM A123/A123M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall mounted handrails.

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 or embedded in masonry with setting templates.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Install anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads. Install sufficient temporary bracing to maintain framing safe, plumb, and in alignment.

D. Field weld components indicated on shop drawings. Perform field welding in accordance with AWS D1.1.

E. Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.

G. Obtain approval of Engineer prior to site cutting or creating adjustments not scheduled.

H. After erection, prime welds, abrasions, and surfaces not galvanized, except surfaces to be in contact with concrete.

3.4 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

3.5 SCHEDULES

A. Stairs A and B: Pan stairs and landings, plastic handrail cover, primed finish.

B. Stair C: Checkered plate stairs and landings, galvanized finish. Pipe handrails specified in Section 05520.

END OF SECTION

SECTION 05520

HANDRAILS AND RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes steel and aluminum pipe railings, balusters, and fittings; and handrails.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
   1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   4. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
   5. ASTM B177 - Standard Guide for Chromium Electroplating on Steel for Engineering Use.
   6. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
   7. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   8. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
   9. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
   10. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

11. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

C. National Ornamental & Miscellaneous Metals Association:
1. NOMMA Guideline 1 - Joint Finishes.

D. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 15 - Steel Joist Shop Paint.
3. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 DESIGN REQUIREMENTS

A. Component handrail system shall be designed and constructed in strict compliance with the requirements of OSHA and the Standard Building Code.

B. Handrails shall be designed to withstand a uniform horizontal load of 50 pounds per foot with a simultaneous vertical load of 100 pounds per foot applied to the top rail.

C. In addition, handrails shall be designed to withstand a concentrated load of 200 pounds applied in any direction, at any point on the railing system.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Samples: Submit one, 12 inch long samples of handrail. Submit one sample, of elbow Tee, escutcheon and end stop.

1.5 QUALITY ASSURANCE

A. Finish joints in accordance with NOMMA Guideline 1.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Field fabrication of the railing system is not permitted.

PART 2 PRODUCTS

2.1 HANDRAILS AND RAILINGS

A. Manufacturers:
1. Thompson Fabricating, Birmingham, AL.
2. Hollaender Manufacturing Co., Cincinnati, OH.
3. Superior Aluminum Products, Inc., Russia, OH.

4. Substitutions: Section 01600 - Product Requirements.

2.2 ALUMINUM RAILING SYSTEM COMPONENTS

A. Rails and Posts: 1-1/2 inch diameter, schedule 40 aluminum pipe, alloy 6063-T6 or 6105-T5, ASTM B-429 or B-221. Post spacing shall be a maximum of 6’-0” on center.

B. Handrails shall be made of pipe and fittings mechanically fastened together with stainless steel hardware. Handrail systems which use fittings that are glued or pop-riveted will not be acceptable.

C. Toeboard, where shown or called out on the Drawings, shall conform to OSHA standards. Toeboard shall be a minimum of 4” high and shall attach to the post using clamps which will allow for expansion and contraction between posts. Toeboard shall be set 1/4" above the walking surface.

D. Openings in the railing shall be guarded by a self closing gate (OSHA 1910.23). Safety chains are not acceptable.

E. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

F. All handrail and components shall be clear anodized per Aluminum Association M10C22A41 (215-R1). The pipe shall be plastic qrapped to protect the finish.

G. All aluminum surfaces in contact with concrete, grout or dissimilar metals shall be protected with a coat of bituminous paint, mylar isolators or other approved material.

2.3 STEEL RAILING SYSTEM COMPONENTS

A. Pipe: ASTM A53/A53M, Grade B, carbon steel, Schedule 40.

B. Rails and Posts: 1.38 inch inside diameter steel pipe; welded or mechanical joints.

C. Fittings: Elbows, T-shapes, wall brackets, escutcheons; fabricated steel.

D. Mounting: Adjustable brackets and flanges, with steel inserts for casting in concrete or embedding in masonry.

E. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

F. Splice Connectors: Steel concealed spigots.

G. Galvanizing: To ASTM A123/A123M, minimum 2.0 oz/sq ft galvanized coating.
1. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic zinc rich.

H. Shop Prefinishing: Powder coated enamel. Color as selected by Owner.

2.4 FABRICATION

A. Fit and shop assemble components in largest practical sizes for delivery to site.

B. Fabricate components with joints tightly fitted and secured. Furnish spigots and sleeves to accommodate site assembly and installation.

C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

E. Drill condensate drainage holes at bottom of members at locations not encouraging water intrusion.

F. 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.

G. Accurately form components to each other and to related structure.

H. Accommodate for expansion and contraction of members and building movement without damage to connections or members.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall mounted handrails.

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, embedded in masonry or placed in partitions with setting templates, to appropriate sections.

3.3 INSTALLATION

A. Install components plumb within 1/8” of vertical and align horizontally to within 1/8” in 12 feet.

B. Anchor railings to structure with anchors. Install wedge anchors to proper depth to develop full pullout and shear values. Check all fasteners and bolts in base connections and splices for tightness.

C. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

D. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Assemble with spigots and sleeves to accommodate tight joints and secure installation.

F. Adequate provisions for expansion and contraction shall be incorporated into the rail.

G. Toeboards shall be shipped loose and attached to the handrail in the field. Attachment to the posts will be made with clamps which will allow for movement while maintaining a straight line.

H. All defective, damaged or otherwise improperly installed handrail shall be removed and replaced with material which complies with this section at no additional cost to the Owner.

I. Following installation, aluminum handrail shall be cleaned with mild soap and clean water. Acid solutions, steel wool or harsh abrasives shall not be used.

J. Following installation, steel handrails shall be painted unless galvanized.

END OF SECTION

SECTION 05530

GRATINGS AND PLATES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes formed floor, mezzanine, or stair tread gratings; flat surface floor plating; and perimeter closure.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   4. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   5. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   6. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
   7. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. American Welding Society:
   1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
   2. AWS D1.1 - Structural Welding Code - Steel.
   3. AWS D1.2 - Structural Welding Code - Aluminum.

C. National Association of Architectural Metal Manufacturers:
   1. NAAMM MBG 531 - Metal Bar Grating Manual.
   2. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual.

D. SSPC: The Society for Protective Coatings:
   1. SSPC - Steel Structures Painting Manual.
   2. SSPC SP 1 - Solvent Cleaning.
   3. SSPC SP 10 - Near-White Blast Cleaning.
   4. SSPC Paint 15 - Steel Joist Shop Paint.
   5. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 PERFORMANCE REQUIREMENTS

A. Design Live (Pedestrian) Load: Uniform load of 200 lb/sq ft minimum with a maximum deflection of 1/4".

B. Maximum Spacing Between Bearing Bars: 1-3/16 inches on center.

C. Maximum Spacing Between Cross Bars: 4" on center.

D. Maximum fiber stress shall not exceed that which is allowed by the Aluminum Association.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawings: Indicate details of gratings, plates, component supports, anchorage, openings, perimeter construction details, and tolerances. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Product Data: Submit span and deflection tables.

D. Samples: Submit one sample, 6 inch x 6 inch in size illustrating surface finish, color, and texture.

E. Manufacturer's Installation Instructions: Submit special requirements.

1.5 QUALIFICATIONS

A. Design gratings and plates under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Alabama.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate Work with placement of frames and tolerances for openings.

PART 2 PRODUCTS

2.1 GRATINGS AND FLOOR PLATES

A. Manufacturers:
   1. Thompson Fabricating Company.
   2. Ohio Gratings, Inc.
   3. Marco Specialty Steel, Inc.
   4. Substitutions: Section 01600 - Product Requirements.

2.2 COMPONENTS

A. Aluminum I-Bar Grating: ASTM B221 extruded aluminum alloy 6063-T6.

B. Aluminum stair treads shall be I-bar grating with an extruded aluminum corrugated nosing.

C. Cross Bars: ASTM B211.

D. Floor Plates: Aluminum checkered floor plates shall be 1/4" thick and shall be alloy 6061-T6 or 5086-H112.

E. Clips: 4 required per panel. Clips shall not protrude above the top of the grating.

F. Welding Materials: AWS D1.1, AWS D1.2, type required for materials being welded.

2.3 ACCESSORIES

A. Fasteners and Saddle Clips: Aluminum.

B. Perimeter Closure: Same material as grating.

C. Edge Banding: required at termination edges and at intermediate panel edges.

2.4 FABRICATION

A. Fabricate grates and plates to accommodate design loads and to sizes indicated.

B. Mechanically clinch joints of intersecting metal sections.

C. Fabricate support framing for all openings.

D. Top Surface of Grating: Serrated.

E. Top Surface of Plates: Checkered.

2.5 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Paint all aluminum surfaces in contact with concrete or dissimilar metals with a shop coat of bituminous paint.

D. Aluminum: Mill finish.

E. Stainless Steel: No. 4 finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify opening sizes and dimensional tolerances are acceptable.

C. Verify supports and anchors are correctly positioned.

3.2 INSTALLATION

A. Place frames in correct position, plumb and level.

B. Mechanically cut finish surfaces. Do not flame cut.

C. Anchor by bolting through saddle clips or flange blocks.

D. Set perimeter closure flush with top of grating and surrounding construction.

E. Secure to prevent movement.

F. Aluminum shelf angles shall be anchored to the concrete using stainless steel (type 18-8) wedge anchors.

3.3 ERECTION TOLERANCES

A. Maximum Space Between Adjacent Sections: 1/4 inch.

B. Maximum Variation from Top Surface Plane of Adjacent Sections: 1/16 inch.

3.4 CLEANING

A. Clean welds and damaged coatings and apply one coat of touch-up primer.

END OF SECTION

SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of paints, and other coatings.

B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Paintings and Coatings:
1. Basis of Measurement: Lump Sum
2. Basis of Measurement: Includes all labor, equipment and materials associated with the painting as designated in the Drawings including, cleaning, prepping, priming, painting, coordination of color selections with the Owner and Engineer, touchup, cleanup, and all related appurtenances.

1.3 REFERENCES

A. ASTM International:
1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.

B. Painting and Decorating Contractors of America:
1. PDCA - Architectural Painting Specification Manual.

C. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Samples:
1. Submit one paper chip samples, 2" x 2" inch in size illustrating range of colors and textures available for each surface finishing product scheduled.

C. Manufacturer's Installation Instructions: Submit special surface preparation procedures, substrate conditions requiring special attention, and special curing requirements.

1.6 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing work of this section with minimum three years documented experience and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Deliver products to site in original manufacturer’s sealed and labeled containers; inspect to verify acceptability.

C. Container Label: 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. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

1.10 WARRANTY

A. Section 01700 - Execution Requirements.

B. Furnish two (2) year manufacturer warranty for paints and coatings.

1.11 EXTRA MATERIALS

A. Section 01700 - Execution Requirements.

B. Supply [1] one gallon of each color, type, and surface texture; store where directed.

C. Label each container with color, type, and texture in addition to manufacturer's label.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

A. Manufacturers:
1. TNEMEC Company, Inc.
2. Substitutions: Section 01600 - Product Requirements

B. Substitutions:
1. Substitutions: Section 01600 - Product Requirements
2. Substitutions which decrease the film thickness, the number of coats applied, change the generic type of coating, or fail to meet the performance criteria of the specified materials will not be approved. Prime and finish coats of all surfaces shall be furnished be the same manufacturer.

C. Materials supplied by other manufacturers may be considered for substitution if the following prevailing conditions exist:
1. Performance criteria of the specified materials are exceeded by the submitted alternate materials as listed in paragraph 2.01 and detailed on the technical data sheets of each specified product.
2. The submittal must compare the performance criteria of the specified material with that of the substituted material and be documented in a side by side manner for the Engineer to review.
3. Substitute materials must be for complete systems and not individual products combined with the specified materials and the performance criteria for all products within a system must meet or exceed the specified materials.
4. Only one alternate submittal will be received for this specification and must be accompanied by a detailed statement of the sum to be added or deducted from the base bid should alternate materials be accepted.

2.2 COMPONENTS

A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
2. For good flow and brushing properties.
3. 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 finishes specified; commercial quality.

C. Patching Materials: Latex filler.

D. All coatings utilized shall be certified “non-lead” as defined in Part 1303 of the Consumer Product Safety Act B. All interior and exterior paint colors shall be certified to be lead free.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive Work as instructed by product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

C. Test shop applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.

C. Marks: Seal with shellac those which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of [tetra-sodium] [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. Apply etching primer immediately following cleaning.

F. Asphalt, Creosote, or Bituminous Coated Surfaces Scheduled for Paint Finish shall not be allowed. Such materials shall be delivered to the project site bare or shall be primed with the appropriate primer.

G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

H. Concrete Floors: Remove contaminations, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Copper Surfaces Scheduled for Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Mechanically scarify to provide a uniform anchor profile of at least 1.0 mil.

J. Copper Surfaces Scheduled for 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.

K. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

L. Galvanized Surfaces: Remove surface contamination and oils in accordance with SSPC-SP 1 Solvent Cleaning. Mechanically abrade surfaces to be coated to provide a uniform anchor profile of at least 1.0 mil. Galvanized surfaces to be coated that will be placed in immersion service shall be abrasive blat cleaned to remove all contaminants and to provide a uniform anchor profile of at least 1.0 mil (reference SSPC-SP 13/ICRI CSP 1-2).

M. 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 solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

N. 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.

O. Uncoated Steel and Iron Surfaces: Remove grease, and other contaminants in accordance with SSPC-SP 1 Solvent Cleaning. All surfaces shall be abrasive blast cleaned in accordance with SSPC-SP 10 Near White Blast Cleaning. All surfaces shall be primed within eight hours of surface preparation and prior to the formation of any corrosion by-products.

P. Shop Primed Steel Surfaces (Immersion Service): Remove all oil, grease and other contaminants by cleaning in accordance with SSPC-SP 1 Solvent Cleaning. All area abraded to bare metal, or where corrosion is present, shall be cleaned in accordance with SSPC-SP 10 Near White Blast Cleaning. All edges shall be feathered. The remaining intact primer shall be cleaned in accordance with SSPC-SP 7u Brush-Off Blat Cleaning to provide a suitable uniform anchor profile. All surfaces shall be clean and dry.

Q. Shop Primed Steel Surfaces (Non-Immersion Service): Remove all oil, grease and other contaminants by cleaning in accordance with SSPC-SP 1 Solvent Cleaning. All area abraded to bare metal, or where corrosion is present, shall be cleaned in accordance with SSPC-SP 6 Commercial Blast Cleaning or SSPC-SP 11 Power Tool Cleaning to Bare Metal. All edges shall be feathered. All surfaces shall be clean and dry.

R. Previously Painted Steel Surfaces: Remove all oil, grease and other contaminants by cleaning in accordance with SSPC-SP 1 Solvent Cleaning. Clean all surfaces of loose paint, loose rust, as well as any other foreign matter in accordance with SSPC WJ4 “Light Cleaning”. All areas of corrosion shall be cleaned in accordance with SSPC-SP 11 Power Tool Cleaning to Bare Metal. All edges shall be feathered.

S. Interior Wood Items Scheduled to Receive Paint 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.

T. 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.

U. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.

V. 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 caulking compound after sealer has been applied.

W. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

X. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with clear sealer.

Y. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.3 EXISTING WORK

A. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified. Confirm existing paint conditions and generic type prior to starting surface preparation and paint application of existing coatings.

3.4 APPLICATION

A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

C. Sand wood surfaces lightly between coats to achieve required finish.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

F. Prime concealed surfaces of interior and exterior woodwork with primer paint.

G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.

H. Finishing Mechanical and Electrical Equipment:

1. Refer to Section 15075 and Section 16075 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit. See color schedule at the end of this Section.
2. Paint shop primed equipment.
3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
5. Paint exposed conduit and electrical equipment occurring in finished areas.
6. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
7. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, and names.
8. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 FIELD QUALITY CONTROL

A. After application of each coating in the specified system and its surface has cured, measure its thickness with a properly calibrated Nordson Microtest Dry Film Thickness Gauge, or equivalent. Follow standard method for measurement of dry paint thickness with magnetic gauges as outlined in Steel Structures Painting Council's SSPC-PA2

B. Make as many determinations as needed to ensure the specified thickness values in each typical area. To all surfaces having less dry film thickness than specified, apply additional coat(s) at no extra cost to Owner to bring thickness up to specifications.

C. Structural metals in immersion service that receive a protective coating system shall be checked with a non-destructive holiday detector that shall not exceed 67 1/2 volts. All pinholes or defects shall be repaired in accordance with manufacturer's printed recommendations and then retested.

D. Masonry, drywall, or other non-metallic surfaces shall be continuously checked with wet-film thickness gauges during application to ensure proper dry film thickness will be attained. Also, square feet coverage needs to be monitored to verify proper coverage rates.

E Painting contractor shall permit Owner's Representative and/or paint & coating manufacturer (as requested by owner) to observe his work for conformance to this specification. Owner reserves the right to reject all work that does not comply with this specification.

3.6 CLEANING

A. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.7 SCHEDULE

A. Steel - Structural, Tanks, Pipes and Equipment

1. Exterior, Non-Immersion
   Surface Preparation: SSPC-SP6 Commercial Blast Cleaning.
   Shop Primer: 91 H20 Hydro-Zinc at 2.5 – 3.5 mils DFT.
   Field Touch-Up: 91 H20 Hydro-Zinc at 2.5 – 3.5 mils DFT.
   1st Coat: 66-1255 Hi-Build Epoxoline at 4.0 - 6.0 mils DFT.
   2nd Coat: 1094 Endura-Shield at 2.0 - 3.0 mils DFT.
2. Immersion, Potable Water
   Surface Preparation: SSPC-SP10 Near-White Blast Cleaning.
   Shop Primer: 91 H20 Hydro-Zinc at 2.5 – 3.5 mils DFT.
   1st Coat: 20-1255 Pota-Pox at 4.0 - 6.0 mils DFT.
   2nd Coat: 141 Epoxoline at 10.0 – 12.0 mils DFT.
3. Immersion, Non-Potable Water
   Surface Preparation: SSPC-SP10 Near-White Blast Cleaning.
   Shop Primer: 1Omnithane at 2.5 – 3.5 mils DFT.
   1st Coat: 20-1255 Pota-Pox at 4.0 - 6.0 mils DFT.
   2nd Coat: 142 Epoxoline at 10.0 - 12.0 mils DFT.
4. Vapor Phase and Liquid Fluctuation Level, Non-Potable water with high levels of Hydrogen Sulfide.
   Surface Preparation: SSPC-SP10 Near-White Blast Cleaning.
   1st Coat: N140 Pota-Pox Plus at 4.0 – 6,.0 mils DFT.
   2nd Coat: 435 Perma-Glaze at 20.0 – 30.0 mils DFT.
5. Interior, Non-Immersion
   Surface Preparation: SSPC-SP6 Commercial Blast Cleaning.
   Shop Primer: 1 Omnithane at 2.5 – 3.5 mils DFT.
   1st Coat: 66-1255 Hi-Build Epoxoline at 4.0 - 6.0 mils DFT.
   2nd Coat: 1094 Endura-Shield at 2.0 – 3.0 mils DFT.
6. Interior and Exterior, non-Immersion, Previously Painted
   Surface Preparation: SSPC WJ4. SSPC-SP 11 corroded areas. Feather edges.
   Spot Primer: 135 Chembuild at 3.0 – 5.0 mils DFT.
   Full Primer: 135 Chembuild at 2.0 -3.0 mils DFT.
   Finish: 1094 Endura-Shield at 2.0 – 3.0 mils DFT.
7. Metal Anchorage for Buried Piping
   Surface Preparation: Shop Primed Materials - Clean and Dry or SSPC-SP3 Power Tool Clean.
   1st Coat: 46-465 H.B. Tnemecol at 8.0 -12.0 mils DFT.
8. Miscellaneous Castings, Including Manhole Rings and Covers
   Surface Preparation: SSPC-SP6 Commercial Blast Cleaning.
   1st Coat: 46H-413 Hi-Build Tneme-Tar at 12.0 - 16.0 mils DFT.
9. Factory Primed
   Surface Preparation: Surface shall be clean and dry.
   Shop Primer: 1 Omnithane at 2.5 – 3.5 mils DFT.
   Intermediate Coat: 1 Omnithane at 2.5 – 3.5 mils DFT.
   Finish Coat: See topcoat for exposure. System 3.04 A 1, 2, 4 or 6.

B. Steel Pipe

1. Exterior of Pipe, Non-Immersion
   Surface Preparation: SSPC-SP 6 Commercial Blast Cleaning.

Shop Primer: 91 H20 Hydro-Zinc at 2.5 – 3.5 mils DFT.
1st Coat: 66-1255 Hi-Build Epoxoline II at 4.0 - 6.0 mils DFT
2nd Coat: 1094 Endura-Shield at 2.0 -3.0 mils DFT.

2. Immersion, Non-Potable Water
Surface Preparation: SSPC-SP10 Near-White Blast Cleaning.
Shop Primer: 1 Omnithane at 2.5 – 3.5 mils DFT.
1st Coat: 20 Pota-Pox at 4.0 - 6.0 mils DFT.
2nd Coat: 142 Epoxoline at 10.0 - 12.0 mils DFT.

3. Immersion, Potable Water
Surface Preparation: SSPC-SP10 Near-White Blast Cleaning.
Shop Primer: 91 H20 Hydro-Zinc at 2.5 – 3.5 mils DFT.
1st Coat: 20 Pota-Pox at 4.0 - 6.0 mils DFT.
2nd Coat: 141 Epoxoline at 10.0 - 12.0 mils DFT.

C. Ductile or Cast Iron: Pipe and Miscellaneous Fabrications

1. Interior – Frequently Sweating Pipe
Surface Preparation: Surfaces shall be clean and dry. Abrasive blast in accordance with NAPF 500-03.
Shop Primer: N140 Pota-Pox Plus at 4.0 – 6.0 mils DFT
Full Field Primer: 20 Pota-Pox at 2.0 – 3.0 mils DFT.
Insulation Coating: 971 Aerolon at 100 mils DFT.
Finish: 1094 Endura-Shield at 2.0- - 3.0 mils DFT

2. Interior – Previously Painted - Frequently Sweating Pipe
Surface Preparation: SSPC WJ 4. All failing paint and corroded areas shall be cleaned in accordance with SSPC-SP 11 Power Tool Cleaning to Bare Metal. Surfaces shall be clean and dry.
Spot Primer: 135 Chembuild at 4.0 – 6.0 mils DFT
Full Primer: 135 Chembuild at 4.0 – 6.0 mils DFT.
Insulation Coating: 971 Aerolon at 100 mils DFT.
Finish: 1094 Endura-Shield at 2.0- - 3.0 mils DFT

3. Interior – Previously Painted – Dry Conditions
Surface Preparation: SSPC WJ 4. All failing paint and corroded areas shall be cleaned in accordance with SSPC-SP 11 Power Tool Cleaning to Bare Metal. Surfaces shall be clean and dry.
Spot Primer: 135 Chembuild at 4.0 – 6.0 mils DFT
Full Primer: 135 Chembuild at 4.0 – 6.0 mils DFT.
Finish: 1094 Endura-Shield at 2.0- - 3.0 mils DFT

4. Exterior and Interior: Non-Immersion
Surface Preparation: Surface shall be clean and dry. Abrasive blast in accordance with NAPF 500-03.
Shop Primer: N140 Pota-Pox Plus at 4.0 -6.0 mils DFT.
1st Coat: 66-Color Hi-Build Epoxoline at 4.0 - 6.0 mils DFT.
2nd Coat: 1094 Endura Shield at 2.0 – 3.0 - mils DFT.

5. Immersion, Potable Water
Surface Preparation: Surface shall be clean and dry. Abrasive blast in accordance with NAPF 500-03.
Shop Primer: N140 Pota-Pox Plus at 4.0 - 6.0 mils DFT.
Full Field Primer: 20 Pota-Pox at 4.0 – 6.0 mils DFT
Finish: 141 Epoxoline at 10.0 - 12.0 mils DFT.

6. Immersion, Non-Potable Water

Surface Preparation: Surface shall be clean and dry. Abrasive blast in accordance with NAPF 500-03.
Shop Primer: N140 Pota-Pox Plus at 4.0 - 6.0 mils DFT.
Full Field Primer: 20 Pota-Pox at 4.0 – 6.0 mils DFT
Finish: 142 Epoxoline at 10.0 - 12.0 mils DFT.

D. Chain Link Fences
1. Surface Preparation: Surfaces shall be clean and dry.
One Coat: 530 Omnithane 2.0 - 3.0 mils DFT.

E. Concrete, Dense Masonry
1. Exterior, Non-Immersion
Surface Preparation: Surface shall be clean and dry.
Two Coats: 156 Enviro-Crete at 6.0 - 8.0 mils DFT per coat.
2. Immersion – Potable Water and Non-Potable Water
Surface Preparation: Abrasive blast to remove curing compounds, hardeners, laitance, and to provide a suitable profile (reference SSPC-SP 13/ICRI CSP 5)
Surfacer: 218 Mortar-Clad at 1/8" minimum to all surfaces.
1st Coat: 20 Pota-Pox at 4.0 - 6.0 mils DFT.
2nd Coat: 22 Epoxoline at 20.0 – 30.0 mils DFT.
3. Interior, exposed to high levels of Hydrogen Sulfide and Sulfuric Acid Condensate.
Surface Preparation: Abrasive blast to remove curing compounds, hardeners, laitance, and to provide a suitable profile (reference SSPC-SP 13/ICRI CSP 5)
Surfacer: 218 Mortar-Clad at 1/8" minimum to all surfaces
1st Coat: 434 Perma-Shield H2S at 125 mils DFT.
2nd Coat: 435 Perma-Glaze at 15.0 mils DFT.
4. Fluoride Room, Floor & Walls
Surface Preparation: Abrasive blast to remove curing compounds, hardeners, laitance, and to provide a suitable profile (reference SSPC-SP 13/ICRI CSP 5)
Surfacer: 218 Mortar-Clad at 1/8" minimum to all surfaces
1st Coat: 120-5002 Vinester(*) at 12.0 - 18.0 mils DFT.
2nd Coat: 120-5001 Vinester at 12.0 -18.0 mils DFT.
Use 120-5003 Vinester Filler and Surfacer to fill bug holes and voids flush.
5. Chemical Storage, Containment Areas (Floor, Trench, Tank Pad, and 3'6" Band on Walls).
Surface Preparation: Abrasive blast to remove curing compounds, hardeners, laitance, and to provide a suitable profile (reference SSPC-SP 13/ICRI CSP 5)
Surfacer: 218 Mortar-Clad at 1/8" minimum to all surfaces
Base Coat: 239SC Chembloc @ 60 – 80 mils DFT. While still wet embed 211-215 Fiberglass Mat. Rib roll.
Saturant: 239 SC Chembloc at 8.0 – 12.0 mils DFT
Finish: 282 Tneme-Glaze @ 8.0 – 12.0 mils DFT.
2nd Coat: 275-Color Stranlok at 25.0 - 40.0 mils DFT.
3rd Coat: 282-Color Tneme-Glaze at 6.0 - 8.0 mils DFT.
6. Immersion or Non-Immersion, Dense Masonry – Clearwell, wetwells and secondary containment
Surface Preparation: Pressure Blast to achieve an open Capillary substrate.
1st Coat: Apply XYPEX Concentrate at 1.5 pounds per square yard.
2nd Coat: Apply XYPEX Mega-Mix I at ¼".
7. Interior, pipe gallery walls - Clear:

Surface Preparation: Rub seams and irregular areas
1st Coat: Chemprobe Series 660 Prima-A-Pell 200.
2nd Coat: Chemprobe Series 660 Prima-A-Pell 200.

F. Porous Masonry (CMU)

1. Exterior

Surface Preparation: Surface shall be clean and dry. Stone rub to remove loose and small particles from surface.
Filler: 130 Envirofill at 60 – 80 square feet per gallon
1st Coat: 156 Enviro-Crete at 6.0 - 8.0 mils DFT.
2nd Coat: 156 Enviro-Crete at 6.0 - 8.0 mils DFT

2. Interior

Surface Preparation: Surface shall be clean and dry. Stone rub to remove loose and small particles from surface.
Filler: 130 Envirofill at 60 – 80 square feet per gallon
1st Coat: 113 Tneme-Tufcoat at 4.0 – 6.0 mils DFT
2nd Coat: 297 Enviro-Glaze at 2.0 -3.0 mils DFT.

3. Exterior: Clear Sealer and/or Stain

Surface Preparation: Surface to be sound, dry and free of cracks, oils efflorescence, paint or other contaminates.
Sealer Coat: Apply TNEMEC Prima-Pell H_20 at 125 to 150 Sq. ft./gal
Stain Option: Apply Conformal Stain in accordance with manufacturers written application instructions at 75 to 125 sq.ft/gallon.

G. Concrete Floors

1. Interior

a. Pipe Gallery, Mechanical Rooms

Surface Preparation: See Product Data Sheet
2 coats: 629 CT Densifyer 201 at 300 to 350 sq. ft. per gallon.

b. Decorative - Lab area, Shower and Bathroom areas

Surface Preparation: Mechanically abrade to remove curing compounds, hardeners, laitance, and to provide a suitable profile (reference SSPC-SP 13/ICRI CSP 5)
1st Coat: 241 Ultra-Tread MVT at 1/8". Broadcast to refusal with Chromaquartz aggregate. Allow to cure and remove excess.
2nd Coat: 222 Deco-Tread at 20 mils DFT. Broadcast to refusal with Chromaquartz aggregate. Allow to cure and remove excess.
Grout Coat: 257 Excellathane at 8.0 – 12.0 mils DFT.
Finish: 248 Everthane at 2.0 – 3.0 mils DFT].

H. Concrete Structures.

1. Below Grade

Surface Preparation: Brush-off Blast.
One Coat: 46H-413 Hi-Build Tneme-Tar at 12.0 - 16.0 mils DFT.

I. Plaster and Wallboard

1. Interior

Surface Preparation: Surface shall be clean and dry.
Primer: 151 Elasto-Grip at 1.0 mil DFT

Finish: Two coats of 113-Color H.B. Tneme-Tufcoat at 4.0 - 6.0 mils DFT per coat.

J. Wood

1. Interior or Exterior

Surface Preparation: Surface shall be clean and dry. Sand smooth. Fill imperfections with suitable filler.
Primer: 10-99W Tnemec Primer at 2.0 – 3.o mils DFT
1st Coat: 1029 Enduratone at 2.0 - 3.0 mils DFT.
2nd Coat: 1029 Enduratone at 2.0 - 3.0 mils DFT.

K. Insulated Pipe

1. Interior

Surface Preparation: Surface shall be clean and dry
1st Coat: 1026 Enduratone at 2.0 - 3.0 mils DFT.
2nd Coat: 1026 Enduratone l at 2.0 - 3.0 mils DFT.

L. PVC Pipe

1. Interior

Surface Preparation: Surface shall be lightly sanded and be clean and dry.
Primer: 66 Build Epoxoline at 2.0 - 3.0 mils DFT.
Finish: 1094 Endura-Shield at 2.0 – 3.0 mils DFT.

M. Non-Ferrous Metals

1. Interior

Surface Preparation: SSPC-SP1 Solvent Cleaning. Mechanically abrade to produce a uniform 1.0 mil anchor profile.
Primer: 66-Color Hi-Build Epoxoline at 2.0 - 3.0 mils DFT.
Finish: 1094 Endura-Shield at 2.0 – 3.0 mils DFT

2. Exterior

Surface Preparation: SSPC-SP1 Solvent Cleaning. Mechanically abrade to produce a uniform 1.0 mil anchor profile.
Primer: 66-Color Hi-Build Epoxoline at 2.0 - 3.0 mils DFT.
Finish: 1094 Endura-Shield at 2.0 – 3.0 mils DFT

N. Brick

1. Exterior Sealer

Surface Preparation: Surface to be sound, dry and free of cracks, oils, efflorescence, paint or other contaminates.
Sealer Coat.: Apply TNEMEC Prima-Pell H_20 at 125 to 150 Sq. ft./gal

3.8 COLOR CODE FOR PROCESSING EQUIPMENT

A. Prior to beginning work verify colors for new equipment with Owner.

	GENERIC COLOR	COLOR IDENTIFICATION
WATER		
Raw Water	olive green	110GN Clover
Settled or Clarified Water	aqua	GB36 Aqua Sky
Finished or Potable Water	Dark Blue	11SF Safety Blue
WASTEWATER		
Sewage Plant Effluent	day*	07RD Terra Cotta
Backwash Waste	light brown	68BR Twine
Sludge	dark brown	84BR Weathered Bark
Sewer (Sanitary or Other)	dark gray	GR28 Fossil
CHEMICAL		
Alum or Primary Coagulant	orange	04SF Safety Orange
Ammonia	white	11WH White
Carbon Slurry	black	35GR Black
Caustic	yellow with green band	02SF Safety Yellow with 09SF Safety Green
Chlorine (Gas and Solution)	yellow	02SF Safety Yellow
Fluoride	light blue with red band	25BL Fountain blue with 06SF Safety Red
Lime Slurry	light green	PA30 Daiquiri Ice
Ozone	yellow with orange band	02SF Safety Yellow with 04SF Safety Orange
Phosphate Compounds	light green with red band	PA30 Daiquiri Ice with 06SF Safety Red
Polymers or Coagulant Aids	orange with green band	04SF Safety Orange with 09SF Safety Green
Potassium Permanganate	violet	14SF Safety Purple
Soda Ash	light green with orange band	PA30 Daiquiri Ice with 04SFSafety Orange
Sulfuric Acid	yellow with red band	02SF Safety Yellow with 06SF Safety Red
Sulfur Dioxide	light green with yellow band	PA30 Daiquiri Ice with 02SF Safety Yellow

	GENERIC COLOR	COLOR IDENTIFICATION
OTHER		
Compressed Air	dark green	94GN Balsam
Gas Tile	red	28RD Monterrey
Other Lines	light gray	32GR Light Gray
Hoists/trolleys	yellow*	02SF Safety Yellow
Fire Protection	red*	06SF Safety Red

* These generic colors are not part of the Recommended Standards for Water Works.

END OF SECTION

SECTION 11050

FABRICATED SLIDE GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Slide Gates.
2. Weir Gates
3. Operators

B. Related Documents:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 GENERAL

A. Slide and weir gates, including lifts, stems, and accessories, shall be of the size and type shown on the Drawings.

B. Where possible, gates shall be installed so that there is a seating head on the gate.

C. See Schedule for gate type, lift type, frame size, type, and seating head.

1.3 SUBMITTALS

A. Shop Drawings: Indicate equipment locations, dimensions, details of attachment, anchors, and materials.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section with a minimum of five years experience.

B. Gates shall be shop inspected for proper operation before shipping.

C. Manufacturer shall be ISO 9001 certified.

1.5 WARRANTY

A. Furnish manufacturer's one year warranty for each gate including lift and actuator.

1.6 PERFORMANCE

A. Leakage Requirement:
   1. Gates shall be substantially watertight under the design head conditions.
   2. Leakage shall not exceed 0.05 gallons per minute per foot of seal periphery under the design head and 0.1 gallon per minute per foot of seal periphery for the design unseating head.

B. Design Head:
   1. Gates shall be designed to withstand the maximum design head (height of the slide).

C. Seal Test Performance:
   1. The gate's sealing system shall be tested through a cycle test in an abrasive environment indicating the leakage requirements are still met after 25,000 cycles with minimum deterioration.

PART 2 PRODUCTS

2.1 GENERAL

A. Gates shall be either self-contained or non self-contained of the rising stem configuration.

B. Manufacturers:
   1. Hydro Gate.
   2. Whipps, Inc.
   3. H. Fontaine Ltd.
   4. Substitutions: Permitted.

2.2 COMPONENTS

A. Frame:
   1. Frame Material: Aluminum.
   2. Frame shall be flat back or channel mount. Spigot-back frames are not acceptable.
   3. The frame shall be an integral unit of structural shapes, rigidly assembled to form the waterway opening
   4. The frame members shall form guides for the slide, and holes shall be provided for mounting of anchor bolts.
   5. The guide slot shall be made of ultra high molecular weight polyethylene.

B. Seal:
   1. Neoprene J-seals shall be securely fastened to the frame with formed stainless steel retainers and shall be replaceable and adjustable without removing the gate from the installed position.

C. Stem:
   1. The operating stem shall be stainless steel designed to transmit in compression at least two times the rated output of the operating manual mechanism with a 40 lb effort on the crank or handwheel.

2. Stems shall have rolled threads.
3. The stem shall be supported by angle guides or cast iron with a 2-piece cast bronze guide collar.
4. Stems shall withstand 1.25 times the stalled motor thrust of the actuator.

D. Slide:
1. The slide shall be of aluminum plate, no less than 1/4 inch thick.
2. The stem connector clips or stem block pocket shall be welded to the slide.

E. Manual Lift:
1. Gate lifts shall be handwheel or geared crank type as shown in the Schedule.
2. Lifts shall operate with a maximum pull of 40 lb on the handwheel or crank.
3. Handwheel or crank shall be located approximately 36 inches above grating or walkway.
4. Lifts shall have thrust bearings, bronze lift nuts and a bronze stop nut to limit the travel of the stem and slide.
5. All lifts shall be the rising stem type.
6. Stem covers made of clear butyrate shall be furnished for all lifts.
7. Lifts shall be grease lubricated and regreasable through grease zerks.

F. Motor Operator:
1. Motor operator shall be a 460V, 3-phase, 60 Hz motor with precision reduction gearing enclosed in weatherproof housing.
2. The operator shall be designed to raise the gate at the rate of approximately 12 inches/minute.
3. Integral controls shall include a control power transformer, reversing controller, torque switches, limit switches, space heater to prevent condensation, open-stop-closed push buttons and gate position indicator.
4. Motor reduction helical gear and pinion shall be of heat-treated alloy steel.
5. Final reduction worm shall be of alloy steel and worm gear of machined high-tensile strength bronze.
6. All gearing shall be proportioned for 100% overload conditions.
7. Operator shall have a declutch lever and handwheel for manual operation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify channel and concrete wall are ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that all parts of the slide/weir gate assembly are included.

3.2 INSTALLATION

A. Install in accordance with the manufacturers instructions.

B. Secure frame to concrete wall with stainless steel anchor bolts, level and plumb.

C. Install gate into frame without binding.

D. Attach operator and manually operate the gate through two complete open/close cycles.

E. Adjust limit switches on the electric operator, if used.

END OF SECTION

SECTION 11217

PACKAGED LIFT STATION

PART 1 GENERAL

1.1 SUMMARY

A. Description:
   1. The Contractor shall furnish, install, test and place into satisfactory operation, as shown on the Plans and specified, three (3) wet-pit, non-clog submersible pump(s) and related accessories in a new prefabricated fiberglass lift station, controls, and all appurtenances, accessories and spare parts as will be required to produce a complete and workable installation.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American National Standards Institute (ANSI) and American Water Works Association (AWWA)
   1. ANSI B16.1 - Cast iron pipe flanges and flanged fittings
   2. ANSI/AWWA C115/A21.51 - Cast/ductile iron pipe with threaded flanges
   3. ANSI 253.1 - Safety Color Code for Marking Physical Hazards
   4. ANSI B40.1 - Gauges, Pressure and Vacuum
   5. AWWA C508 - Single Swing Check Valves
   6. AWWA C504 - Plug Valves

B. American Society for Testing and Materials (ASTM)
   1. ASTM A48 - Gray Iron Castings
   2. ASTM A126 - Valves, Flanges, and Pipe Fittings
   3. ASTM A307 - Carbon Steel Bolts and Studs
   4. ASTM F593 - Stainless Steel Bolts, Hex Cap Screws, and Studs
   5. ASTM A36 - Structural Steel

C. Institute of Electrical and Electronics Engineers (IEEE)
   1. ANSI/IEEE Std. 100 - Standard Dictionary of Electrical Terms
   2. ANSI/IEEE Std. 112 - Test Procedure for Polyphase Induction Motors
   3. IEEE Std. 242 - Protection of Industrial and Control Power Systems

D. National Electric Code (NEC), National Electrical Manufacturers Association (NEMA)
   1. NEC - National Electric Code
   2. NEC 701 - National Electric Code article 701
   3. NEMA Std. MG1 - Motors and Generators

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawings:
   1. Submit detailed dimensions for materials and equipment, including wiring and control diagrams, performance charts and curves, installation and anchoring requirements, fasteners, and other details.
   2. Include manufacturer's specified displacement tolerances for vibration at operational speed specified for pumps.

C. Product Data: Submit information concerning materials of construction and fabrication.

D. Manufacturer's Installation Instructions: Submit detailed instructions on installation requirements including storage and handling procedures, anchoring, and layout.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Manufacturer's Field Reports: Certify equipment has been installed in accordance with manufacturer's instruction.

G. Other Information: Technical manuals, parts list, warranty information, equipment storage recommendations.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

C. Operation and Maintenance Data:
   1. Submit five (5) copies of operation and maintenance data in three-ring hard-backed binder, with cover indicating Owner specified station name.
   2. Submit maintenance instructions for equipment and accessories.
   3. Furnish list of equipment and tools needed to maintain and calibrate equipment.
   4. Include detailed dimensions for materials and equipment, including wiring and control diagrams, performance charts and curves, electrical motor data, installation and anchoring requirements, fasteners, recommended spare parts list, equipment start-up documentation.
   5. Motor performance chart exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. Data to include motor starting and no-load characteristics.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Owner's standard.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. The manufacturer shall have a minimum of five installations of the exact combination of pump and motor model proposed to be furnished for this project. Installations must be in operation for a minimum of five years and shall list the pump model, motor model and horsepower, date of installation, duty point, and contact information including telephone number. A list of these installations shall be furnished to the Engineer with submittals.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Inspect for damage.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces. Store and handle products in accordance with manufacturer's recommendations.

1.9 SEQUENCING

A. Section 01100 - Summary.

B. Sequence work to prevent interference with Owner's operation.

1.10 SCHEDULING

A. Section 01300 - Administrative Requirements.

B. Schedule work to install pumps in wet well prior to connecting piping work.

1.11 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate installation and start-up with Owner and Engineer.

1.12 MAINTENANCE MATERIALS

A. Section 01700 - Execution Requirements.

B. Furnish one complete rebuild kit for each pump.

C. Furnish special tools required for equipment maintenance.

PART 2 PRODUCTS

2.1 STATION WET WELL

A. Station Construction

1. Wet well shall be fabricated of fiberglass suitable for sewage catch basins. All walls shall be continuous and watertight and shall be supported by reinforcing members where required. Fabrication and erection shall conform to the appropriate requirements. Connections shall conform to the requirements of the American Plumbing Code and shall develop the full strength of the member.
2. Materials of construction used in the wet well shall be commercial grade and shall either be evaluated as a laminate by test or determined by previous service to be acceptable for the environment.
3. The resins used shall not contain fillers except as required for viscosity control. Up to five percent by weight of thixotropic agent, which will not interfere with visual inspection, may be added to the resin for viscosity control. Resins may contain pigments and dyes by agreement between the fabricator and the purchaser, recognizing that such additions may interfere with visual inspection of laminate quality.
4. The reinforcing material shall be a commercial grade of glass fiber having a coupling agent, which will provide a suitable bond between the glass reinforcing and the resin.
5. The station shall be of the laminated type construction. The laminate shall consist of an inner surface, an interior layer, and an exterior layer of laminate body.
6. The inner surface shall be free of cracks and crazing with a smooth finish and with an average of not over two pits per square foot, providing the pits are less than 1/8" in diameter and not over 1/32" deep and are covered with sufficient resin to avoid exposure of inner surface fabric. Same waviness is permissible as long as the surface is smooth and free of pits. Between 0.010 and 0.020 inches of resin-rich surface shall be provided. This will be a gel-cote surface.
7. A minimum of 0.100 inch of the laminate next to the inner surface shall be reinforced with not less than 20 percent or more than 30 percent by weight of non-continuous glass strands having fiber lengths from 0.5 to 2.0 inches.
8. The exterior layer of body of laminate shall be of construction suitable for the service intended and contain sufficient glass by weight to provide aggregate strength necessary to meet the tensile and flexural requirements. Where separate layers such as mat, cloth or woven roving are used, all layers shall be lapped a minimum of one inch. Laps shall be staggered as much as possible. If woven roving of cloth is used, a layer of chopped strand glass shall be placed as alternate layers. The exterior surface shall be relatively smooth with no exposed fibers of sharp projections. Handwork finished is acceptable, but enough resin shall be present to prevent fiber show.
9. SURFACE HARDNESS - The laminate shall have a Barcol hardness of at least 90 percent of the resin manufacturer's minimum specified hardness for the cured resin when tested. This applies to both interior and exterior surfaces.
10. APPEARANCE - The finished laminate shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, air bubbles, pin holes, pimples, and delamination

B. Anti-Floatation Flange

1. When the basin is constructed an anti-floatation flange is applied; pump-mounting studs are located in the basin bottom. Studs are stainless steel and mounted in a 1/4" steel plate. The plate is drilled and tapped 3/8" for studs to thread into. Studs are welded on the bottom of the plate. The stud plate is fastened in place and another laminate of fiberglass is molded to the bottom to complete the basin construction.

C. Wet Well Chamber

1. A wet well chamber shall be provided and shall be of the sufficient capacity to provide an efficient pumping operation. The wet well shall be equipped with access lid, air vent and bug screen, submersible pump system, inlet and outlet connections, electrical control panel and level sensors.
2. The access lid and frame assembly shall be provided in the top of the wetwell structure. The access door shall have means of locking and a latch to hold the door in the open position.
3. Air vent and bug screen shall be constructed of the configuration shown on the plant and shall be fitted with manufactured screen to prevent intrusion of insects or birds into the vent piping.
4. The structure dimensions of the wet well chamber and air vent shall be as shown on the Drawings.
5. Safety grating shall be provided with the wet well top and access cover for the safety of the operating personnel.

D. Valve Chamber

1. A valve chamber shall be provided as an integral part of the lift station. The valve chamber shall be equipped with access lid, air vent and bug screen, one (1) check valve and one (1) gate valve for each pump.
2. The access lid and frame assembly shall be provided in the top of the valve chamber structure. The access door shall have means of locking and a latch to hold the door in the open position. Air vent and bug screen shall be constructed of the configuration shown on the plans and shall be fitted with manufactured screen to prevent intrusion of insects or birds into the vent piping.
3. A valve chamber drain shall be furnished so that water can drain to the wetwell chamber. This drain shall be equipped with a check valve.
4. The structure dimensions of the valve chamber shall be as shown on the Drawings.
5. If approved by the Engineer because of piping size, weight, or other factors, the valve vault may be provided separately. Installation instructions for separately-mounted valve vaults will be provided by the fiberglass station manufacturer as a part of the required submittal data.

2.2 RAW SEWAGE PUMPS

A. Manufacturers:

1. Ebara
2. Barnes
3. KSB
4. Sulzer
5. Substitutions: Section 01600 - Product Requirements

B. General:
   1. The sewage pumping units shall be vertical, non-clogging, centrifugal sewage pumps with bottom inlet and side discharge. The pumps shall be direct driven by integral squirrel cage, electric induction motors. Each pump shall include motor, bearings, quick removal system, anchor bolts and all accessories specified herein.
   2. Pump Materials of Construction: Compatible with raw sewage.
   3. Pump and motor produced by same manufacturer.

C. Power Cable:
   1. Minimum 50 feet of submersible cable (SUBCAB) suitable for submersible pump applications, sized in accordance to NEC and ICEA standards and meeting P-MSHA approval.

D. Lifting Cable:
   1. Minimum 30 feet per pump of stainless-steel cable capable of lifting loads 5 times greater than actual pumping unit weight.

E. Pump Design:
   1. Pump designed to automatically and firmly connect to the discharge connection, guided by no less than two guide bars extending from top of station to discharge connection.
   2. Provide intermediate guide brackets for installations greater than 20 feet.
   3. Sealing of pumping unit to discharge elbow accomplished by machined metal-to-metal watertight contact.

F. Pump Construction:
   1. Major pump components shall be grey cast iron ASTM A-48, Class 35, with smooth surfaces free of blow holes or other irregularities.
   2. Exposed nuts or bolts of stainless steel construction.
   3. Factory applied spray coating of acrylic dispersion zinc phosphate primer with polyester resin paint finish on exterior pump surfaces coming into contact with sewage.
   4. Metal to metal contact sealing design on machined surfaces.
   5. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings.

G. Cooling System:
   1. Integral, closed-loop motor cooling system encircling stator housing providing for dissipation of motor heat, consisting of integral impeller driven by pump shaft.
   2. Cooling system to include one fill port and one drain port integral to the cooling jacket.
   3. Cooling system to provide continuous pump operation at liquid or ambient temperatures up to 104°F.

H. Cable Entry Seal:
   1. Dual cylindrical elastomer grommets, flanked by washers, all having close tolerance fit against cable outside diameter and entry inside diameter.
   2. Grommets compressed by cable entry unit, providing strain relief function.
   3. Cable entry junction chamber and motor sealed from each other.

I. Motor:

1. NEMA B, induction type with squirrel cage rotor, shell type design, housed in air-filled watertight chamber.
2. Stator windings insulated with moisture resistant Class F insulation rated for 180°C.
3. Stator insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in winding fill factor of no less than 95%.
4. Inverter duty rated in accordance with NEMA MGA, Part 31.
5. Stator heat shrink fitted into cast iron stator housing.
6. Motor designed for continuous duty while handling pumped media up to 104°F.
7. Motor designed to withstand no less than 15 evenly spaced starts per hour.
8. Rotor bars and short-circuit rings constructed of aluminum.
9. Three thermal switches embedded in stator end coils, one per phase winding to monitor stator temperature.
10. Junction chamber sealed from stator housing containing a terminal board for connection of power and pilot sensor cables using threaded compression type terminals.
11. Motor service factor of 1.15.
12. Motor voltage tolerance of +/- 10%.
13. Motor designed for continuous operation up to 40°C ambient temperature with NEMA Class B maximum operating temperature rise of 80°C.
14. Motor horsepower sufficient for pump to be non-overloading throughout entire performance curve, from shut-off to run-out.
15. Motor and cable capable of continuous submergence underwater without loss of watertight integrity up to and including to a depth of 65 feet.

J. Bearings:

1. Integral pump/motor shaft to rotate on two bearings.
2. Motor bearings sealed and permanently grease lubricated with high temperature grease.
3. Two row angular contact ball bearing on upper motor bearing.
4. Two row angular contact ball bearing on lower motor bearing designed to handle both thrust and radial forces.
5. Minimum L10 bearing life of 50,000 hours at any useable point on the pump curve.

K. Mechanical Seals:

1. Provide pumps with positively driven, dual, tandem mechanical shaft seal system consisting of two seal sets, each with independent spring.
2. Lower primary seal, located between pump and seal chamber, containing one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring.
3. Upper secondary seal, located between seal chamber and seal inspection chamber, containing one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring.
4. Provide pumps with lubricant chamber for shaft sealing system. Lubricant chamber designed to prevent overfilling and providing capacity for lubricant expansion. Lubricant chamber designed with one drain plug and one inspection plug accessible from exterior of motor unit.

5. Separate seal leak chamber capable of capturing leakage occurring past upper secondary mechanical seal prior to leakage entry into motor stator housing. Leakage chamber provided with float type switch that will signal if chamber reaches 50% capacity.

L. Pump/Motor Shaft:
1. Single piece unit, ASTM A479 S43100-T stainless steel.

M. Impeller:
1. ASTM A-48 Class 35 grey cast iron, dynamically balanced, non-clog design.
2. Mechanically self-cleaned automatically upon each rotation as passing across spiral groove located on volute suction.
3. Impeller leading edges hardened to Rc 45.
4. Impeller capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater.
5. Impellers shall be key driven and securely held to the shaft by a streamlined impeller washer and bolt assembly specifically designed to reduce friction in the suction eye of the impeller. The arrangement shall be such that the impeller cannot unscrew or be loosened by torque from either forward or reverse rotation.
6. The impeller shall be capable of passing a 3-inch solid non-deformable sphere through the bottom inlet and out between the two shrouds. Designs which cannot pass a sphere through the impeller or rely on deforming, cutting or chopping solid materials shall not be acceptable.

N. Volute:
1. ASTM A-48, Class 35 single piece grey cast iron, with smooth passages of sufficient size to pass any solids entering impeller.
2. Volute to have integral spiral-shaped, sharp-edged grooves cast into suction cover.
3. Internal volute bottom shall provide effective sealing between the impeller and volute. All mating surfaces requiring a watertight seal shall be machined and fitted with Buna-n O-rings. Paper gaskets are not acceptable.

O. Discharge Base Elbow:
1. ASTM A-48, Class 35 grey cast iron, ANSI class 125 pound flange, coated with coal tar epoxy.
2. The discharge base elbow shall be provided to support the full weight of the submersible pump in the installation and provide a leak proof connection in which the pump coupling mates using a conformed Buna-N seal which is held in place by the combined weight of the cantilevered pump and motor. The hydraulic pressure generated while the pump is in operation also aids the sealing.

P. Guide Rails:
1. 304 stainless steel guide rails supported by upper and intermediate brackets of 316 stainless steel shall guide each pump.
2. The guide rails shall consist of standard dimension schedule 40 piping with a 2” diameter as shown on the drawings. The guide rails shall be supported by a 316 upper guide rail bracket that will be mounted in the opening of the access cover to support and guide the pump/motor into and out of the wet well. Intermediate guide rail brackets will be provided for all installations deeper than 20 ft.

Q. Operating Characteristics:

Pumping units as specified herein include units installed at the location(s) as shown on the Drawings. The design characteristics are summarized as follows:

Primary Design Conditions:	675 GPM @ 27' TDH
Minimum Hydraulic Efficiency at Design Point:	70%
Secondary Design Conditions:	675 GPM @ 14' TDH
Minimum Hydraulic Efficiency at Design Point:	70%
Electrical Service:	460 V/ 3Ø/ 60Hz
Motor HP:	10 HP
Maximum Operating Speed:	1760 RPM
Discharge Elbow Size:	3-inch
Impeller Design:	Non-clog centrifugal

R. Pump Warranty:

1. Pump manufacturer shall warrant units supplied against defects in workmanship and materials for a period of five (5) years or 10,000 hours under normal use, operation and service. Warranty period to extend from date of start-up.

2.3 PUMP CONTROLS

A. Control panels will be provided for each pump station, designed to automatically operate pumps in response to excursions in liquid level as specified for each station. Each control panel shall be UL 508A certified, completely assembled, wired, tested and properly labeled prior to shipment. The control panel shall be supplied by the pump distributor to ensure compatibility between pumps and controls.

B. The pump controls will be housed in a NEMA 4X "UL Listed" stainless steel enclosure with an aluminum inner door. Wiring shall not have less than 600-volt insulation with a 75-degree Celsius rating. The enclosure will have a 3-point pad lockable stainless-steel latch and stainless steel hinge.

C. Refer to Specification Section 16480 ("Manufactured Control Panels") for additional control panel requirements.

1. The following pump control panels shall be provided with the pumps by the pump supplier and shall consist of the following components:
    a. Grit Wash Lift Station
        1) Voltage 460V 3-Phase
        2) Main Breaker sized by control panel manufacturer.
        3) Overload and short circuit protection for each pump.
        4) Integral 120V Control Power Transformer with primary/secondary overcurrent protection as required (see diagram on electrical plans).
        5) Circuit breakers for Control power and GFCI Outlet (mounted inside control panel).
        Pump Controls as summarized below.
    b. Existing Drain Lift Station
        1) Voltage 460V 3-Phase
        2) Main Breaker sized by control panel manufacturer.

3) Overload and short circuit protection for each pump.
4) Integral 120V Control Power Transformer with primary/secondary overcurrent protection as required (see diagram on electrical plans).
5) Circuit breakers for Control power and GFCI Outlet (mounted inside control panel).
Pump Controls as summarized below.

2. Electrical
   a. Refer to electrical plans for panel short circuit ratings and other similar electrical requirements.
   b. All breakers shall be mounted such as to be accessible from the outside of the dead front panel without requiring the operator to be exposed to live/energized parts.
   c. All circuit breakers shall be heavy duty thermal magnetic or motor circuit protectors similar and equal to SQUARE D type FAL.
3. The control panels shall consist of the following components.
   a. Hand-Off-Automatic switch for each pump.
   b. Red high level tamper resistant LED alarm light with steady and flash circuits.
   c. Thermal motor protection circuit.
   d. Solid state cross wired alternator with pump isolation switch.
   e. Circuit breaker protection capable of full panel operation with interlocked handle.
   f. Circuit breaker for each pump.
   g. Pump seal fail monitor.
   h. Pump run green LED pilot light for each pump.
   i. Full Voltage across line non reversing NEMA-rated starter/contactor for each pump.
   j. Overload reset button.
   k. Run time hour meters.
   l. Lightning arrestor installed as per the drawing.
   m. Red overload trip LED pilot light for each pump.
   n. Amber seal fail LED pilot light for each pump.
   o. 15A GFCI convenience outlet mounted on inner door.
   p. All switches and pushbutton to be oil tight NEMA 4X rated.
   q. SCADA dry contacts for:
      1) Power Loss Alarm.
      2) High Level Alarm
      3) Alarm (overload, seal failure, overtempt) for each pump.
      4) Pump running for each pump.
   r. Installation of pump monitor relays as outlined above on the inner door of the panel enclosure, with internal wiring and interconnection for pilot lights, alarm indication, etc. as required.

D. Field wiring connection points will be supplied using terminal strips with the exception of supply power. The terminals will have printed tabs using UV setting printer ink.

E. Pump control will use 4 floats. Float switches shall be Anchor Scientific Roto-Float type S with integral weights, chemical-resistant polypropylene casings, and normally-open AND normally-closed dry contacts

F. Panel control sequencing will alternate pumps on each off cycle. The alternator shall have a selector switch for pump 1, pump 2 or alternate. No pump will run with the off float in the deactivated position. When the off float is activated and the level continues to rise and activates the lead float the lead pump will start and run until the off float is deactivated. Should the level continue to rise upon activation of the lag float the second pump will start and both pumps run until the off float is deactivated. Should the level continue to rise the high-level alarm float will be activated turning on the alarm light, and close the alarm SCADA contact.

G. The control panel will contain a thermal motor temperature circuit and pump seal moisture detector. The thermal circuit will shut down the corresponding motor on winding over temperature. The seal monitor will activate the SCADA alarm contact for the associated pump upon detecting moisture in the pump motor.

H. The panel will contain a correctly sized main circuit breaker.

I. Each pump will have a correctly sized breaker, contactor and ambient compensated adjustable overload with a reset button on the inner door. Hour meters will be installed for pump run time display.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify layout and orientation of pumps, accessories, and piping connections.

3.2 INSTALLATION

A. Install pumps where indicated on Drawings and in accordance with manufacturer's instructions.

B. Provide and connect piping, power and control conduit and wiring to make system operational, ready for startup.

C. Flush piping with clean water.

3.3 FIELD QUALITY CONTROL

A. Section 01700 - Execution Requirements.

B. Pre-operational Check: Before operating system or components, make the following checks:
   1. Check pump and motor alignment.
   2. Check for proper motor rotation.
   3. Check pump and drive units for proper lubrication.

C. Start-up and Performance Testing:

1. Operate pump on clear water at design point for continuous period of two hours, under supervision of manufacturer's representative and in presence of Engineer.

D. Verify pump performance by performing time/draw down test.

E. Check pump and motor for high bearing temperature and excessive vibration in accordance with the manufacturer’s recommendations. Check for motor overload by taking ampere readings.

F. Equipment Acceptance:
1. Adjust, repair, modify or replace system components that fail to perform as specified and rerun tests. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 MANUFACTURER'S FIELD SERVICES

A. Section 01400 - Quality Requirements.

B. Furnish services of manufacturer's representative experienced in installation of products furnished under this specification for not less than one eight-hour day on-site for installation inspection and field testing, and instructing Owner's personnel in maintenance of equipment.

C. Certify that equipment has been properly installed and is ready for start-up and testing.

3.5 DEMONSTRATION

A. Section 01700 - Execution Requirements.

B. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner’s personnel.

END OF SECTION

SECTION 11220

REFRIGERATED SAMPLER

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Refrigerated wastewater samplers

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.3 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Basis of Measurement: Lump sum for each.

B. Basis of Payment: Includes all labor, materials and equipment including power cable, conduit, connection to electric, setting of unit, testing, calibration, cleanup and all related items.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Samplers to be of a single type from a single source from a single manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Teledyne Isco

B. Emerald Cost Manufacturing

C. Or Approved Equal.

2.2 FUNCTIONAL DESIGN

The automatic refrigerated wastewater sampler shall be furnished for sequential and composite sampling applications and shall be suitable for indoor or outdoor installation without the requirements for additional enclosures for weather protection. The sampler shall be capable of collecting samples from a variety of liquid sources including open channels, sewers, and stormwater conduits. The sampler will route samples to storage containers for collection and off-site analysis. The sample stream will be a direct path from sample source to sample bottle. Samples will not pass-through metering chambers or other diversions. The sampler shall be suited to collect priority pollutant or general-purpose samples in multiple bottles or a single bottle. The sampler will be line (AC) powered (115-volt 60Hz or 230-volt 50Hz).

A. Refrigerator

1. The refrigerator shall cool to a setpoint selectable from 34 to 48°F (1 to 9°C), with a setpoint stability of ± 1 °C over a 48-hour period.
2. The refrigerator shall have a 5-minute typical recovery time to return to 39°F (4°C) after the door has been opened for 1 minute in 75°F (24°C) ambient conditions.
3. The collected samples shall be stored in an enclosure capable of operating in ambient temperatures from -20° to 120°F (-29° to 49°C).
4. Built-in heaters shall prevent collected samples from freezing if the ambient air temperature drops below freezing.
5. For single bottle composite sampling only, the refrigerator can, upon program initiation, drop the temperature within the sample compartment by 2.5° C below the set temperature for the first 24 hours of operation before resuming normal operation.

B. Controller

1. The sampler's memory shall maintain the program settings, stored programs, and the results of the last two sampling sequences when the sampler is turned off or an external power interruption occurs.
2. A user-initiated diagnostics routine shall indicate the operational status of the sampler. The controller will display any error conditions detected by the diagnostic routines.
3. The current refrigeration temperature shall appear on the sampler’s display, and temperature readings shall be stored in a report.
4. The controller shall be able to automatically switch input power to a connected battery in the event of a loss of AC power.
5. Sample volumes shall be selectable between 10 and 9,990 ml in 1ml increments.
6. The sampler shall be capable of being programmed to rinse the suction line with the source liquid up to three times.
7. The sampler shall typically deliver sample volumes with an accuracy of ±10 ml or ±10%, whichever is greater, of the programmed value. The typical sample volume repeatability shall be ±5 ml or ±5%, whichever is greater, of the average of the maximum and minimum sample volume in the sample set.
8. The sampler shall collect sequential or composite samples at user-definable intervals and volumes. A delay to first sample collection shall be programmable by the real-time clock.
    a. Time Pacing

The sampler will use an internal real-time clock to provide time and date information. Uniform time-paced samples shall be collected at regular time intervals from 1 minute to 99 hours 59 minutes. Sample volumes may be equal or variable in proportion to flow.

b. Flow Pacing, DC Pulse
The sampler shall accept a 5 to 15 VDC flow proportional pulse or isolated dry contact closure, at least 25 ms in duration, from an external flow meter for flow pacing. Samples shall be equal in volume and shall be taken at variable times proportional to flow. The number of flow pulses shall be selectable, from 1 to 9,999 pulses, as the flow interval for each sample collection.

c. Flow Pacing, Analog Input
The sampler shall have a standard 4-20mA flow proportional input compatible with most flow meters without additional interfacing. Samples shall be equal in volume and shall be taken at variable times proportional to flow.

d. Flow-Weighted Volumes, DC Pulse
The sampler shall accept a 5 to 15 VDC flow proportional pulse or isolated dry contact closure, at least 25 ms in duration, from an external flow meter. Samples shall be taken at equal time intervals, and variable sample volumes shall be proportional to cumulative flow.

e. Flow-Weighted Volumes, Analog Input
The sampler shall have a standard 4-20 mA flow proportional input compatible with most flow meters without additional interfacing. Samples shall be taken at equal time intervals, and variable sample volumes shall be proportional to cumulative flow.

9. The sampler shall have 3 selectable modes of sample distribution.
   a. Samples per bottle mode: The sampler shall be capable of placing a sample volume from one or more sample events in a bottle.
   b. Bottles per sample mode: The sampler shall be capable of filling all sample bottles with a single initiation.
   c. Multiple bottle composite mode: The sampler shall be able to simultaneously create a user-selected set of bottles for depositing of multiple samples, switching bottles after a programmed period of time has elapsed, or a programmed number of samples has been collected.

10. Sampler Outputs
   a. The sampler shall have four standard digital alarm outputs capable of direct wiring to a Programmable Logic Controller (PLC) or data logger (5 volt, 100 mA).
   b. Output alarms shall include: Program started, Program completed, Pump error, Distributor jammed, 3-way valve control , Taking sample, Pumping forward, Powered up, Pumping reverse, Bottle full, and Delay before sample.
   c. The sampler shall output an event mark of 12VDC for a duration of 3 seconds, beginning at the start of forward pumping, from the flow meter connector.
   d. The sampler shall store a one-minute temperature data report retrievable by an IBM-compatible computer using a terminal emulator tool such as

Tera Term. The program shall include failsafe loading with site ID codes to prevent field errors due to multiple files.

11. Pump

a. Samples will be collected via a peristaltic pump. This pump shall produce typical line velocities of 3.0 feet per second in a 3/8 inch (0.95 cm) ID suction line at 3 feet (1 m) of head. At 25 feet (7.6 m) of head, the pump shall typically produce a line velocity of 2.2 feet (0.67 m) per second. The pump shall be capable of lifting a sample a maximum of 28 feet (8 m).

b. Before and after each sample is collected, the pump shall air-purge the suction line. Pre-purges and post-purges will be automatically controlled, and no pre-calibration adjustments are required.

c. With the opening of the pump's latch and band, all power will be removed from the sampler's pump motor, to eliminate the possibility of a pump activation injuring personnel.

d. The liquid detection system shall minimize the effects of changing head, intermittent flow in the suction line, or variable battery conditions on sample volume.

e. After initial detection of liquid, the sensor shall monitor for the presence of liquid during the sample collection sequence. In composite mode without use of a distributor arm, this feature can be used for full bottle detection during the post-purge cycle.

f. The liquid detector shall monitor for anomalies in the sample collection process. If no liquid is detected, the sampler shall be capable of retrying the sampling sequence up to three times.

g. After liquid detection, the pump revolution counter shall count actual pump revolutions to determine sample volume delivery to the storage containers. If liquid flow is interrupted during the sample collection sequence, the detector shall inhibit the pump revolution counter from incrementing until liquid flow is restored. Automatic compensations for air slugs in the sample shall be made by the delivery system. Additionally, the pump revolution counter shall monitor the total number of pump revolutions and alert the user when a pre-selected number of counts has been reached to alert the user of the need for pump tubing replacement. One pump revolution is equivalent to 12 pump counts. This indicator shall appear on the controller display screen

2.3 Equipment Description

A. Sampler

1. The top section housing the control panel, pump, distributor electronics, and power supply box shall be rated NEMA 4X, 6, and IP 67.

2. The sampler shall include long-life electronic temperature sensing devices that measure the refrigeration compartment and evaporator plate temperatures. A microprocessor will utilize this sensor to control operation of the compressor, built-in heaters, and the self-defrosting cycle of the evaporator plate.

B. Refrigerator

The shell of the refrigerator shall be constructed of rotationally molded UV-resistant polyethylene with molded-in-place thermal insulation, providing exceptional resistance to corrosion and weathering. The top of the refrigerator door shall be recessed for ease of access from above. For 24 bottle configurations, the bottle rack shall slide out for ease of sample recovery. The copper refrigeration lines, condenser coil, and evaporator plate will be powder-coated with heat-treated polyester, and then painted with a rust converter paint overcoat, for additional corrosion resistance.

1. The refrigerator's door shall have hasps capable of accepting a padlock to prevent unauthorized tampering with the sample compartment contents. A compression gasket will be used to seal the refrigerator door. The refrigerator power supply and solid-state thermostat shall be contained in an epoxy-potted enclosure housed in a discrete compartment of the sampler's molded frame. All exposed metal components used in the construction of the refrigeration system shall be either plated aluminum or stainless steel.
2. The refrigerator will use a condensing coil with forced-air cooling.
3. The compressor is rated at (1/5 Hp for 150V)(1/4 Hp for 230V).
4. The refrigeration system will contain HFC-134a refrigerant, a non-CFC refrigerant with an ozone depletion potential of zero.

C. Controller

1. The controller shall be housed in a discrete compartment of the sampler's molded frame beneath a flip cover.
2. The controller will show sampler status and program information via a 2-row, 20-column, 40 total character display. This display shall be angled for easy viewing, and backlit for easy use in all light conditions. All programming and manual control of the sampler will be entered via an 18-position keypad.
3. The controller shall not require a separate heater.
4. Pump
    a. The modular peristaltic pump shall be housed in a discrete compartment of the sampler's molded frame, beneath a latched cover. The pump casing shall be constructed of high strength Noryl plastic and designed for corrosion resistance.
    b. The pump shall include a latched housing cover and thumbscrew opening for the replacement of pump tubing. The pump shall include a built-in magnetic safety interlock.
    c. The pump shall include an optional heater, housed beneath the pump cover, for the prevention of liquid freezing inside the pump under extremely cold conditions. A heater shall be available for both 115VAC and 230VAC samplers.
    d. Liquid Detector
    The sampler will sense the presence of the liquid via a non-wetted, non-conductive detector. The sensor shall not be dependent on, or affected by, any chemical or physical property of the liquid or its contents. The sensor shall not require routine maintenance or cleaning.
    e. The pump tubing used shall be specially treated to minimize water extractable pollutants. Specially designed bands shall indicate the correct placement of the tubing inside the pump. The tubing shall typically last for a minimum of 1,000,000 pump counts.

D. Distributor

The modular distributor shall be housed in a discrete compartment of the refrigerator's molded frame. Sample distribution will be belt-driven by a stepper motor. Positive location of the distributor arm will be achieved using an optical sensor. One of two available fixed-length distributor arms will be used for all bottle configurations and sampler mounting possibilities. The distributor arm may be moved by hand for ease of sample recovery and shall relocate itself before the next sample is taken.

E. Suction Lines and Strainers

The sampler will utilize a suction line and strainer for taking samples. The suction line shall be made of 3/8 inch (.95 cm) ID vinyl with a length of 20 feet. The suction line shall have a factory-installed standard 3/8" weighted polypropylene strainer, or an optional all stainless steel strainer for 3/8" (0.95cm) line.

F. Sample Collection Containers

The sampler shall be supplied with sample collection container(s). The container(s) shall be 1 round 10L polyethylene.

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 11251

ELECTRIC VALVE ACTUATORS

PART 1 GENERAL

1.1 SUMMARY

A. Description:
   1. The Contractor shall furnish, install, test and place in satisfactory operation, quarter-turn electric valve actuators complete with electric motor, position and torque sensors, manual handwheel override capability, controls, and all accessories and features as shown on the Plans and specified herein, for a complete and operable system.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

1. AWWA Standard C542

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawings:
   1. Submit detailed dimensions for materials and equipment, including wiring and control diagrams, performance charts and curves, installation and anchoring requirements, fasteners, and all other details.
   2. Descriptive literature, bulletins, and catalog cuts of all equipment components to indicate full compliance with these specifications.
   3. Complete bill of materials for all components.
   4. Complete information concerning materials of construction and fabrication demonstrating compliance with these specifications.
   5. Complete spare parts list.

C. Product Data: Submit information concerning materials of construction and fabrication.

D. Manufacturer's Installation Instructions: Submit detailed instructions on installation and configuration requirements including storage and handling procedures, electrical connection, controls setup, anchoring, and layout.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Other Information: Technical manuals, parts list, warranty information, equipment storage recommendations.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories. Record initial settings and parameters for controls equipment.

C. Operation and Maintenance Data:
1. Submit operation and maintenance (O&M) manuals for all equipment and accessories supplied. Prepare O&M manuals specifically for this installation and provide all cuts, as-built drawings, equipment lists, spare parts lists and sources, manufacturer's recommended preventative maintenance procedures, troubleshooting recommendations, descriptions, etc, that are required to instruct operation and maintenance personnel unfamiliar with such equipment. Include as-built control and electrical diagrams.
2. Include all manufacturer's data provided in the initial submittal.
3. Provide list of equipment and tools required to maintain and calibrate equipment.
4. Provide manufacturer's certification that all equipment has been installed in accordance with manufacturer's instructions.
5. Provide fully executed warranty document.
6. Furnish one (1) hard copy of O&M manual in three-ring binder, and electronic copy in .pdf format. Provide minimum of two (2) laminated electrical and control wiring diagrams based on as-built conditions on maximum 11" x 17 sheets.

D. Special Tools: Provide two (2) sets of any special tools required for proper maintenance of all equipment.

E. Spare Parts: Provide spare parts properly bound and labeled for easy identification without opening packaging and suitably protected for long-term storage.

F. Manufacturer's Field Reports: Following performance testing, certify that equipment has been installed in accordance with manufacturer's instructions, and that all systems have been installed properly and are functioning correctly.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Owner's standard.

B. Maintain one copy of each document on site.

C. Actuator and associated valve shall be provided by the same supplier.

1.6 PRE-INSTALLATION MEETINGS – **NOT REQUIRED**

A. Section 01300 - Administrative Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Inspect for damage.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces. Store and handle products in accordance with manufacturer's recommendations.

1.8 SEQUENCING

A. Section 01100 - Summary.

B. Sequence work to prevent interference with Owner's operations.

1.9 SCHEDULING

A. Section 01300 - Administrative Requirements.

B. Schedule work to prevent interference with Owner's operations.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate start-up, performance testing, and demonstration with Owner and Engineer. Provide minimum of one week's notice.

1.11 MAINTENANCE MATERIALS

A. Section 01700 - Execution Requirements.

B. Furnish special tools and equipment required for maintenance, repair, and adjustment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Electric motor actuators with torque output requirements of 750 ft-lbs and less for butterfly valves and eccentric plug valves shall be quarter-turn type and shall be Rotork "IQT" Series or Auma SQ.

B. Other electric motor actuators for open-close, modulating or explosion proof service shall be intelligent multi-turn type and shall be Rotork "IQ" Series or Auma SA.

C. All actuators on the project shall be of one manufacturer.

2.2 ACTUATOR TAGGING

A. Provide identifying tags for electric motor-actuated valves. Show valve actuator tag number, name or designation as shown in the drawings, and valve size. Attach tags to actuators by means of stainless steel wire.

2.3 MOTORS FOR ELECTRIC ACTUATORS

A. Motors shall be 480 volt/3 phase as called for in the schedule contained herein; specifically designed for high torque, low inertia duty. Motors for on/off, open/close actuators shall be designed and rated for 15-minute duty or 60 starts per hour at 104°F. Motors and starters for modulating actuators shall be designed for 30-minute duty or 600 starts per hour at 104°F.

B. Output capacity shall be sufficient to open or close the valve against the maximum differential pressure when the voltage is 10% above or below normal at the specified service conditions. Motors shall have Class F insulation. Provide motor with torque output (at duty rating) that exceeds the requirements of paragraph E below including safety factor.

C. Provide an electrical and mechanical disconnection of the motor without draining the lubricant from the actuator gear case.

2.4 ACTUATOR TORQUE REQUIREMENTS

A. Actuators being installed on existing valves shall include the manufacturer's inspection, field testing and evaluation of the existing valve in order to apply the applicable torque requirements in order to properly actuate the existing valves.

B. The rated output torque of the motor actuator shall be at least 1.5 times the maximum torque required to open or close the valve at any position including seating and unseating conditions when subjected to the most severe operating condition including any mechanical friction and/or other restrictive conditions that are inherent in the valve assembly. Do not include hammer-blow effect in sizing the actuator to comply with this torque requirement. Coordinate with the valve manufacturer to assure that the motor actuator stall torque output does not exceed the torque limits of the valve operating stem or shaft.

C. Maximum torque shall include seating or unseating torque, bearing torque, dynamic torque, and hydrostatic torque. Assume that the differential pressure across the valve is equal to the pressure or head rating of the valve.

D. Assume a maximum pipeline fluid velocity of 10 fps with the valve fully open, unless a higher velocity is specified in the detailed valve specification.

2.5 DESIGN OF ELECTRIC MOTOR ACTUATORS

A. Actuators shall comply with AWWA C542, except as modified herein. Output capacity of motors shall be sufficient to open or close the valve against the maximum differential pressure when the voltage is 10% above or below normal at the specified service conditions. Provide motor with torque output (at duty rating) that exceeds the requirements of the following paragraphs including safety factor.

B. Provide a reversing starter, three overloads (one in each ungrounded leg) or two motor thermal cutouts, 120-volt control power transformer, local-off- remote selector switch, stop-open-close push buttons, and open and closed indicator lights. Provide magnetic starters in actuators for open/close operation and for modulating operation. Provide dry contact for remote indication of the actuator mode of operation. The contact shall be closed

when the local-off-remote selector switch is in the remote position and the internal control power exists.

C. Do not use external conduit for wiring any components within the actuator.

D. Assume a maximum pipeline fluid velocity of 10 fps with the valve fully open, unless a higher velocity is specified in the detailed valve specification.

E. Gear actuators shall be totally enclosed and factory-grease packed or oil- bath lubricated. The power gearing shall consist of helical gears of heat- treated steel. Worm gears shall be alloy bronze accurately cut with a hobbing machine. Worm shall be hardened steel alloy. Design gears for 24- hour continuous service with an AGMA rating of 1.50.

F. Position switches shall be adjustable and capable of actuation at any point between fully opened and fully closed positions. The position switches shall operate while the actuator is either in manual or in motor operation. Provide motor actuators with position switches capable of being separately used to provide remote indication of end of travel in each direction and to stop motion at the end of travel in each direction.

G. Provide two individually adjustable torque switches to protect the valve and motor against overload in the opening and closing directions. To prevent hammering, the torque switch shall not reclose until the valve is made to travel in the opposite direction.

H. Provide a manually operated handwheel that shall not rotate during electrical operation. In the event electrical power is interrupted, handwheel operation shall be activated by a hand lever attached to the mechanism. While the valve is being operated manually, the motor shall not rotate. Upon restoration of electrical power, the handwheel shall automatically disengage. Design the handwheel diameter such that hand operation will not damage the valve.

I. The position switch and torque switch contacts shall be capable of interrupting at least 0.2-ampere inductive load at 125-volt dc or 6-ampere inductive load at 120-volt ac.

J. Provide a lost motion device for open/close operation to permit the motor to reach full speed before the load is applied. Provide lost motion action for manual operation also. Do not provide lost motion device for modulating applications.

K. “Latching” shall be provided to inhibit high torque during unseating or starting in mid-travel against high inertia loads. The actuator electrical diagram shall be identical, regardless of whether the valve is to operate on torque or position limit. Provide the actuator with means to non-intrusively calibrate torque or position and interrogate the status and performance of the actuator.

L. Motor shall de-energize in the event of a stall when attempting to unseat a jammed valve.

M. Provide a time delay to prevent instant reversal of the actuator motor.

N. Provide terminal connections for external remote controls fed from an internal 24-volt or 120-volt supply.

O. Provide two separate 3/4-inch conduit connections for control and power wiring.

2.6 LOCAL ACTUATOR CONTROL

A. Integral to the actuator shall be local controls for Open, Close, and Stop, and a local/remote selector Switch:

1. Open/Stop/Close Push Buttons

2. Local/Off/Remote Selector Switch

B. All the necessary wiring, indication relays and terminals shall be provided in the actuator to accommodate the remote mounted push button control functions. Provide terminal connections for external remote controls fed from an internal 120-volt AC supply.

C. The following Control, Status and Alarm indication shall be available locally at the actuator:

Controls:	**Status:**	**Alarms:**
1. Open/Stop/Close	1. Motor Running Open Direction	1. Actuator Alarm
2. Desired Valve Position Control	2. Motor Running	2. Valve Alarm
	3. Fully Open	3. Battery Low Alarm, if required
	4. Fully Closed	
	5. Percentage Open	

D. The actuator must provide a local display of the position of the valve, even when the power supply is not present. The display shall be able to be rotated in 90 degree increments so as to provide easy viewing regardless of mounting position.

E. The actuator shall include a digital position indicator with a display from fully open to fully closed in 1% increments with +/- ½% accuracy. Red, green, and yellow lights corresponding to Open, Closed, and Intermediate positions shall be included on the actuator. The digital display shall be maintained even when the power to the actuator is isolated.

F. The local display should be large enough to be viewed from a distance of six feet (6’) when the actuator is powered up.

G. Provide a diagnostic module, which will store and enable download of historical actuator data to permit analysis of changes in actuator or valve performance. A software tool for a PDA or laptop shall be provided to allow configuration and diagnostic information to be reviewed, analyzed and reconfigured.

H. Diagnostic status screens must be provided to show multiple functions. Emergency Shut Down shall be selectable; Last-position, Full Open, Full Closed.

2.7 LOCAL ACTUATOR CONTROL

A. Capabilities shall be provided to position the valve (or gate) locally via the Local/Off/Remote selector switch and Open/Stop/Close push buttons.

B. For on/off service, when in remote, the actuator shall accept one remote signal to open the valve or gate and a second remote signal to close the valve or gate.

C. For modulating service, when in remote the actuator shall accept a 4- 20mADC position control signal, and shall position the valve 0-90 degrees or gate 0-100% of travel in proportion to the control signal.

D. Valve position shall be sensed by an 18-bit, optical, absolute position encoder with redundant position sensing circuits designed for Built-In-Self- Test [BIST]. Each of the position sensing circuits shall be redundant permitting up to 50% fault tolerance before the position is incorrectly reported. The BIST feature shall discern which failures signal a warning only and which require a warning plus safe shutdown of the actuator. Open and closed positions shall be stored in permanent, nonvolatile memory. The encoder shall measure valve position at all times, including both motor and handwheel operation and with or without power present. The absolute encoder will be capable of resolving ±7 degrees of output shaft position over 10,000 output drive rotations.

E. Discrete outputs to SCADA shall be provided for all limit and torque switches, and for Local/Off/Remote switch in Remote position, as required by the Drawings.

2.8 WIRING AND TERMINALS

A. Internal wiring shall be tropical grade insulated stranded cable of appropriate size for the control and three-phase power. Each wire shall be clearly identified at each end. All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable.

B. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal. The terminal compartment of the actuator shall be provided with a minimum of four threaded cable entries.

C. Control logic circuit boards and relay boards must be mounted on plastic mounts to comply with double insulated standards.

D. A durable terminal identification card showing plan of terminals shall be provided attached to the inside of the terminal box cover indicating:

1. Serial Number

2. External Voltage Values

3. Wiring Diagram Number

4. Terminal Layout

E. This must be suitable for the contractor to inscribe cable core identification beside terminal numbers.

2.9 ACTUATOR CRITERIA

A. Schedule:

Actuator Identification	Odenville/EQ Flow Line	SBR Flow Line
Service Condition	On-Off Service	On-Off Service
Electric Service	480 V – 3 Phase – 60 Hz	480 V – 3 Phase – 60 Hz
Actuated Valve Size and Configuration	12-inch Plug Valve	12-inch Plug Valve
Installation Max Differential Pressure	20 psi	20 psi

2.10 WARRANTY

A. Actuator manufacturer shall warrant units supplied against defects in workmanship and materials for a period of not less than one (1) year beginning with the date of final payment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify layout and orientation of equipment and accessories. Immediately report discrepancies or conflicts to the Engineer for resolution.

3.2 INSTALLATION

A. Install equipment where indicated on Drawings and in accordance with manufacturer's instructions.

B. Provide and connect piping, power and control conduit and wiring to make system operational, ready for startup.

3.3 FIELD QUALITY CONTROL

A. Section 01700 - Execution Requirements.

B. Start-up and Performance Testing:
   1. Operate equipment under actual field conditions and following installation of all other systems just prior to placement of all Work into operation. Demonstrate all required functionality under supervision of manufacturer's representative and in presence of Owner and Engineer.

C. Equipment Acceptance:
   1. Adjust, repair, modify or replace system components that fail to perform as specified and rerun tests. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 MANUFACTUER’S FIELD SERVICES

A. Section 01400 - Quality Requirements.

B. Furnish services of manufacturer's representative experienced in installation of products furnished under this specification for not less than one eight-hour day on-site for installation inspection and field testing, and instructing Owner's personnel in maintenance of equipment. Make additional trips to site as required for resolution of non-compliant conditions at no additional cost to the Owner.

C. Certify that equipment has been properly installed and is ready for start-up and testing.

3.5 DEMONSTRATION

A. Section 01700 – Execution Requirements

B. Demonstrate equipment startup, shutdown, routine maintenance and adjustments, alarm condition responses, and emergency repair procedures to Owner’s personnel.

END OF SECTION

SECTION 11331
SEMI-CYLINDRICAL SCREEN

PART 1 GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall furnish, install and place into satisfactory operating condition the number of semi-cylindrical screens noted in paragraph 1.03.C. for removing floating, particulate, or fibrous material from wastewater as shown on the Drawings and described in the Specifications.

B. Related Sections

1. General Conditions, Supplementary Conditions, and General Requirements sections apply to work of this Section.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)

B. American Society of Testing and Materials (ASTM)

C. American Society of Civil Engineers (ASCE)

D. American Welding Society (AWS)

E. Steel Structures Painting Council (SSPC)

F. American Gear Manufacturers Association (AGMA)

G. National Electrical Manufacturers Association (NEMA)

1.03 SYSTEM DESCRIPTION

A. Each unit shall consist of a stationary, semi-cylindrical screen basket, concentric screw conveyor/dewatering screw, screenings press with drive unit, support structure, weather protection system, and electrical control system.

B. Screens other than semi-cylindrical screens, will not be considered for this project.

C. Design Summary

1. Number of Semi-Cylindrical Screens 1
2. Average Flow per Screen, mgd 1.25
3. Maximum Hydraulic Capacity per Screen, mgd 1.94
4. Maximum Upstream Liquid Level, inches 27

5. Maximum Clean Water Headloss, inches..... 16
6. Nominal Screening Basket Diameter, inches 13
7. Orifice Diameter, inches..... 1/4
8. Orifice Centerline-to-Centerline Distance, inches..... 5/16
9. Screening Channel Width, inches..... 24*
10. Nominal Screw Conveyor Diameter, inches 10
11. Minimum Screen Invert to Discharge Height, inches 100
12. Speed Reducer Minimum Torque Rating, in.-lb 15,700
13. Speed Reducer Minimum Thrust Rating, lbf..... 5,800
14. Drive Motor Size, hp 2
15. Electrical Power Characteristics, VAC-Phase-Hertz..... 460/3/60
16. Motor and Solenoid Valve Electrical Classification ..... Class I, Div. I, Group D
17. Maximum Spray Wash System Flow Rate, gal/min..... 20
18. Minimum Spray Wash System Pressure, psig..... 60
19. Lower Wash System Number of Nozzles..... 6
20. Liquid Level Sensing System Type..... Float switch
21. Electrical Enclosure Type..... NEMA 4X stainless steel

**Seal plates to be provided as necessary to mate screen with concrete channel*

1.04 PERFORMANCE

A. The semi-cylindrical screen shall be designed to handle the conditions noted within paragraph 1.03.C. The maximum upstream liquid depth includes the maximum allowable clean water headloss while operating at an angle of inclination of 45 degrees.

B. The screen shall be a stationary semi-cylindrical perforated plate screen with an integral screw for cleaning the screen, conveying and compacting the screenings.

C. The screen shall use a single drive for screening, conveying, dewatering and compacting screened material.

D. The design of the screen shall be such that there are no metal-to-metal wearing surfaces in the screening, transport and compaction/dewatering sections of the screen to minimize maintenance labor and replacement parts costs.

E. The screen shall remove solids from the screenings basket by the action of a concentric shaftless screw conveyor. The screenings shall be conveyed up the transport tube via a shafted screw conveyor and through a compaction/dewatering chamber. The complete removal procedure shall be encased to reduce odors.

F. The screening equipment shall produce dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095B of EPA Publication SW-846.

G. Due to the presence of large objects in raw wastewater, the screen shall be capable of picking up objects 3-1/8 inches in diameter and depositing them for washing and passage through the compaction and dewatering zone. The screen design shall prevent objects larger than 3-1/8 inches in diameter from entering into the screenings transport tube to prevent jamming.

H. The control system shall be designed so that the cleaning characteristics of the screen and spray wash systems can be changed via the programmable logic controller. Systems that do not offer this feature will not be considered for this project.

1.05 SCREENINGS WASHING

A. Each screen shall be furnished with a dual screenings spray wash system to flush organic material from the screenings prior to compaction and dewatering. The dual screenings washing systems shall be designed to minimize the amount of organic material in the screenings and to maximize solids dryness after compaction and dewatering. The dual screenings washing systems shall include:

1. Lower wash system shall be located immediately prior to the point where the screenings are removed from the screen and enter the screenings transport tube. This wash system shall pre-wash the screenings to remove fecal material and to prevent material from sticking to the screw conveyor flights.

2. Screenings wash system shall be located just prior to the beginning of the compaction zone after maximum maceration of the screenings by the screenings transport screw conveyor. At the maximum wash water flow rate noted in paragraph 1.03.C, the screw conveyor shall be designed to prevent screenings from being washed down the screenings transport tube to the basket.

1.06 ODOR CONTROL

A. To minimize odors and nuisance insect populations, the semi-cylindrical screen transport system and compaction/dewatering system shall be completely enclosed.

B. The spray wash systems shall be completely enclosed to prevent spray, aerosols, and leakage from coming in contact with the operating floor.

1.07 MATERIALS OF CONSTRUCTION

A. All fabricated components of the screen shall be AISI Type 304 stainless steel including the screen basket, screw conveyor, outer screw conveyor housing and support structure. Materials thicknesses identified in PART 2 - PRODUCTS are the <u>minimum</u> requirements for this project. Materials with increased thicknesses will be acceptable.

B. All fabricated components shall be manufactured in the United States. To ensure prompt service and to ensure spare parts availability in a timely manner and at a reasonable cost, foreign fabricated materials of construction for the components identified in paragraph 1.08.A. will not be acceptable for this project.

1.08 SUBMITTALS

A. Refer to Section 01330 for shop drawing submittal requirements.

B. Submit shop drawings and manufacturer's data showing screening and conveyance equipment size, layout, piping and any special requirements prior to proceeding with work. Submit complete wiring diagrams, terminal connections, interior component layout and front layout on

the electrical control panel and its control logic. Equipment included in this submittal shall include, but is not limited to:

1. Screening unit
2. Heat tracing system
3. Conveyance systems
4. Level transmitters
5. Valves
6. Electrical Control Panel and Components

C. Review of the shop drawings shall not relieve the Contractor from the responsibility of proper fitting and construction of the work, nor from furnishing materials and work required by the Contract that may not be indicated on any drawings.

D. As work progresses, the Contractor shall record in red ink on a set of black and white prints of the Contract Drawings the "as-built" locations, sizes, elevations, identifications, etc. of all piping, service trenches, equipment, etc. The prints shall be kept in good conditions at all times. Dimensions and elevations shall relate to datum references established for the project. Required information shall be certified by signature on the prints maintained by the Contractor.

1.09 QUALITY ASSURANCE

A. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single manufacturer. The equipment manufacturer shall, in addition to the CONTRACTOR, assume the responsibility for proper installation and functioning of the equipment.

B. Naming of a manufacturer within this or any other Specification does not relieve them from complying with the performance features, the salient features and the Made in the U.S.A. requirements of the Contract Documents. The Contract Documents represent the minimum acceptable standards for the screening equipment for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the drawings and specifications. Equipment that is a "standard product" with the manufacturer shall be modified, redesigned from the standard mode, and shall be furnished with special features, accessories, materials of construction or finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the specification.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. The screening system shall be provided as a complete unit including all necessary equipment and appurtenances and be supplied as manufactured by:
   1. Lakeside Equipment Corporation
   2. WesTech Inc.
   3. Substitutions: Section 01600 - Product Requirements.

2.02 SEMI-CYLINDRICAL SCREEN

A. Screen Basket

1. The screen shall be designed and built to withstand maximum possible static hydraulic forces exerted by the liquid to the screen. All structural and functional parts shall be sized to prevent deflections or vibrations that may impair the screening, conveying and pressing operations. All submerged components and all components of the screen in contact with the screened solids shall be of stainless steel construction.

2. The screen basket shall be of a semi-cylindrical shape and installed in the housing parallel to the direction of liquid flow. The screen shall be furnished with a 5/8-inch thick minimum upper basket support flange for mating to the screenings screw conveyor body.

3. The minimum diameter of the screening basket shall be as noted in paragraph 1.03.C.

4. The screen basket shall use perforated plate for capturing solids in the wastewater flow stream. The perforated plate screen orifice opening diameter shall be as noted in paragraph 1.03.C. with an orifice centerline spacing as noted in paragraph 1.03.C. The perforated plate screen shall have a minimum thickness of 0.12 inches for heavy-duty applications to minimize tearing.

5. The width of the screening channel shall be as noted in paragraph 1.03.C.

6. Stainless steel seal plates or rubber flaps shall be provided with a profile conforming to the channel to prevent flow from by-passing the screen.

B. Screenings Conveyor and Screenings Dewatering Press

1. The semi-cylindrical screen shall be cleaned by a shaftless screw conveyor with helical flights designed to operate and to convey screened material at a 45-degree angle of operation. The shaftless screw conveyor flights for cleaning the screen shall be fabricated with 3/8-inch minimum stainless-steel plate and machined in accordance with paragraph 2.08.F. Screw conveyor designs fabricated of material that is not AISI designated stainless steel will not be acceptable for this project. Designs that form the shaftless portion of the screw out of bar stock shall be fabricated from AISI Type 316Ti stainless steel to prevent stress relieving after fabrication and shipment.

2. The screw conveyor flight edges shall be parallel to the face of the perforated screen with a gap not to exceed 0.040-inches.

3. Attached to the shaftless screw conveyor flights the full length of the perforated screen shall be a stainless steel backed brush composed of plastic bristles. Brush shall be attached to the shaftless screw conveyor with stainless steel holder clips and stainless-steel fasteners.

4. As material is conveyed into the enclosed transport tube there shall be a transition section from the nominal screen diameter noted in paragraph 1.03.C. to a nominal screenings transport tube diameter as noted in paragraph 1.03.C. The transport tube shall be fabricated of stainless steel with a wall thickness equal to or greater than that provided by Schedule 10S pipe to minimize deflection.

5. A 3/4-inch thick minimum basket support plate flange shall be welded to the lower end of the screenings transport tube to attach the screen basket and to provide for attachment of the screenings collection hopper. A 3/4-inch thick minimum drive support flange shall be welded to the upper end of the screenings transport tube for attachment of the drive assembly. After all welding of components to the screenings transport tube have been completed the fabrication shall be placed in a lathe to machine the face of the upper drive flange and to machine the face of the lower basket support plate flange for mating the basket in accordance with paragraph 2.08.F.

6. To prevent rotation of the material in the transport tube and to provide maceration of screenings during transport, there shall be a minimum of three (3) 1/4-inch minimum thick stainless-steel anti-rotation bars equally spaced along the inside axis of the transport tube. Anti-rotation bars shall be welded to the inside of the transport tube.

7. In the transition section from the screen to the transport tube there shall be two (2) replaceable bearing strips to support the screw conveyor when the unit operates without screenings. These replaceable wear strips shall prevent the transport screw flights from wearing on the anti-rotation bars or on the cleaning brush. The wear strips shall be replaceable without having to remove the screw conveyor from the screenings transport tube for ease of maintenance. Wear strips shall be a special ultra-high molecular weight polyethylene material filled with molybdenum disulfide and oil for superior life. The wear strips shall be held in place via a stainless-steel backing housing with a bolted connection for ease of field replacement.

8. The transport screw shall change from a helical-flight shaftless design to a helical-flight shafted design just prior to the screen transition section. The shafted screenings transport screw shall have 3/16-inch minimum stainless-steel flights that are welded to a 3-inch minimum diameter stainless steel torque tube. Flight thickness shall be increased on the last flights to 3/8-inch in the compaction zone. Where the transport screw passes through the discharge section a reverse stainless-steel flight spiral shall be provided to cut off the compacted material plug to drop into the receiving receptacle.

9. The upper screenings conveyor torque tube shall be fitted with a solid stainless-steel stub shaft. The shaft and screenings screw conveyor torque tube shall be accurately machined in accordance with paragraph 2.08.F. to allow a shrink-fit and welded design for the upper drive end stub shaft. Bolting the upper stub shaft to the screening transport screw conveyor torque tube will not be acceptable for this project.

10. The screen shall be provided with a pivoting support stand allowing for easy removal of the screen basket from the channel for maintenance purposes. To ensure operator safety during servicing of the screen, supports and support stand shall be fabricated from 1/4-inch minimum stainless-steel shapes and plates.

11. A compaction zone shall be an integral part of the screenings screw conveyor and transport tube design. The compaction zone shall be designed to form a screening plug of material and to return water released from the screened material back to the wastewater channel through circular holes that are machined into the screenings transport tube. Compaction zone shall be fabricated from 12-gauge minimum thick stainless steel welded to the screenings transport tube to provide a watertight screenings collection chamber.

Compaction zone housings that are non-metallic and which require seals to prevent leakage around the screenings transport tube will not be acceptable for this project. Compaction zone housing shall be furnished with a hinged and sealed access cover held in place with stainless steel latches as well as a removable dewatering section panel inside the dewatering chamber to allow direct access to the screw conveyor should the compaction zone ever become plugged. Designs that require removal of the drive assembly, discharge head or screw conveyor to gain access to the compaction zone will not be acceptable for this project.

12. The screen shall be designed with a minimum height as noted in paragraph 1.03.C. as measured from the channel invert to the lowest point of the discharge chute.

C. Drive Assembly

1. The screw conveyor shall be driven by a direct-connected cycloidal-helical hollow-shaft high-thrust in-line speed reducer as shown on the drawings. The cyclo element of the speed reducer shall be designed to take a 500 percent shock load without damage. The speed reducer manufacturer shall be a member of AGMA. Combination gear motor designs will not be acceptable for this project. The speed reducer shall have a minimum torque rating as noted in paragraph 1.03.C. and a minimum thrust rating as noted in paragraph 1.03.C.

2. The speed reducer shall be bolted to the drive adaptor flange at upper end of the screenings transport tube.

3. The speed reducer shall be driven by a field replaceable NEMA C-flanged, 1,800 rev/min, ball bearing, continuous-duty, totally enclosed, fan-cooled motor with leads to a large conduit box. The reducer shall utilize a taper grip bushing to connect to the drive shaft of the screw conveyor. The use of keys and keyways will not be an acceptable connection method for this project.

4. Motor size shall be as noted in paragraph 1.03.C., shall be rated for electrical power characteristics as noted in paragraph 1.03.C.15. and shall be rated for an environment as noted in paragraph 1.03.C. Explosion-proof motors shall be furnished with over-temperature thermostats in the windings designed for cutout at approximately 160^{o}C.

5. Chain-drives, belt drives, hydraulic drives or a separate upper bearing for the transport screw will not be acceptable for this project.

D. Spray Wash Systems

1. A minimum of six (6) spray systems shall be provided. Each spray wash system shall be furnished with a control solenoid valve, stainless steel piping and fittings, flexible reinforced PVC hose and nozzles. Piping, fittings and valves shall be 3/4-inch diameter minimum. A water strainer shall be provided for the incoming water supply. The wash water flow requirements shall be as noted in paragraph 1.03.C. with a minimum pressure as noted in paragraph 1.03.C. The three (3) spray wash systems shall include:

   a. Lower spray wash system shall be located near the upper end of the screenings basket just prior to where screenings enter the screw conveyor transport tube. The lower

wash system shall have the minimum of spray nozzles as noted in paragraph 1.03.C. Lower spray wash bars without replaceable spray nozzles will not be acceptable.

b. Screenings spray wash system shall be located in the upper section of the transport tube no more than 17 inches from the beginning of the compaction zone to break up and return organic materials to the flow stream and to ensure maximum screenings washing. A minimum of one (1) spray nozzle shall be provided. The screenings spray wash system and screenings screw conveyor shall be designed to prevent washing screenings down the center of the screw conveyor.

c. The dewatering chamber flush water system shall periodically clean the compaction and dewatering zone via a stainless-steel wash nozzle located in the compaction/dewatering chamber. The dewatering chamber flush water system shall not be a substitute for the screenings washing systems described in paragraphs 2.02.D and 2.02.D.

2. The six (6) wash system solenoid valves shall be 3/4-inch minimum, brass body suitable for 120 VAC operation with a rating as noted in paragraph 1.03.C. Solenoid valves shall be normally closed and rated for up to 150 psig. Solenoid valves shall be slow close type to minimize water hammer.

3. Solenoid valves shall be factory installed to a piping manifold to ensure even pressure distribution to each spray wash system. The solenoid valve wiring shall be factory installed to a common junction box on the spray wash manifold for wire nut connection to external power. Conduit and fittings shall be factory installed between the solenoid valves and junction boxes. Junction box, conduit and fittings shall be rated NEMA 4/7/9 for an explosion-proof electrical environment as noted in paragraph 1.03.C.

4. Water strainer shall be provided that is suitable for a 3/4-inch NPT connection and a maximum flow rate as noted in paragraph 1.03.C. and suitable for a maximum pressure as noted in paragraph 1.03.C. Water filter shall be a stacked filter element design with washable 80-mesh (200 micron) polyethylene or polypropylene disc elements, polypropylene head and bowl and Buna N gaskets. Y-type strainers will not be acceptable for this project.

2.03 CONTROL SYSTEM

A. Refer to Specification Section 16480 (“Manufactured Control Panels”) for additional control panel requirements.

B. All controls necessary for the fully automatic operation of the semi-cylindrical screen shall be provided in accordance with NEMA standards.

C. The electrical control system shall provide for automatic control of the screen via a high liquid level using a liquid level control system in connection with an adjustable time clock. The screen shall operate at a high liquid level and or a pre-determined time sequence to provide a variable time between cleaning operations.

D. The float switches shall be a hermetically sealed, axially non-position sensitive type, mercury-switch activated and enclosed in a polypropylene housing. The switches shall operate over a

narrow switching angle and have a minimum rating of 1 amp at 120 volts. A 20 ft PVC jacketed power cable, weight, grip cord, and stainless-steel mounting bracket shall be furnished as part of the switch assembly. For a Class I Division I electrical classification environment the level switching circuit shall be rated intrinsically safe by inclusion of a UL approved switch isolator with relay output. The switch isolator shall be rated for 120-volt service with output contacts rated for 2 amps minimum. A second high-level float switch shall be included for alarm indication and as a backup start switch circuit.

E. Remote mounted main panel suitable for wall mounting shall contain the following items:

1. Door interlocked fused disconnect
2. Process controller complete with LCD operator interface panel providing field settable/adjustable/access to process parameters and for providing specific indications of each type of fault that may occur. Controller ram shall be backed up with non-volatile memory which will load automatically if ram is corrupted.
3. Variable frequency drive (VFD) with line reactor
4. Control power transformer fused primary and secondary with 120VAC transient voltage surge suppressor (TVSS)
5. Full voltage LED pilot lights for the following:
   a. Control power on (White)
   b. Multifunctional overload shutdown/screen fault (Red)
   a. High level (Amber)
6. Door-mounted elapsed time meter
7. Remote dry contact outputs for the following:
   a. Screen Running
   b. Malfunction alarm
   c. High water level alarm
8. Weather protection system heat tracing circuit breaker
9. Wash water heat tracing (250 watts max.) 20A-120VAC-1P GFI-EPD (30mA ground fault trip) circuit breaker
10. Set spare fuses
11. White phenolic nameplates with black lettering
12. 600 VAC terminal block
13. U.L. panel label per the application
14. Electrical enclosure shall be provided in accordance with paragraph 1.03.C.

F. A local mounted operator control station shall contain the following items:

1. Hand-Off-Auto selector switches for the following:
   a. Screen drive
   b. Common wash system solenoid valves
2. Forward-Off-Reverse selector switch (spring return to center) for screen drive
3. E-stop pushbutton (Red)
4. Re-set push button (Black)
5. White phenolic nameplates with black lettering
6. NEMA 4/7/9 cast aluminum explosion-proof enclosure

2.04 COLD WEATHER PROTECTION

A. The screenings discharge transport tube shall be furnished with a heat tracing system for outdoor weather protection that shall completely enclose the screenings transport tube, compaction and dewatering zone, screenings discharge drop chute and all spray wash piping and solenoid valves.

B. The cold weather protection system shall include heat tracing, adjustable thermostat, insulation and a protective jacket. Heat tracing shall be suitable for an electrical environment as noted in paragraph 1.03.C.

C. The heat tracing system shall be suitable for operation down to a minimum temperature of -25ºC (-13ºF) and shall be powered from the main control panel.

D. Weather protection system protective cover shall be molded fiberglass reinforced polyester laminate, or a custom fit, coated fiberglass cloth jacket. Fabricated metallic or plastic covers that are bolted or riveted together will not be acceptable for this project.

E. The custom fit, coated fiberglass cloth jacket shall be removable and replaceable. The inner and outer jacketing and the side gussets shall be fabricated from a minimum of 18 oz/sq yd Teflon coated fiberglass cloth containing a minimum of 1-inch thick insulation core of Type E fiberglass mat. Seam closures shall be Teflon coated fiberglass thread and fasteners shall be Teflon straps with stainless steel D-rings. Weather flaps of Teflon cloth shall cover seams and slits and will be fastened with Velcro hook and loop closures. 3-inch wide Teflon cloth terminal end flaps with Nomex drawstrings sewn into the sides of the jacket shall be provided. Identification tags in AISI Type 304 stainless steel with embossed lettering shall be provided.

F. A fabricated composite weather enclosure shall be provided for the water strainer specified in paragraph 2.02.D Enclosure shall be provided with a removable cover.

G. The water supply system piping to the screen and the water strainer described in paragraph 2.02.D shall be provided with heat tracing and insulation by the CONTRACTOR. The MANUFACTURERS control panel shall be provided with sufficient low voltage power to handle up to an additional 250 Watts from the CONTRACTOR supplied water heat tracing system.

2.05 ANCHOR BOLTS

A. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Bolts, washers and hex nuts shall be 304 stainless steel unless noted otherwise. Anchor bolts shall be drilled-in epoxy-type stainless steel.

B. Anchor bolts shall be set by the CONTRACTOR. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.06 SPARE PARTS

A. The following spare parts shall be provided:

1. One (1) brush assembly with stainless steel mounting hardware
2. One (1) complete solenoid valve assembly
3. One (1) solenoid valve re-build kit

4. One (1) set of lower wear strips and mounting hardware

B. Spare parts shall be individually boxed with the project name and part number clearly identified on each individual box. All spare parts shall be shipped in a separate crate and clearly labeled. Spare parts shall be stored indoors by the Contractor in a temperature-controlled environment.

2.07 SHOP SURFACE PREPARATION AND PAINTING

A. Electric motors, speed reducers, and other self-contained or enclosed components shall have manufacturer's standard enamel finish.

B. All external non-wetted stainless steel shall be cleaned to a uniform finish by glass bead blasting and chemically treating with Citrisurf 2210 or 2050. No hazardous wastes shall be produced during fabrication because Citrisurf is a citric acid based product that is non-toxic. The semi-cylindrical screen manufacturer shall clearly identify the passivation procedure methodology and shall certify that no hazardous wastes were produced.

2.08 SOURCE QUALITY CONTROL

A. All structural stainless-steel components shall be fabricated in the United States and shall conform to the requirements of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the American Institute of Steel Construction.

B. All parts and assemblies shall be fabricated from sheets and plates of AISI Type 304 stainless steel with a finish conforming to ASTM A666, unless noted otherwise. All rolled or extruded shapes shall be fabricated to conform to ASTM A276. All tubular products and fittings shall be fabricated to conform to ASTM A312, A351 and A403.

C. All welding in the factory shall use shielded arc, inert gas, MIG or TIG method. Add filler wire to all welds to provide for a cross section equal to or greater than the parent metal does. All butt welds shall be full penetration type to the interior surface. Provide gas shielding to interior and exterior of the joint.

D. Welding of the screen components shall be in accordance with the latest edition of the American Welding Society (AWS) standards. Field welding of stainless steel will not be permitted.

E. Bolts, nuts and washers shall be AISI 304 stainless steel furnished in accordance with ASTM A193.

F. All surfaces that are specified to be machined shall be designed and fabricated to provide a runout of not more than 0.005 inches and a concentricity to within 0.005 inches.

G. Design and fabrication of structural steel members shall be in accordance with AISC and AWS Standards. The manufacturer shall comply with the American Welding Society (AWS) and the American Institute of Steel Construction (AISC) most current listed standards and qualifications in 2004 D1.1, the criteria per the requirements of Section 6 - Inspection - Structural Welding Code. Evidence of such AWS and AISC compliance shall be submitted with shop drawing submittals as follows:

1. AWS Certified Welding Inspectors (minimum 2 on staff) shall conform to all standards, current or previous as listed in section 6.1.4 AWS QC1, Standard and Guide for Qualification and Certification of Welding Inspectors.

2. AWS Non Destructive Testing Inspectors (Level I, II, III) for Magnetic Particle and Ultra-Sonic testing (minimum 2 on staff) shall conform to all standards, current or previous as listed in and in conformance with The American Society for Non-Destructive Testing (ASNT-TC-1A).

PART 3 – EXECUTION

3.01 FIELD PREPARATION AND PAINTING

A. The CONTRACTOR shall touch-up all shipping damage to the paint and stainless steel as soon as the equipment arrives on the job site.

B. The CONTRACTOR shall supply paint for field touch-up and field painting.

C. The CONTRACTOR shall finish paint electrical motors, speed reducers, and other self-contained or enclosed components with oil-resistance enamel.

D. Prior to assembly the CONTRACTOR shall coat all stainless-steel bolts and nut threads with a non-seizing compound.

3.02 INSTALLATION

A. The manufacturer shall schedule one (1) trip to the project site for equipment start-up assistance as noted in paragraph 3.05.A. for the CONTRACTOR and for operating training as noted in paragraph 3.05.A. for OWNER personnel.

B. After the CONTRACTOR has installed the screen and the equipment is capable of being operated, the equipment manufacturer shall furnish a qualified representative for a minimum of two (2) days (up to 16 hours) to perform start-up inspection of the equipment and training for the CONTRACTOR.

C. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

3.03 SHOP TESTING

A. Prior to shipment of the equipment the screen shall be operated for a minimum of four (4) hours at the fabrication location with the specific drive motor that will be furnished for the project at the actual operating angle of the screen for the project.

B. During the shop test the following parameters shall be recorded:

1. Motor serial number
2. Amperage draw at start-up, after two hours and after four hours during forward operation

3. Amperage draw during reverse operation

C. A certified shop test report shall be submitted to the ENGINEER.

3.04 FIELD TESTING

A. Prior to final acceptance of the screen, three (3) tests shall be conducted according to the EPA Paint Filter Test as described in method 9095B of EPA Publication SW-846.

B. Should the system fail to produce screenings capable of passing the "EPA Paint Filter Test", the manufacturer shall at its own expense make all necessary modifications to the equipment until such tests can be passed.

3.05 OPERATOR TRAINING

A. Provide operator training for OWNER'S personnel after system is operational. Training will take place while manufacturer's representative is at the job site for inspection. Training shall include standard and extended operating procedures, standard maintenance tasks, and review of the manufacturer’s printed materials.

END OF SECTION

SECTION 11341

MAGNETIC FLOW METER

PART 1 GENERAL

1.1 SUMMARY

A. Description:
   1. The Contractor shall furnish, install, test and place in satisfactory operation, 4-wire magnetic flow meters, signal converters, and all accessories and features as shown on the Plans and specified herein, for a complete and operable system.

B. Related Sections:
   1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures.

B. Shop Drawings:
   1. Submit detailed dimensions for materials and equipment, including wiring and control diagrams, performance charts and curves, installation and anchoring requirements, fasteners, and all other details.
   2. Descriptive literature, bulletins, and catalog cuts of all equipment components to indicate full compliance with these specifications.
   3. Complete bill of materials for all components.
   4. Complete information concerning materials of construction and fabrication demonstrating compliance with these specifications.
   5. Complete spare parts list.

C. Product Data: Submit information concerning materials of construction and fabrication.

D. Manufacturer's Installation Instructions: Submit detailed instructions on installation and configuration requirements including storage and handling procedures, electrical connection, controls setup, anchoring, and layout.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Other Information: Technical manuals, parts list, warranty information, equipment storage recommendations.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements.

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories. Record initial settings and parameters for controls equipment.

C. Operation and Maintenance Data:
   1. Submit operation and maintenance (O&M) manuals for all equipment and accessories supplied. Prepare O&M manuals specifically for this installation and provide all cuts, as-built drawings, equipment lists, spare parts lists and sources, manufacturer's recommended preventative maintenance procedures, troubleshooting recommendations, descriptions, etc, that are required to instruct operation and maintenance personnel unfamiliar with such equipment. Include as-built control and electrical diagrams.
   2. Include all manufacturer's data provided in the initial submittal.
   3. Provide list of equipment and tools required to maintain and calibrate equipment.
   4. Provide manufacturer's certification that all equipment has been installed in accordance with manufacturer's instructions.
   5. Provide fully executed warranty document.
   6. Furnish one (1) hard copy of O&M manual in three-ring binder, and electronic copy in .pdf format. Provide minimum of two (2) laminated electrical and control wiring diagrams based on as-built conditions on maximum 11" x 17 sheets.

D. Special Tools: Provide two (2) sets of any special tools required for proper maintenance of all equipment.

E. Spare Parts: Provide spare parts properly bound and labeled for easy identification without opening packaging and suitably protected for long-term storage.

F. Manufacturer's Field Reports: Following performance testing, certify that equipment has been installed in accordance with manufacturer's instructions, and that all systems have been installed properly and are functioning correctly.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Owner's standard.

B. Maintain one copy of each document on site.

C. Actuator and associated valve shall be provided by the same supplier.

1.6 PRE-INSTALLATION MEETINGS – **NOT REQUIRED**

A. Section 01300 - Administrative Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements.

B. Inspect for damage.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces. Store and handle products in accordance with manufacturer's recommendations.

1.8 SEQUENCING

A. Section 01100 - Summary.

B. Sequence work to prevent interference with Owner's operations.

1.9 SCHEDULING

A. Section 01300 - Administrative Requirements.

B. Schedule work to prevent interference with Owner's operations.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements.

B. Coordinate start-up, performance testing, and demonstration with Owner and Engineer. Provide minimum of one week's notice.

1.11 MAINTENANCE MATERIALS

A. Section 01700 - Execution Requirements.

B. Furnish special tools and equipment required for maintenance, repair, and adjustment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The meter shall be as manufactured by:
1. Hach
2. ABB
3. Substitutions: Section 01600 - Product Requirements.

B. All meters on the project shall be of one manufacturer.

2.2 MAGNETIC FLOW METER

A. Electromagnetic flowmeter shall operate on electromagnetic induction principle and give an output signal directly proportional to the liquid rate of flow.

B. Each meter shall have a stainless steel metering tube and a non-conductive liner suitable for the liquid being metered. End connections shall be steel flanged for sizes 1/2" and greater, ANSI Class 150#, for meter sizes up to 24" and AWWA Class B or D for meters larger than 24". The housing shall be epoxy coated steel, welded at all joints. Bolted coil enclosures shall not be acceptable.

C. The field coils of the meter shall be supplied with a precisely adjusted bi-polar direct current.

D. There shall be no electronic components on the primary flow head. Coil drive power shall be supplied by a remote signal converter. Output signal from the primary shall be fed through 'DS' proprietary cable supplied with the meter to the signal converter.

E. Electrode material shall be Hastelloy C and compatible with the process fluid.

F. Liner material will be hard rubber suitable for service in applications that include raw waste water, sludge and abrasive matter. Liner material shall be NSF approved for installation in potable water.

G. The instrument shall be manufactured in an ISO 9001 approved facility.

H. The meter shall be provided with 316 stainless steel corrosion resistant grounding rings. Grounding electrodes shall not be acceptable.

I. Meter shall be rated for prolonged submergence, NEMA 6P.

J. Meter calibration shall be performed by a direct volumetric comparison method. A calibration certificate shall accompany each meter. Calibration facility shall be certified to .04% accuracy, and be traceable to national standards.

2.3 SIGNAL CONVERTER/TRANSMITTER

A. The Magnetic Flowmeter Converter shall be remotely mounted and provide precisely controlled and regulated, bipolar DC primary field excitation pulses at a keyed frequency of 1/6, 1/16, or 1/32 of line frequency digitally selectable. It shall convert the primary flowmeter signal into a 4-20 mA DC and pulse output directly proportional to the flow rate.

B. Converter shall be rated for 120 VAC operation

C. The full scale measuring range shall be a direct digital input in gpm and fully adjustable over a range from 1.0 to 40 ft/sec.

D. Each converter shall contain self diagnostics, automatic data integrity checking, and be completely interchangeable with other converters of the same type without need for recalibration. No auxiliary test meter or primary simulator shall be required for commissioning, zeroing, or interchanging of flow meter/converter.

E. Each converter shall contain the following features as standard equipment:
1. Simultaneous analog output (750 ohm load) and a scaled pulse output.
2. Adjustable damping of analog signal from 0.2 to 99 seconds.
3. Low flow cutoff.
4. Forward/reverse flow measurement capabilities
5. Integral rate of flow indicator and (2) 8-digit LCD totalizers
6. Capability of testing analog and frequency outputs.
7. Ten year data retention without the need for auxiliary power.

8. Engineering units for display and programming; flow and total shall be user programmable in any engineering unit of measure.
9. HART
10. All adjustments and changes of above features shall be by direct digital input.
11. Repeatability shall be 0.1% of rate.
12. Two (2) 4-20mA (Hart) Outputs

F. Accuracy of the system (Primary Flow Head and Converter) shall be:
1. Meter sizes 3/8" - 24" +/- 0.4% of actual flow rate (for velocities of 1.3 - 40 ft/sec)
2. Meter sizes 28" - 40" +/- 0.5% of actual flow rate(for velocities of 0.8 - 40 ft/sec)

G. The enclosures shall be rated NEMA 4X.

H. Provide a 50 foot signal cable for meters (FE-SP2A & FE-SP2B) in the sludge pump station. Provide a 15 foot signal cable / coil power cable for all others.

I. The instrument shall be manufactured in an ISO 9001 approved facility.

J. Stainless Steel Tags: Provide stainless steel identification tags on primary flow head and signal converter. Attach tags with stainless steel wire or screws.

K. The signal converter shall be Hach model SC200 or equivalent.

2.4 METER CRITERIA

A. Schedule:

Meter Identification	Influent Flow Line	Effluent Flow Line
Pipe Size and Material	12-inch Ductile Iron	10-inch Ductile Iron
Meter Flow Range	0 – 2,000 gpm	0 – 2,000 gpm

2.5 WARRANTY

A. Meter manufacturer shall warrant units supplied against defects in workmanship and materials for a period of not less than one (1) year beginning with the date of final payment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements.

B. Verify layout and orientation of equipment and accessories. Immediately report discrepancies or conflicts to the Engineer for resolution.

3.2 INSTALLATION

A. Devices with displays mounted outside shall be mounted facing north, if possible. Install sun shield/shade over unit such that the sun does not directly shine on the LCD/LED display and the unit itself is not in the sun.

3.3 FIELD QUALITY CONTROL

A. Section 01700 - Execution Requirements.

B. Start-up and Performance Testing:
   1. Operate equipment under actual field conditions and following installation of all other systems just prior to placement of all Work into operation. Demonstrate all required functionality under supervision of manufacturer's representative and in presence of Owner and Engineer.

C. Equipment Acceptance:
   1. Adjust, repair, modify or replace system components that fail to perform as specified and rerun tests. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 MANUFACTUER'S FIELD SERVICES

A. Section 01400 - Quality Requirements.

B. Provide manufacturer's Field Service Technician (certified, factory trained) for a minimum of one 8-hour days on site (minimum two trips). Field Service Technician shall calibrate instruments, check all installed equipment, perform initial start-up, make all tests, adjustments and related items as required to ensure that the flow meters are performing and operating as specified and required, and train operators in daily operational procedures, O & M, trouble shooting, and computer operations.

C. Field Service Technician shall verify installation is in accordance with Drawings, Specifications and as instructed by manufacturer. The technician will schedule site visits at scheduled points of construction completion, coordinated with Contractor, to ensure proper installation of equipment, structures and facilities. Technician will coordinate with other manufacturers Field Service Technicians as required.

D. Field Service Technician will instruct Owner's personnel in operational, maintenance and troubleshooting procedures.

3.5 CERTIFICATION OF INSTALLATION

A. Section 01700 – Execution Requirements

B. Upon completion of the installation, the manufacturer shall furnish a certificate of compliance detailing that the instruments and materials have been installed and calibrated in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 11390
SEQUENCING BATCH REACTOR (SBR)

PART 1 GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall furnish, install and place into satisfactory operating condition a Sequencing Batch Reactor (SBR) system and appurtenances as shown on the Drawings, described in the Specifications, and as required to construct a fully operating system.

B. Each unit shall be complete as specified herein and shall utilize new concrete tank(s) to form the SBR basin(s) and common equalization basin.

C. Related Sections
   1. General Conditions, Supplementary Conditions, and General Requirements sections apply to work of this Section.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)

B. American Society of Testing and Materials (ASTM)
   1. A36 - Standard Specification for Structural Steel
   2. A48 - Standard Specification for Gray Iron Castings
   3. A53 - Standard Specifications for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   4. A325 - Standard Specifications for High-Strength Bolts for Structural Steel Joints
   5. A536 - Standard Specification for Ductile Iron Castings

C. American Society of Civil Engineers (ASCE)

D. American Welding Society (AWS)
   1. AWS A2.4 - Symbols for Welding and Non-Destructive Testing
   2. AWS D1.1 - Structural Welding Code - Steel

E. Steel Structures Painting Council (SSPC)

1.03 SYSTEM DESCRIPTION

A. Each SBR shall be as specified herein and as shown on the drawings and shall consist of, in general, a diffuser system, mixing system, decanter system, sludge wasting pumps, influent valves, effluent valves, level sensors, D.O. probes, electrical controls, and access walkway.

B. Design Summary
   1. The wastewater treatment system specified herein is to treat municipal wastewater having the general influent parameters shown herein and meeting the anticipated effluent requirements stated. The basic system shall consist of two (2) secondary treatment tanks as

shown on the Drawings. The design of the equipment is based on the SBR process for the following parameters:

Parameter	Influent	Effluent
Average Daily Flow	1.25 mgd	
Peak Daily Flow	1.80 mgd	
BOD_5 Average	250 mg/l	10 mg/l
Total Suspended Solids (TSS)	250 mg/l	10 mg/l
TKN	35 mg/l	
NH_3-N Average		2.0 mg/l
Total Nitrogen (TN)		5.0 mg/l
Total Phosphorus (TP)	8.0 mg/l	1.0 mg/l
Site Elevation	720 ft	
Wastewater Temperature, Min.	15°C	
Wastewater Temperature, Max.	25°C	
Air Temperature, Winter	32°F	
Air Temperature, Summer	105°F	

C. SBR Equipment Design Summary

General design features incorporated within the design of the system are as summarized. Modifications to certain parameters may be considered based upon the equipment supplier that is to be utilized by the Contractor. These are provided as a basis of design calculations contained herein.

1. Tank Width, feet 66
2. Tank Length, feet 66
3. Tank Height, feet 23
4. Tank High Water Level, feet 21
5. Tank Low Water Level, feet 15.41
6. Blower Motor Size, min. hp 60
7. Mixer Motor Size, min. hp 30
8. Decanter Maximum Flow Rate, gpm 3,749
9. Decanter Design Flow Rate, gpm 2,107
10. Electrical Classification ..... Non-Hazardous

1.04 SUBMITTALS

A. Refer to Section 01330 for shop drawing submittal requirements.

B. Submit shop drawings and manufacturer's data showing treatment equipment size, layout, piping and any special requirements prior to proceeding with work. Submit complete wiring diagrams, terminal connections, interior component layout and front layout on the electrical control panel and its control logic. Equipment included in this submittal shall include, but is not limited to:

1. Fabricated Units and Their Components
2. Diffuser assemblies
3. Blowers
4. Mixers

5. Pumps and Motors
6. Pump Slide Rail Assemblies
7. Decanter Drive Units
8. Valves
9. Electrical Control Panel and Components

C. Review of the shop drawings shall not relieve the Contractor from the responsibility of proper fitting and construction of the work, nor from furnishing materials and work required by the Contract that may not be indicated on any drawings.

D. As work progresses, the Contractor shall record in red ink on a set of black and white prints of the Contract Drawings the "as-built" locations, sizes, elevations, identifications, etc. of all piping, service trenches, equipment, etc. The prints shall be kept in good conditions at all times. Dimensions and elevations shall relate to datum references established for the project. Required information shall be certified by signature on the prints maintained by the Contractor.

1.05 OPERATION AND MAINTENANCE MANUALS

A. Upon completion of no less than 60 percent of the work and at least 60 days prior to the date set for final inspection, the Contractor shall submit to the Owner five (5) Operation and Maintenance Manuals for all mechanical and electrical systems and equipment furnished for the project. The manual shall include all installation, operation, start-up and maintenance instructions. The data contained in the manuals shall consist of catalogs, brochures, bulletins, charts, curves, schedules, parts, lists, assembly drawings, wiring diagrams, lubrication instructions, preventive maintenance measures, approved working drawings, and all other information necessary for the Owner to establish an effective operating and maintenance program.

B. The manuals shall be 8 1/2-in. by 11-in. bound in 3-ring loose-leaf binders and indexed. Oversize drawings shall be folded to the above dimensions and placed in envelopes bound at the rear of the manuals. Digital copies of this data shall be provided to the Owner in a suitable electronic format including USB drive or similar media.

C. The manual shall be prepared to assist the Operator and/or Owner in understanding the functions, capabilities, requirements and limitations of the equipment as well as to provide guidance in operation and maintenance. Technical and maintenance information from original manufacturers of mechanical and electrical components shall be included when available. The manual shall include, but not limited to, the following elements:
1. Operation Responsibilities
2. Plant Safety
3. Theory of Operations
4. Process Design Criteria
5. Operational Modifications
6. Start-up and Operational Procedures
7. Component Equipment O&M
8. System Equipment Drawings, As-Built
9. Electrical Schematics, As-Built

D. Approval of Manuals: Acceptance will not be reached until approved Operation and Maintenance Manuals have been submitted. Partial approvals will not be made.

1.06 QUALITY ASSURANCE

A. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single manufacturer. The equipment manufacturer shall, in addition to the CONTRACTOR, assume the responsibility for proper installation and functioning of the equipment.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. The sequencing batch reactor system shall include all necessary equipment and appurtenances to form a complete and functioning system and shall be as manufactured by:
   1. Aqua-Aerobics Systems, Inc.
   2. Lakeside Equipment Corporation
   3. Fluidyne
   4. Or Engineer Pre-Approved Equal

2.02 DIFFUSER ASSEMBLIES

A. Materials
   1. Welded Stainless Steel Components:
      a. Sheets and plates of Type 304L stainless steel conforming to AISI 304L and ASTM A240.
      b. Limit carbon content to 0.30% maximum.
   2. Non-welded Stainless Steel Components:
      a. Sheets and plates of Type 304 stainless steel conforming to AISI 304 and ASTM A240.
   3. Fasteners and Anchorage Components:
      a. 18-8 series stainless steel.
   4. PVC Pipe and Fittings (Schedule 40 and 80):
      a. Base material shall be ASTM D-1784.
      b. Pipe shall be manufactured in accordance with ASTM D-1785 and ASTM D-2665.

B. Aeration Equipment
   1. System Performance:
      a. The aeration-mixing system shall be designed to meet the following:
         1) AOR = 240 pounds oxygen per hour
         2) SOTE = 29.75 %
         3) Airflow = 1910 scfm maximum
         4) Discharge Pressure = 8.93 psig
         5) Design Diffuser Submergence = 19.29 feet maximum
      b. The diffusers shall not exceed the following:

1) Air Fluxrate = 0.12 scfm/ft2 of active diffuser surface area at the design airflow.
2) Active Surface Area = 464.64 ft2 minimum
    i. Active surface area shall be defined as the net perforated area of the media or membrane and shall reflect only that portion of the membrane which can be demonstrated to produce uniform air discharge under the full operating range proposed for the diffuser.

2. Flexible Membrane, Fine Pore Diffusers:
    a. A flexible membrane, fine pore diffuser assembly shall be furnished and installed.
    b. Each diffuser assembly shall be factory assembled and include two diffuser units and mounting saddle.
    c. Diffuser units shall have nominal dimensions of 4.5 inches in diameter and 53.5 inches long.
    d. The diffuser membrane shall be fully supported over full length and circumference with a 4.5-inch PVC membrane support frame.
        1) Use of a non-fully supported diffuser membrane is not acceptable.
    e. The diffuser support frame shall be approximately 53.5 inches long and have a full diameter mounting connection.
        1) Use of non-full diameter mechanical connections including threaded connections is not acceptable.
    f. The diffuser membrane shall be held in place by two 304 stainless clamps.
        1) Retainer clamps shall be crimp type. Worm gear type clamps are not acceptable.
    g. Installation of the diffuser membrane shall be accomplished with the removal and installation of the membrane clamps.
        1) Disassembly of diffuser assembly to remove and install membranes is not acceptable.
    h. Individual diffuser units shall be provided with an internal end cap.
    i. The diffuser unit shall be fully capable of operating under continuous or intermittent conditions and shall be designed with check valve capabilities to prevent entry of mixed liquor into the diffuser unit or air piping on air shutdown or interruption of air supply. A minimum of three (3) check valve features shall be provided, not limited to the following:
        1) Membrane shall be elastic and allow openings to close when the air supply is interrupted.
        2) Membrane shall contract and close around full diameter support frame.
        3) Membrane shall employ a non-perforated section that is aligned and seals against the support frame, air distribution orifices.
        4) Use of independent or internal check valve components is not acceptable.
    j. Diffuser assemblies shall be completely factory assembled with diffuser units, membranes and mounting saddle factory installed.
        1) Field solvent welding or assembly of diffuser is not acceptable.
    k. Diffuser assemblies shall be shipped to the jobsite assembled and properly crated and protected for shipment and handling.

l. Diffuser saddle mount shall be ABS or PVC construction and shall be capable of withstanding an external force of 7,500 inch-pounds without structural failure of the air distribution pipe, diffuser unit connection or mounting saddle.
    1) Small diameter threaded connections to attach diffusers to the air distribution header are not acceptable.
    2) Saddle mount shall fully encompass the air distribution header and reinforce the pipe section at the diffuser assembly connection.
    3) Alignment plug shall be provided to ensure proper alignment and resistance to rotation.
    4) An O-ring gasket shall be provided to ensure an airtight seal between the mounting saddle and air header.

m. A minimum 3.5-inch diameter connection shall be provided between the saddle mount and diffuser assembly.

3. Flexible Membrane:
    a. Membrane material for the diffuser unit shall be polyurethane.
    b. Alternate membrane materials are not acceptable.
    c. Membrane shall be extruded in a single piece with the following characteristics.
        1) Membrane shall be 117 mm inside diameter with an overall length of 1359 mm.
        2) Perforated length on diffuser membrane shall be 1308 mm.
        3) Membrane shall be perforated on the top half of the sleeve.
        4) Non-perforated membrane section shall be provided to seal off air distribution orifices on the diffuser support structure.

4. Aeration System Piping:
    a. Out-of-basin air piping including blower manifold, air header, and header stubs are required and are to be supplied by the Contractor.
        1) Header stubs shall extend to the inside top of the wall and terminate with a full diameter, horizontal face flange.
        2) Out-of-basin piping may be unlined ductile iron, galvanized steel, stainless steel, or painted carbon steel.
        3) The Contractor shall provide an isolating/balancing valve for control and distribution of air to the aeration grid and to allow isolating of the grid for inspection and maintenance on the header stub.
        4) Isolation/balancing valve shall be positioned for accessibility from the top of the tank.
    b. Drop pipe shall be provided with a flanged top connection and plain end.
        1) Drop pipe shall extend from the top connection to within 2 feet of the air manifold.
        2) Material of construction for the drop pipe shall be schedule 5, stainless steel.
        3) Drop pipe shall connect to air manifold piping by means of a wrap-around clamp adapter.
    c. All submerged manifolds and header components shall be Schedule 40 PVC minimum.
        1) Use of PVC piping shall only be employed when the expected mean wall temperature is less than 140°C. If temperature exceeds this limit,

alternate materials shall be used or cooling loops added until the temperature is at the appropriate level.

2) Use of PVC piping shall only be employed when diffuser mounting system reinforces pipe wall at each mounting location.

3) Use of non-reinforced diffuser connections including threaded diffuser mounts is not acceptable.

d. Pipe supports shall be all stainless-steel construction.

1) Supports shall accommodate longitudinal movement in the piping components due to the thermal expansion and contraction over a temperature range of 100°F.

2) Supports shall restrain the axial and rotational movement of the pipe while providing for unrestrained longitudinal movement.

3) Supports shall allow leveling of the air piping with 2-inch minimum vertical adjustment at each support.

4) Each pipe support shall be connected to basin floor by at least 2 anchor bolts.

5) The integrated pipe support assembly shall be designed to withstand the associated uplift force of the piping and diffuser assemblies with a minimum design factor of safety equal to ten (10).

2.03 BLOWERS

A. The manufacturer shall furnish for off plant mounting the following blower assemblies which shall be completely factory built and tested before shipping.

B. All blower units shall be shop-mounted on a compact base frame supporting both the compressor and the electric motor, integrated with patented reactive outlet silencer and transmission belt tensioning device, made in high strength steel plate. Each unit shall consist of a positive displacement blower, TEFC electric motor, V-belt drive, a common base and a sound-attenuation housing.

C. Each positive displacement blower shall have:

1. Impellers shall be solid three lobe design to reduce pulsations and noise, with integral shafting, produced from close grain ductile iron. Impellers shall be machined on all exterior surfaces to a precise contour for operating at close clearances and high efficiency operation. Impellers shall be dynamically balanced to minimize vibration.
2. Impeller housing shall be strongly ribbed one-piece design to prevent case distortion when operating at rated pressures. The housing shall be of high strength cast iron and precision machined for close clearance operation. End plates shall be high strength cast iron with precision machined bearing fits to assure exact positioning of impellers in the main body housing.
3. Side-covers reinforced with ribbing to resist induced loads from shafts, made in high strength grey cast iron G 250 EN 156.
4. Bearings shall be double row ball bearings on the gear end. Cylindrical roller bearings shall be on the drive shaft free end to accommodate belt loading. A deep groove ball bearing shall be located on the non-drive shaft free end.
5. A maximum peripheral speed of the lobe head below 40 m/s (131.2 feet per second).
6. Timing gears shall be helical design and machines from high strength allow steel for precision timing, quiet operation, and long life.

7. Air seals of controlled flow design shall be piston ring type seals precision fitted to each impeller shaft to minimize air leakage and maximize efficiency. Oil seals of piston ring and oil flinger design shall be provided on each internal impeller shaft to prevent leakage from the oil reservoirs. The drive seal shall be a high temperature elastomer lip type seal to prevent oil leakage from the oil reservoir.
8. An oil seal on each shaft, without sliding parts and wear free coupled with labyrinth seal to prevent the leaking of oil vapor into the air chamber of the blower.
9. An oil seal on the drive shaft by means of lip seal ring in high strength rubber (VITON) and hardened and ground shaft protection sleeve to ensure extended working life.
10. Lubrication of timing gears and bearings shall be a dual splash lubrication system. Steel splash plates shall be directly fastened to the impeller shafts to provide positive oil lubrication at all operating speeds.
11. One (1) check valve, one (1) manual butterfly valve, one (1) set of belts, one (1) inlet filter, one (1) inlet silencer, one (1) discharge silencer, one (1) pressure gauge, and one (1) pressure relief valve.

D. The following minimum design criteria shall be used in sizing the blowers, final blower sizing shall be based on SBR manufacturer's system calculations:
1. Number of blowers 3
2. Process air flow, scfm 1910
3. Discharge pressure, psig 8.93
4. Installation elevation, ft MSL 720
5. Inlet air temperature range, °F ..... 32 to 100
6. Maximum allowable HP 60

E. Each blower assembly shall be mounted on a frame. A compact base frame supporting both the compressor and the electric motor, integrated with patented reactive outlet silencer and transmission belt tensioning device, made in high strength steel plate. Anti-vibration mounts capable of withstanding compression and shear loads with vibration damping level > 80% shall be incorporated.

F. An asynchronous three-phase electric motor with squirrel cage rotor constructed in compliance with NEMA standards shall be supplied with the following:
1. A high efficiency motor suitable for operation with 460 volt/ 3 phase/ 60 hertz supply voltage.
2. A minimum protection grade IP 54.
3. A cooling system TEFC casing cooled with external fan on the shaft.
4. An assembly arrangements IM B 3 or NEMA F3 location (with terminal box at the top).
5. An insulation class F.
6. An over-temperature class B.
7. A minimum service factor 1.15.
8. A drive side bearing to support the radial load induced by the V-belt transmission.

G. Each blower assembly shall be furnished with a weather tight sound attenuating enclosure (provide 15 DBA noise reduction).
1. A hood made up of modular self-supporting panels in galvanized plate type Z200 EN 10142 suitable for outdoor installation.

2. Sound-absorbing material consisting of open cell polyurethane foam thickness 50 mm (2") with profiled finish, fire resistant according to ISO 3795 (MVSS TN 302).
3. Perimeter panels supported directly on the ground and detached from the structure of the blower package to eliminate the transmission of vibrations (noise) from the package to the panels.
4. A seal between panels by means of special rubber joints to ensure airtight closure in order to allow outdoor installation.
5. Hood ventilation with auxiliary electric motor driven fan, 1 phase 60 Hz, with integral starter/overload and integral thermostatic control, ensuring the extraction of hot air from inside the hood independently of the rotation speed of the compressor and even after the compressor stop.
6. A hood air inlet and outlet ducts silenced with a lined single-chamber plenum and lined bends.
7. Access for routine maintenance operations from the front side of the blower package by opening the hood.
8. Blower discharge pipe on opposite side to the front of the blower package.

B. Discharge Pressure gauge for measuring the outlet pressure, diameter 63 mm (2.5 inches) in glycerine bath, precision class 1.6, dial with scale 0 / 1.6 bar (23.2 psi) relative. Scales for bar & psi included on dial face.

C. Manufacturer
1. The blower units shall be as manufactured by:
a. Gardner Denver
b. Kaeser
c. Aerzen
d. Approved equal

2.04 AIR CONTROL VALVES

A. Furnish operated butterfly valve(s) to control the air flow as outlined herein.
1. Valve quantity, shared for all SBR basins 2
2. Valve size, inch 6
3. Connection type ..... Lug style
4. Valve seat..... Viton
5. Disk ..... SS
6. Actuator power, phase ..... Single
7. Actuator type, service ..... Open/Close
8. Compartment heater ..... Yes

B. Furnish electrically operated butterfly valve(s) as specified above to direct the airflow. Valve actuator shall include motor winding protection, manual override, and limit switch feedback in the open and closed position. Actuator(s) include local controls consisting of pushbutton(s), selector switch(es), and light(s).

C. CONTRACTOR shall provide provisions for valve access.

2.05 FLOATING MIXERS

A. Mixer Drive Motor
   1. The motor shall be rated as outlined in 1.03, C and shall be wired for 230/460Volts, 60 Hz, three phase service.
   2. Protection class shall equal or exceed IP 55.
   3. The motor will be totally enclosed, fan cooled, and rated for severe chemical duty, with all cast iron motor construction: conduit box, motor frame, end shields, and fan cover. Drip cover shall be constructed of stamped steel.
   4. The motor shall in all cases equal or exceed NEMA standard specifications.
   5. The motor windings shall be non-hygroscopic with tropical protection. Motor windings and rotor shall be epoxy coated.
   6. The motor insulation shall meet or exceed NEMA class F with class B temperature rise providing a service factor of 1.15.
   7. One condensate drain shall be located at the lowest point in the lower end-bell housing.
   8. All motor frame parting surfaces shall be deep registered and silicone sealed.
   9. The motor vibration class shall equal or exceed Class R.
   10. All through bolts, nuts and screws shall be corrosion – resistant.
   11. A stainless-steel nameplate shall be provided with each motor and shall be securely fastened thereto, the following data shall be steel stamped or otherwise permanently marked on the nameplate:
       a. manufacturer's name
       b. manufacturing year
       c. motor type and serial no.
       d. power, voltage, speed, current, frequency, efficiency, service factor and power factor
       e. insulation and protection class
       f. motor weight
       g. bearing type

B. Motor Shaft
   1. The motor shall have a one-piece solid shaft, continuous from the top bearing to the point at which the shaft is connected to the impeller. The drive shaft shall not be exposed to wastewater. Extended motor shaft or designs utilizing couplings shall not be accepted.
   2. The motor/impeller shaft assembly shall be sufficiently rigid that no support bearings are required below the motor.

C. Shaft Sealing
   1. The motor shaft will be sealed with an InPro seal.
   2. The motor bearings shall be re-greasable in order to optimize bearing life. The motor bearings shall be designed for a minimum L10 bearing life of 100,000 hours.

D. Motor Terminal Box
   1. The box shall be firmly bolted to the motor frame at four points. The terminal box shall be sized to meet the NEMA standards.
   2. The terminal box shall be of sufficient size to receive two separate four-conductor cables and shall be drilled and tapped to receive two compression watertight IP 68 fittings to accommodate the above electrical service cables.

E. Floatation
   1. Each unit will be equipped with a one-piece float.
   2. Floats shall be constructed of type 304 stainless steel. Fiberglass floats will not be acceptable.
   3. Floats shall be constructed so that all stress imposed from wave action and mooring line tension shall be transmitted from each mooring line to another by pulling across the float in such a manner as not to "flex" the structure.
   4. Floats shall be constructed as a single unit, filled full of closed cell polyurethane foam having a minimum density of 2.0 pounds per cubic foot, and shall be completely sealed watertight.
   5. The float shall be designed with no more than 20% reserve buoyancy to facilitate normal operation and maintenance activities.
   6. The float will have three supports and three or four stainless steel mooring eyes. The eyes shall be welded to the float.

F. Impeller
   1. The impeller shall be of an Archimedes type, designed to pump liquid from near the surface towards the basin floor.
   2. The one-piece impeller shall be fabricated of type 304 stainless steel and shall be dynamically balanced.
   3. The impeller will be hydraulically balanced to assure equalization of load under full load operation. The impeller will be dynamically balanced to a vibration level not to exceed 2 mil peak to peak value.

G. Baffling/Support Legs
   1. Each mixer shall be equipped with type 304 stainless steel flow-straightening baffles or type 304 stainless steel volute designed to properly direct the flow. Baffles shall be mounted below the float.
   2. Each mixer shall be equipped with type 304 stainless steel support legs designed to support the entire assembly. A minimum of 3 such legs shall be supplied, integral with the float assembly.
   3. The unit shall be designed so that no external hydraulic stabilizers are required.

H. Location and Mooring
   1. The anchor cable shall be installed as recommended by the manufacturer so the mixer shall be permitted to rise and fall with water level variations, but will have a minimum of lateral movement.
   2. The maximum amount of anticipated water level variation is noted on the drawings.
   3. A three (3) point or four (4) point mooring system, restrained mooring post systems, or pivoting mooring arm system, as shown on the drawings, shall be used.
   4. All anchor cables and mooring hardware shall be 316 stainless steel.

I. Electrical Service Cable
   1. Each unit shall be furnished with the applicable feet of 8 gauge/four conductor electrical cable. The cable supplied shall be CSA/UL approved for severe environments, suitable for underwater service, and of one continuous length. The cable shall be furnished complete with floats to maintain the cable at the water surface level unless required otherwise by the supplier.

2. The cable shall be jacketed, four conductor, flexible stranded cable with individually wrapped conductors bound together with a non-wicking filler and sheathed in a TPE, PVC, neoprene.

2.06 DECANTER

A. Flotation
   1. Each unit shall be equipped with a one-piece float, fabricated of 304,316 stainless steel, or fiberglass. The float shall be filled with two component closed cell type polyurethane foam and shall be completely sealed watertight.
   2. The float shall be circular, square or rectangular shaped and shall be larger in size than the intake weir in order to prohibit all floating material from being sucked into the overflow weir.
   3. The overflow weir shall be attached to the float by means of 4 guiding bars and 1 central fixation to the actuator. These 4 bars allow the overflow weir to slide up and down to change between open and closed position when activated by the actuator.
   4. The float shall have at least three support legs to allow the unit to stand on the bottom of the basin when the basin is emptied or when the unit is stored outside the basin.
   5. An anti-vortex plate shall be mounted in the overflow weir.

B. Stability
   1. The unit shall have its gravity center under the water line.

C. Location and Mooring
   1. Each decanter shall be located substantially as shown on the engineer's drawings.
   2. The manufacturer shall provide recommendations for the appropriate mooring system, allowing the unit to follow the changes in water level.
   3. All mooring hardware shall be 316 stainless steel.

D. Rigid Pipe Discharge System
   1. The unit can be supplied with a flexible discharge hose or with a rigid pipe discharge system with flexible connections and parallelogram.
      a. Rigid Pipe Discharge System:
         1) Each unit shall be furnished with 12-inch diameter discharge System.
         2) This system consists of three parts of stainless-steel pipe interconnected with stainless steel bars and hinges. Fitted between the three parts of stainless-steel pipe, shall be two parts of 10- Inch diameter flexible hose. Both ends of the discharge system shall have a connection flange for connection to the decanter on one end and to the basin discharge on the other end.
         3) The discharge system will allow the decanter to follow the varying water level to the minimum level and to stand on its support legs if the tank is emptied. If required, the supports will have extensions.

E. Actuator
   1. The linear actuator shall be electrically driven. The power supply shall be 460V-60HZ 3 Phase. This actuator shall have sufficient power to lift the overflow weir and discharge system. At the same time, it must ensure that the overflow weir is pulled against the bottom plate of the float to sufficiently keep it completely closed.

2. If the actuator is not equipped with torque protection, an electric over current protection must be integrated in the electrical control of the decanter to avoid destruction of the actuator should an end switch fails.
3. A signal cable for detection of the open and closed position of the decanter must be included.
4. A cover must be installed over the actuator to protect it against the weather, such as rain or snow.
5. An IP 56 Junction box with the electrical control system of the decanter shall be part of the supply and this junction box shall have sufficient cable length to allow installation on the outside of the basin.

F. Electrical Service Cable
1. An electric cable of type SOOW shall be fixed to the junction box of the decanter for the control and activation of the actuator.

G. Seal
1. The overflow weir shall be fitted with a seal. This seal shall be at least 15mm thick in uncompressed condition to insure a completely closed decanter if the overflow weir is pulled against the bottom of the float by the actuator in closed position.

H. Decant Valve
1. One (1) Effluent Butterfly Valve: Operation shall be 90° from full open to tight shut with operators designed to hold the valve in any intermediate position without fluttering. Valves to be of the tight closing rubber seat type with rubber or other synthetic permanently bonded to the valve body.
2. Automatic Valve Actuators: Electric Motor Operators for valves shall be sized to suit each valve and service, and shall include NEMA 4 weatherproof enclosures with limit switches and condensation heater.
3. The Valves furnished shall be suitable for the service intended and, in general:
    a. Shall open clockwise or to the left
    b. Shall be of the same manufacturer wherever possible
    c. Shall have manufacturer's name and pressure rating clearly marked on the outside of body
    d. Hand wheels or levers shall be provided

2.07 SLUDGE WASTING PUMP

A. Sludge Wasting Pump
1. One (1) Submersible Wasting Pump shall be provided per basin. Each submersible pump shall be capable of handling raw unscreened sewage, shall meet the performance characteristics as outlined below, and shall be properly selected to conform in the intended application. Pump performance criteria for each pump shall be as follows:

    a. Design Rating:.....339 GPM @ 13' TDH
    b. Minimum Motor HP:.....5 HP
    c. Electrical Voltage:.....460 V
    d. Power Characteristics:.....3 Ph, 60 Hz
    e. Impeller Design:.....Non-clog centrifugal

2. Pumps shall have discharge connections with 125# standard cast iron flanged fittings. Internal pump openings and passages shall be of adequate size to pass the minimum sphere solids shown above, as well as any trash or stringy material which can pass through the sewer collection system.

3. Pump Construction:
    a. All major components of the pumping units, including the casing, impeller, suction cover, wear rings, motor frame and discharge base elbow shall be manufactured from gray cast iron, ASTM A-48 Class 30. Castings shall have smooth surfaces devoid of blow holes or other casting irregularities. The casing design shall be a centerline discharge with a large radius on the cut water to prevent clogging. Units shall be furnished with a discharge elbow and 125# flat-faced ANSI flange.
    b. All exposed bolts and nuts shall be AISI 304 stainless steel. Mating surfaces of major components shall be machined and fitted with nitrile Buna rubber O-rings where watertight sealing is required. Machining and fitting shall be such that sealing is accomplished by the automatic compression of O-rings in two (2) planes, ensuring that O-ring contact is made on four (4) surfaces without the requirement of specific torque limits for compression.
    c. All internal and external surfaces shall be prepared to the requirements of SSPC-VISI-SP-3-63, then coated with a suitable zinc-chromate primer. Finish coating for all external pump surfaces shall be Corothane I Coal Tar epoxy, as manufactured by Tnemec.
    d. Pump impellers shall be a radial multi-vane enclosed design, incorporating not less than two vanes. Impellers will be dynamically balanced and shall be designed for solids handling service with a long thrulet, and without acute turns. The inlet edge of the impeller vanes shall be angled toward the impeller periphery so as to facilitate the release of objects that might tend to otherwise clog the pump.
        1) A lip seal shall be located behind the impeller hub to reduce the entry of foreign materials into the mechanical seal area.
        2) Impellers shall be direct connected to the motor shaft with a slip fit, and shall be positively (key) driven, and secured with an impeller bolt. The design shall include a replaceable casing wear ring at the pump suction to maintain working clearances and hydraulic efficiencies.
    e. A hoisting bail shall be provided for each pump, and shall provide for proper balance of the pump when used with a single lifting chain as outlined herein.
    f. The pump shafts of all submersible non-clog pumps shall be sealed against leakage by means of a double mechanical seal in a tandem arrangement. Each seal shall be positively driven and shall act independently with its own spring system. The upper seal shall operate in an oil bath, while the lower seal is lubricated by the oil from between the shaft and the seal faces, and in contact with the pumped media on the outside. The oil filled seal chamber shall be designed to prevent over-filling and include an anti-vortexing vane to ensure proper lubrication of both seal faces. Lower seal face materials shall be silicon carbide, and the upper faces shall be carbon vs. ceramic. Nitrile Buna rubber elastomers, and 304 S.S. hardware shall be utilized. The pump sealing system shall not rely on pumping medium for lubrication.
    g. The mechanical seals shall require no special maintenance or routine unit adjustment, yet shall be easily inspected or replaced. No seal damage shall

result from operating the pump for short periods of time out of the pumped liquid.

4. Pump Motors
    a. Each submersible pump motor will be driven by a motor of the size and RPM as indicated under "Sewage Pumps" Section above, and shall be suitable for operation on electrical service as indicated herein. Each motor and pump shall be suitably connected to comprise an integral pumping unit.
    b. The pump motor shall be an air-filled induction type with a squirrel cage rotor, shell type design, and built to NEMA MG-1, Design B specifications. The use of oil filled motors, with the associated losses of pump efficiency, will not be considered acceptable.
    c. All stator windings shall be copper, insulated with moisture resistant Class F insulation, rated for 311 degrees F. The stator shall be dipped and baked three (3) times in Class F varnish and heat-shrink fitted into the stator housing. Rotor bars and short circuit rings shall be manufactured of cast aluminum.
    d. The motor shaft shall be one piece AISI 403 S.S. material, and shall rotate on two permanently lubricated ball bearings designed for a minimum B-10 life of 60,000 hours. Motor service factor shall be 1.15, and the pump motor shall be capable of sustaining up to twenty (20) non-evenly-spaced starts per hour.
    e. Motors shall be designed for continuous duty pumping at a maximum sump temperature of 104° F. Voltage and frequency tolerances for the motor shall be a maximum 10/5%, respectively. Motor over temperature protection shall be provided by miniature thermal protectors (thermistors) embedded in the windings. Mechanical seal failure protection shall be provided by means of a mechanical float switch located in a chamber above the seal. The seal fail switch shall be comprised of a magnetic float that actuates a dry reed switch encapsulated within the stem. Should the mechanical seal fail, liquid shall be directed into the float chamber, in which the rising liquid activates the switch opening the normally closed circuit. The float switch components shall be 304 S.S.
        1) Moisture switches shall be wired to terminate motor operation should the entry of liquid into the stator cavity is sensed. The use of special purpose relays or low-voltage circuitry is not considered acceptable for moisture sensing.
        2) Thermal and moisture sensing devices shall be suitable for operation on 120VAC control voltage, and shall be wired to the control panel by the contractor. Individual pilot lights shall be provided on the inner door of the control panel to alert maintenance personnel to a high pump temperature or moisture alarm condition.
    f. The pump motor shall be non-overloading over the entire specified range of operation, and shall be capable of operating at full load on an intermittent basis while non-submerged without incurring damage to the unit.
    g. The power cable jacket shall be manufactured of an oil resistant chloroprene rubber material, specifically designed for submerged applications. Cables shall be watertight to a depth of a least 65'. Cables shall be length as required to reach the control panel without splicing. The cable entry system shall be comprised of primary, secondary, and tertiary sealing methods.
        1) Primary cable sealing shall be accomplished by means of a cylindrical elastomeric grommet compressed between the motor cover and a 304

S.S. washer. The specified primary seal will prevent leakage around the outside diameter of the cable.

2) Secondary cable sealing shall be accomplished by a compression O-ring made of nitrile Buna rubber. The compression of the O-ring and subsequent sealing shall preclude specific torque requirements. The secondary seal shall prevent leakage through the cable gland area.

3) The cable sealing system shall also include tertiary sealing to prevent leakage into the motor housing due to capillary action through the insulation of the individual conductors if the cable is damaged or cut. At the manufacturer's facility, the cable wires shall be cut, stripped, reconnected with a copper butt-end connector, and totally embedded in epoxy inside the cable gland. This sealing system shall provide a dead end for wicked leakage through the cable insulation to the motor junction box area. The cable entry sealing system shall be the same for both the power and control cables.

5. Automatic Discharge Connection

a. Each submersible pump shall be furnished with a submersible discharge connection system to permit the removal and installation of the pump without the necessity of an operator entering the wet well. The design must insure an automatic and firm connection of the pump to the discharge piping when the pump is lowered into place. The base elbows shall be mounted in the sump as shown on the Plans.

b. The guide rail system design shall include two (2) 304 S.S. Schedule 40 guide rails sized to mount directly to the quick discharge connector (QDC), at the floor of the wet well and to a guide rail bracket at the top of the wet well directly below the hatch opening.

c. Guide bars will be provided by the contractor in accordance with the manufacturer's recommendations. Upper (and intermediate, if required due to depth of the wet well) guide bar support brackets shall be provided by the equipment supplier. The use of guide wire systems is strictly prohibited and will not be allowed.

d. The quick discharge connector (QDC) shall be manufactured of ASTM A48 Class 30 cast iron, and shall be designed to adequately support the guide rails, discharge piping, and pumping unit under both static and dynamic load conditions with support legs that are suitable for anchoring it to the wet well floor. The face of the inlet QDC flange shall be perpendicular to the floor of the wet well. The discharge flange of the QDC shall conform to ANSI B16.1 Class 125 drilling.

e. The submersible pump design shall include an integral self-aligning sliding bracket. Sealing of the pumping unit to the QDC shall be accomplished by a single linear downward motion of the pump. The entire weight of the pump shall be guided to and wedged tightly against the inlet flange of the QDC, making metal-to-metal contact with the pump discharge and forming a seal without the use of bolts, gaskets or o-rings.

f. AISI 304 stainless steel lifting chain shall be provided, along with all required installation hardware (also 304 S.S.) The lifting chain shall be provided with a large lifting eye located a maximum of every three (3) feet along the chain. The lifting chain and intermittent lifting eyes shall be suitable for removing and installing the pump unit.

B. Manufacturer
   1. The sludge wasting pumps shall be as manufactured by:
      a. Ebara
      b. KSB
      c. FLYGT
      d. ABS
      e. Approved Equal

2.08 INFLUENT VALVE

A. One (1) Influent Plug Valve per basin: Plug valves shall be Eccentric Plug Valves with 100% port opening. Valves to be of the tight closing rubber seat type with rubber or other synthetic permanently bonded to the valve body. Seat type to be as approved by the Engineer.

B. Automatic Valve Actuators: Electric Motor Operators for valves shall be sized to suit each valve and service, and shall include NEMA 4 weatherproof enclosures with limit switches and condensation heater.

C. The Valves furnished shall be suitable for the service intended and, in general:
   1. Shall open clockwise or to the left
   2. Shall be of the same manufacturer wherever possible
   3. Shall have manufacturer's name and pressure rating clearly marked on the outside of body
   4. Hand wheels or levers shall be provided

2.09 EQUALITZATION BASIN

D. Structure
   1. The equalization basin shall be field erected as shown on the contract drawings and summarized below:
      a. Tank Width, feet 26
      b. Tank Length, feet 66
      c. Tank Height, feet 23
      d. Tank High Water Level, feet 14.41
      e. Tank Low Water Level, feet 0

E. Transfer Pump
   1. Three (3) submersible transfer pumps shall be provided per basin. Each submersible pump shall be capable of handling raw unscreened sewage, shall meet the performance characteristics as outlined below, and shall be properly selected to conform in the intended application. Pump performance criteria for each pump shall be as follows:
      a. Design Rating: ..... 525 GPM @ 14' TDH
      b. Minimum Motor HP: ..... 7.5 HP
      c. Electrical Voltage: ..... 460 V
      d. Power Characteristics: ..... 3 Ph, 60 Hz
      e. Impeller Design: ..... Non-clog centrifugal

2. Pumps shall have discharge connections with 125# standard cast iron flanged fittings. Internal pump openings and passages shall be of adequate size to pass the minimum sphere solids shown above, as well as any trash or stringy material which can pass through the sewer collection system.

3. Pump Construction:
    a. All major components of the pumping units, including the casing, impeller, suction cover, wear rings, motor frame and discharge base elbow shall be manufactured from gray cast iron, ASTM A-48 Class 30. Castings shall have smooth surfaces devoid of blow holes or other casting irregularities. The casing design shall be a centerline discharge with a large radius on the cut water to prevent clogging. Units shall be furnished with a discharge elbow and 125# flat-faced ANSI flange.
    b. All exposed bolts and nuts shall be AISI 304 stainless steel. Mating surfaces of major components shall be machined and fitted with nitrile Buna rubber O-rings where watertight sealing is required. Machining and fitting shall be such that sealing is accomplished by the automatic compression of O-rings in two (2) planes, ensuring that O-ring contact is made on four (4) surfaces without the requirement of specific torque limits for compression.
    c. All internal and external surfaces shall be prepared to the requirements of SSPC-VISI-SP-3-63, then coated with a suitable zinc-chromate primer. Finish coating for all external pump surfaces shall be Corothane I Coal Tar epoxy, as manufactured by Tnemec.
    d. Pump impellers shall be a radial multi-vane enclosed design, incorporating not less than two vanes. Impellers will be dynamically balanced and shall be designed for solids handling service with a long thrulet, and without acute turns. The inlet edge of the impeller vanes shall be angled toward the impeller periphery so as to facilitate the release of objects that might tend to otherwise clog the pump.
        1) A lip seal shall be located behind the impeller hub to reduce the entry of foreign materials into the mechanical seal area.
        2) Impellers shall be direct connected to the motor shaft with a slip fit, and shall be positively (key) driven, and secured with an impeller bolt. The design shall include a replaceable casing wear ring at the pump suction to maintain working clearances and hydraulic efficiencies.
    e. A hoisting bail shall be provided for each pump, and shall provide for proper balance of the pump when used with a single lifting chain as outlined herein.
    f. The pump shafts of all submersible non-clog pumps shall be sealed against leakage by means of a double mechanical seal in a tandem arrangement. Each seal shall be positively driven and shall act independently with its own spring system. The upper seal shall operate in an oil bath, while the lower seal is lubricated by the oil from between the shaft and the seal faces, and in contact with the pumped media on the outside. The oil filled seal chamber shall be designed to prevent over-filling and include an anti-vortexing vane to ensure proper lubrication of both seal faces. Lower seal face materials shall be silicon carbide, and the upper faces shall be carbon vs. ceramic. Nitrile Buna rubber elastomers, and 304 S.S. hardware shall be utilized. The pump sealing system shall not rely on pumping medium for lubrication.
    g. The mechanical seals shall require no special maintenance or routine unit adjustment, yet shall be easily inspected or replaced. No seal damage shall

result from operating the pump for short periods of time out of the pumped liquid.

4. Pump Motors
    a. Each submersible pump motor will be driven by a motor of the size and RPM as indicated under "Sewage Pumps" Section above, and shall be suitable for operation on electrical service as indicated herein. Each motor and pump shall be suitably connected to comprise an integral pumping unit.
    b. The pump motor shall be an air-filled induction type with a squirrel cage rotor, shell type design, and built to NEMA MG-1, Design B specifications. The use of oil filled motors, with the associated losses of pump efficiency, will not be considered acceptable.
    c. All stator windings shall be copper, insulated with moisture resistant Class F insulation, rated for 311 degrees F. The stator shall be dipped and baked three (3) times in Class F varnish and heat-shrink fitted into the stator housing. Rotor bars and short circuit rings shall be manufactured of cast aluminum.
    d. The motor shaft shall be one piece AISI 403 S.S. material, and shall rotate on two permanently lubricated ball bearings designed for a minimum B-10 life of 60,000 hours. Motor service factor shall be 1.15, and the pump motor shall be capable of sustaining up to twenty (20) non-evenly-spaced starts per hour.
    e. Motors shall be designed for continuous duty pumping at a maximum sump temperature of 104° F. Voltage and frequency tolerances for the motor shall be a maximum 10/5%, respectively. Motor over temperature protection shall be provided by miniature thermal protectors (thermistors) embedded in the windings. Mechanical seal failure protection shall be provided by means of a mechanical float switch located in a chamber above the seal. The seal fail switch shall be comprised of a magnetic float that actuates a dry reed switch encapsulated within the stem. Should the mechanical seal fail, liquid shall be directed into the float chamber, in which the rising liquid activates the switch opening the normally closed circuit. The float switch components shall be 304 S.S.
        1) Moisture switches shall be wired to terminate motor operation should the entry of liquid into the stator cavity is sensed. The use of special purpose relays or low-voltage circuitry is not considered acceptable for moisture sensing.
        2) Thermal and moisture sensing devices shall be suitable for operation on 120VAC control voltage, and shall be wired to the control panel by the contractor. Individual pilot lights shall be provided on the inner door of the control panel to alert maintenance personnel to a high pump temperature or moisture alarm condition.
    f. The pump motor shall be non-overloading over the entire specified range of operation, and shall be capable of operating at full load on an intermittent basis while non-submerged without incurring damage to the unit.
    g. The power cable jacket shall be manufactured of an oil resistant chloroprene rubber material, specifically designed for submerged applications. Cables shall be watertight to a depth of a least 65'. Cables shall be length as required to reach the control panel without splicing. The cable entry system shall be comprised of primary, secondary, and tertiary sealing methods.
        1) Primary cable sealing shall be accomplished by means of a cylindrical elastomeric grommet compressed between the motor cover and a 304

S.S. washer. The specified primary seal will prevent leakage around the outside diameter of the cable.

2) Secondary cable sealing shall be accomplished by a compression O-ring made of nitrile Buna rubber. The compression of the O-ring and subsequent sealing shall preclude specific torque requirements. The secondary seal shall prevent leakage through the cable gland area.

3) The cable sealing system shall also include tertiary sealing to prevent leakage into the motor housing due to capillary action through the insulation of the individual conductors if the cable is damaged or cut. At the manufacturer's facility, the cable wires shall be cut, stripped, reconnected with a copper butt-end connector, and totally embedded in epoxy inside the cable gland. This sealing system shall provide a dead end for wicked leakage through the cable insulation to the motor junction box area. The cable entry sealing system shall be the same for both the power and control cables.

5. Automatic Discharge Connection

a. Each submersible pump shall be furnished with a submersible discharge connection system to permit the removal and installation of the pump without the necessity of an operator entering the wet well. The design must insure an automatic and firm connection of the pump to the discharge piping when the pump is lowered into place. The base elbows shall be mounted in the sump as shown on the Plans.

b. The guide rail system design shall include two (2) 304 S.S. Schedule 40 guide rails sized to mount directly to the quick discharge connector (QDC), at the floor of the wet well and to a guide rail bracket at the top of the wet well directly below the hatch opening.

c. Guide bars will be provided by the contractor in accordance with the manufacturer's recommendations. Upper (and intermediate, if required due to depth of the wet well) guide bar support brackets shall be provided by the equipment supplier. The use of guide wire systems is strictly prohibited and will not be allowed.

d. The quick discharge connector (QDC) shall be manufactured of ASTM A48 Class 30 cast iron, and shall be designed to adequately support the guide rails, discharge piping, and pumping unit under both static and dynamic load conditions with support legs that are suitable for anchoring it to the wet well floor. The face of the inlet QDC flange shall be perpendicular to the floor of the wet well. The discharge flange of the QDC shall conform to ANSI B16.1 Class 125 drilling.

e. The submersible pump design shall include an integral self-aligning sliding bracket. Sealing of the pumping unit to the QDC shall be accomplished by a single linear downward motion of the pump. The entire weight of the pump shall be guided to and wedged tightly against the inlet flange of the QDC, making metal-to-metal contact with the pump discharge and forming a seal without the use of bolts, gaskets or o-rings.

f. AISI 304 stainless steel lifting chain shall be provided, along with all required installation hardware (also 304 S.S.) The lifting chain shall be provided with a large lifting eye located a maximum of every three (3) feet along the chain. The lifting chain and intermittent lifting eyes shall be suitable for removing and installing the pump unit.

6. Manufacturer
    a. The transfer pumps shall be as manufactured by:
        1) Ebara
        2) KSB
        3) FLYGT
        4) ABS
        5) Approved Equal

2.10 ELECTRICAL CONTROL SYSTEM

A. The SBR manufacturer shall provide a UL508A, PLC based control panel in a NEMA 1 enclosure.

F. All controls necessary for the fully automatic operation of the SBR and supporting equipment shall be provided in accordance with applicable NEMA/IEC standards.

G. The electrical control system shall provide for automatic control of the SBR via timers and high liquid level using a liquid level control system in connection with an adjustable time clock. The SBR shall operate at a pre-determined time sequence or an emergency high liquid level storm flow operation.

H. A pressure transducer level sensing system shall be suitable for an environment as noted in paragraph 1.03 B. The pressure transducer shall be mounted to the wall of the tank. Conduit and fittings shall be field installed between the pressure transducer and junction boxes along with the conduit. Junction box, conduit, and fittings shall be NEMA 4X for a non-rated electrical environment as noted in paragraph 1.03 B.

I. An emergency high level float switch shall be supplied for field installation.

J. Provide three NEMA 4X SS junction box with intrinsically safe relays for the SBR #1 transducer and float, SBR #2 transducer and float, and the Post EQ basin transducer and float.

K. Provide a 15” HMI Screen on front of SBR panel displaying all SBR processes and all non-SBR processes as shown on drawings E-109, E-110, and E-111.

L. The SBR control panel shall provide 120V power via fuse blocks or breakers for all equipment shown on drawings E-109, E-110, and E-111, including, but not limited to: the three intrinsically safe level barriers junction boxes, DO Probes, SBR air valves (x4), SBR influent valves (x2), decanter and decant valve, and the two 12” magnetic flow meter transmitters.

M. Starters and/or VFDs will be located in a contractor-provided MCC as indicated on electrical plans.

N. A main control panel suitable for wall mounting shall contain the following items:

1. Door interlocked fused disconnect
2. Allen Bradley programmable logic controller (PLC), with Ethernet IP network port(s) as required for monitoring/control by the associated plant SCADA system, relays and

timers to monitor equipment-mounted electrical devices and to perform necessary logic functions. The control panel supplier shall provide a network Register Map to the SCADA system integrator.

3. Control power transformer fused primary and secondary with 120 VAC transient voltage surge suppressor (TVSS)
4. HAND-OFF-AUTO selector switches for the following:
    a. Blowers
    b. Mixer
    c. Sludge Wasting Pump
    d. EQ Transfer Pumps
5. OPEN-CLOSE-AUTO selector switch for Influent Valve
6. OPEN-CLOSE-AUTO selector switch for Decant Valve
7. E-STOP pushbutton (Red)
8. CYCLE/RE-SET pushbutton (Black)
9. Full-voltage LED pilot lights for the following:
    a. Control power ON (White)
    b. Blowers RUN (Green)
    c. Mixer (Green)
    d. Sludge Wasting Pump RUN (Green)
    e. EQ Transfer Pumps RUN (Green)
    f. Multifunctional overload shutdown FAULT (Red)
    g. High water level ALARM (Red)
10. Non-resettable elapsed time meter for the Blowers, Mixer and the sludge wasting pump motors
11. Remote dry contact outputs for the following:
    a. Blowers RUN
    b. Mixer RUN
    c. Sludge Wasting Pump RUN
    d. EQ Transfer Pumps RUN
    e. Multifunctional overload shutdown fault ALARM
    f. High water level ALARM
12. White phenolic nameplates with black lettering
13. 600 VAC terminal block
14. U.L. panel label per the application
15. In addition to all discrete/analog inputs and outputs required for the SBR system, the manufacturer shall provide all discrete/analog inputs as shown on drawings E-109, E-110, and E-111, including, but not limited to:
    a. AI = Lagoon Cell 1 Level
    b. AI = 12” Flow from Pump Staiton
    c. AI = 10" Effluent Flow from Post Eq Basin
    d. AI = UV Intensity from existing UV System
    e. 3DI = Bar Screen Run, Fault, and High Level
    f. 3DI = UV Ready, Lampe Fail, Common Fault
    g. 1DI = Influent Sampler Common Fault
    h. 3DI = UV Supply Pump Ready, Run, and Common Fail
    i. 9DI = Influent Pump Station Pumps 1, 2, 3 Run, Fault, High Level, Low Level, and Common Fault

j. 2DI = ATS in Normal and Emergency Position
k. 3DI = Generator Run, Fault, Low Fuel
l. 3DI = 12" SBR Actuated Valve (Controls Flow to SBR Basin) 100% Open, 100% Closed, Remote Position
m. 2DO = 12" SBR Actuated Valve (Controls Flow to SBR Basin) Call to Open and Call to Close
n. 3DI = 12" Odenville Actuated Valve (Controls Flow to Cell 1 Lagoon) 100% Open, 100% Closed, Remote Position
o. 2DO = 12" Odenville Actuated Valve (Controls Flow to Cell 1 Lagoon) Call to Open and Call to Close

All signals shall be properly displayed on the HMI, all faults shall be alarmed, and all flow signals shall be totalized.

16. Provide adjustable timer on front of HMI for the 12" Odenville Actuated Valve and the 12" SBR Actuated Valve
17. The control panel shall include surge suppressors for ALL inputs/outputs leaving the control panel (not including I/O to the MCC). See Specification section 13660 for surge suppressors.
18. The SBR manufacturer shall control the two 12" actuators as follows:

- "SBR Actuated Valve" Mode of Operation (red line):
  - When flow is registered at Odenville flow meter, send "call to close" command to the SBR actuated valve
  - When no flow is registered at Odenville flow meter, send "call to open" command to the SBR actuated valve
  - Display "Valve Open Override" and "Valve Close Override" buttons on the HMI, which when selected, send "call to open" or "call to close" commands to the SBR actuated valve regardless of the status of a "call to run" command associated with the Odenville flow meter. Display notification of the particular "override" condition on the HMI. Maintain the "override" condition until manually removed on the HMI, at which time the functionality shall revert to that described above and the "override" notification shall be removed.

- "Odenville Actuated Valve" Mode of Operation (blue line):
  - At 6:00AM, send "call to open" command to the Odenville actuated valve
  - When totalized flow registered at Odenville flow meter reaches an operator-adjustable set volume, send "call to close" command to the Odenville actuated valve.
  - Display "Valve Open Override" and "Valve Close Override" buttons on the HMI, which when selected, send "call to open" or "call to close" commands to the Odenville actuated valve regardless of the status of a "call to run" command associated with the time of day or the totalized flow. Display notification of the particular "override" condition on the HMI. Maintain the "override" condition until manually removed on the HMI, at which time the functionality shall revert to that described in a-b above and the "override" notification shall be removed.

O. Accessory Equipment

1. A float switch shall be furnished for each SBR reactor and equalization basin and will activate the systems storm mode during high flow conditions. Each float shall be made of high impact, corrosion-resistant polypropylene and designed for use in sewage up to 140°F and capable of withstanding up to 30 feet of head pressure. Each float shall have 30 feet of flexible 18 gauge 3-conductor cord with weight. A stainless-steel float

bracket shall be used to mount each float. Intrinsically safe relays shall be furnished for each float switch and mounted in the control panel.

2. Submersible Level Transducer
    a. A submersible level transducer shall be provided to sense the liquid level of each SBR reactor and equalization basin at the location as shown on the plan drawings and in accordance with the manufacturer's recommendations.
    b. The transducer shall be a 4-20 mADC, 2 wire.
    c. The transducer shall be suspended by its signal cable and pipe mounted to the side of the tank wall.

3. Dissolved Oxygen Probe
    a. A dissolved oxygen probe shall be provided to sense the oxygen level of each SBR at the location as shown on the plan drawings and in accordance with the manufacturer's recommendations. This probe will allow the blowers to be turned on and off to conserve energy or to optimize the aeration for nitrification and denitrification. A corrosion-resistant hinged handrail mounting system shall be provided with each probe and shall be provided with all necessary hardware such that the probe can swivel or pivot for access.
    b. The transducer shall be a 4-20 mADC, 2 wire.

2.11 SPARE PARTS

A. The Contractor shall furnish the following spare parts and store as directed:

1. One (1) - diffuser assembly completely factory assembled.
2. Two (2) – Membrane sleeves and stainless-steel membrane clamps.
3. Twelve (12) oil inspection plug O-rings for the submersible pumps.
4. One (1) of each type mechanical seal used in the pumps.
5. One (1) complete set of all O-rings used in the pumps.

B. All spare parts shall be provided packed in suitable containers for extended storage by the Owner. Any spare parts consumed during equipment startup shall be replaced by the manufacturer without cost to the Owner.

2.12 ANCHOR BOLTS

A. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Bolts, washers and hex nuts shall be 304 stainless steel unless noted otherwise. Anchor bolts shall be J-type embedded, L-type embedded, or epoxy-type. Expansion-type anchors will not be acceptable.

B. Anchor bolts shall be set by template and protected from misalignment by the CONTRACTOR. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout. All miscellaneous hardware shall be galvanized steel.

2.13 SHOP SURFACE PREPARATION AND PAINTING

A. Protect, for life of equipment, surfaces which will be inaccessible after assembly as necessary.

B. Faying surfaces of carbon steel bolted joints which will be inaccessible for field preparation and painting shall be shop coated as necessary.

C. Finish smooth, thoroughly clean, and fill exposed surfaces, as necessary, to provide smooth uniform base for coating.

D. Sharp projections of cut or sheared edges of ferrous metals shall be ground to a radius by multiple passes of a power grinder as necessary to assure satisfactory paint adherence. All welds shall be thoroughly ground smooth in preparation for shop painting.

E. Shop finish electric motors, speed reducers, starters, and other self-contained or enclosed components with oil-resistant enamel.

F. Apply rust preventative compound to all machined, polished, and nonferrous surfaces which are not to be painted.

G. All fabricated carbon steel or cast iron components for submerged service shall be near-white blast cleaned per SSPC-SP10 and given a 2.5 to 3.5 mil dry film thickness coat of Tnemec Series 1 Omnithane Primer.

H. All fabricated carbon steel or cast-iron components for non-submerged service shall be commercial blast cleaned per SSPC-SP6 and given a 2.5 to 3.5 mil dry film thickness coat of Tnemec Series 1 Omnithane Primer.

2.14 SOURCE QUALITY CONTROL

A. All welded joints fully or partially submerged, shall be sealed watertight with continuous welds.

PART 3 - EXECUTION

3.01 FIELD PREPARATION AND PAINTING

A. The CONTRACTOR shall touch-up all shipping damage to the paint as soon as the equipment arrives on the job site.

B. Prior to the assembly all stainless-steel bolts and nut threads shall be coated with a non-seizing compound by the CONTRACTOR.

3.02 INSTALLATION

A. The manufacturer shall schedule one (1) trip to the project site for pre-installation assistance and up to two (2) days on site for CONTRACTOR assistance.

B. After the CONTRACTOR has installed the equipment and the units are capable of being operated, the manufacturer shall schedule one (1) trip to the project site for equipment start-up assistance and up to three (3) days on site for the CONTRACTOR and for operator training.

C. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

3.03 OPERATOR TRAINING

A. Provide operator training for OWNER'S personnel after system is operational. Training shall take place while manufacturer's representative is at the job site for inspection. Operator training shall consist of a minimum of two (2) eight (8) hour day of training with manufacturer’s staff or staffing certified by the manufacturer of the equipment.

END OF SECTION

SECTION 13610

APPLICATION ENGINEERING SERVICES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The General Provisions of Section 13400 shall apply to this section.

B. All work in this Section shall be the product of the Process Instrumentation and Control Supplier (PICS). Sub-suppliers and/or manufacturers may provide components, and/or services to the PICS, but the final product shall conform to this specification and shall be the sole responsibility of the PICS.

C. The PICS shall provide all applications programming and services required to achieve a fully integrated and operational system. The PICS shall coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other sections of these Specifications and with related existing equipment.

D. Auxiliary and accessory programming structures necessary for system operation or performance shall be included whether or not they are specified or shown on the Contract Drawings.

E. All equipment shall be controlled in full conformity with the Specifications, Drawings, engineering data, instructions and recommendations of the equipment manufacturer.

F. To facilitate the Owner's future operation and maintenance requirements, all programming and operator interface development shall utilize standards as agreed upon by the Owner and Engineer.

G. The PICS shall coordinate and schedule all testing procedures with the General Contractor.

H. Refer to electrical and instrumentation drawings for I/O requirements.

1.2 RELATED WORK

A. Refer to Section 13400.

B. Refer to Section 13420

C. Refer to Section 13660

1.3 SUBMITTALS

A. Refer to Section 13400.

B. Submittals listed below shall be provided, as a minimum. Each submittal must be complete in order to be reviewed by the Engineer.

1. Preliminary Graphics Submittal

2. Testing - Refer to Section 13400.

3. Training - Refer to Section 13400.

4. O&M Manuals - Refer to Section 13400.

1.4 SYSTEM DESCRIPTION

A. The PICS is responsible for providing all applications programming and configuration services to accomplish the control and monitoring functions described in the Specifications and Contract Drawings. The PICS shall provide all programming functions. The PICS shall also provide all application programming and configuration services necessary to produce the HMI graphic displays, reports, trends, historical archive, etc. as described in the Specifications and Contract Drawings.

B. PICS shall develop and provide twelve (12) customized graphic displays (not including standard trends, pop-up windows, HMI supplied displays, etc.) to illustrate the entire plant process control system. All graphic displays shall be designed by the PICS utilizing the HMI software and shall be approved by the Engineer/Owner. These displays shall be prepared and submitted for review at the second coordination meeting. The displays shall represent all process control systems and all associated equipment, pumps, valves, gates, feed systems, filters and auxiliary systems. The PICS shall establish a consistent process control philosophy, standard graphical layout and standard graphical symbolic representation for all displays. The PICS shall provide the following list of displays as a minimum:

- Plant Overview Menu (Plan View)
- System/Communications (SCADA Block Diagram)
- Flow Summary
- Headworks / Influent Pump Station
- SBR System (Copy from SBR Manufacturer)
- UV
- Sludge Press
- Trends, Alarms, Historical Data

1.5 PROGRAMMING AND CONFIGURATION GUIDELINES AND DELIVERABLES

A. Real Variables Processing

1. Real variables shall represent process data for which there are analog signal inputs to the system. The system shall sample each of these input signals at the selected scan frequency and perform the proper conversions and scaling to obtain the instantaneous engineering values. These values shall be used to update real-time data on HMI displays, check for alarm conditions and store for use in historical files.

2. The instantaneous values of all variable data shall be displayed on the appropriate HMI display and shall be added to the historical database whenever the present value exceeds a preprogrammed compression dead band. The compression dead band will be field adjusted by the PICS to provide for maximum storage utilization.

3. Variables such as rate of flow, weight and kilowatt usage shall have their instantaneous values integrated with respect to time and their quantities totaled before archiving.

4. Alarm conditions shall be stored in a separate historical file. In addition, the last 500 alarms shall be displayed on the alarm graphic display. The alarm storage format shall be an alarm description, true time of occurrence, and tag number.

B. Manual Input Data Handling

1. The application software shall provide the capability to manually enter data from any operator's computer keyboard. This data shall consist of additional values for the current data file (e.g., laboratory analyses), inserting alarm limits, set point changes, adjustment to process constants, control system set point changes and system tuning parameter adjustments.

2. All manually entered data shall be entered and stored in the appropriate engineering units. All data entered shall be displayed for confirmation on the data entry device prior to incorporation to the database.

C. HMI Graphic Displays

1. All displays shall contain and continuously update the displayed process variables, date and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers.

2. The HMI displays shall make maximum use of the colors available. Color for status such as open/close, start/stop shall be the same as the indicators used on the existing process control system. PICS shall have designated colors for Influent, Effluent, RAS, WAS, Process Air, Raw Sewage, Thickened Sludge, etc. All colors shall be approved by the Owner.

3. The HMI displays shall be interlinked for easy and direct operator call up. They shall be available for viewing be either entering the display name (via keyboard) or via a "hot spot" on the current display screen (mouse driven cursor movement and pick button). All displays shall have "hot spots' for, at a minimum, the Alarm Summary display, Plant Overview Menu display and the Summary Menu display.

4. The system shall allow the operator to manually control the status of pumps, valves, etc. via either keyboard entry or the currently displayed graphic display. The status change shall require a secondary acknowledgement (action confirmation) by the operator before the command is processed.

5. Unless specifically noted, all timers, set points, alarm actuation levels, etc. shall be operator adjustable from the HMI.

6. Menu displays shall be provided as a guide to the available display options. The menu displays shall be a complete and logical listing of the names and number of all displays.

7. Graphic displays shall depict basic process schematic diagrams with representative symbols for pumps, tanks, etc. combined with real time process variables or conditions. The equipment represented on the display shall be suitably titled for identity. The displays shall be dynamic (i.e., symbols for a pump shall change color indicating run or stop or alarm, the volume of tanks shall be indicated by varying the height of the interior color of the tank symbol, etc.). Its name and tag number shall identify the data on the display. All of the current data in the database shall be available for graphic displays. It shall be possible to easily modify an existing display or generate a new display. The graphic displays shall consist of a single master plant flow schematic and multiple sub-displays detailing specific plant systems or elements. The process graphic displays shall consist of Master, Area and System displays. The Master and Area displays shall show general graphic representations of the facility covered with general equipment, alarm, analytical summaries and control capabilities. The System display shall detail all relevant aspects of the individual equipment or system (i.e., an individual pump). The intent is to provide the operator with an overview (Master) with the capability of "zooming in" on a process (Area) or a piece of equipment (System) as necessary. The PICS shall use the Instrumentation and Piping Diagrams as part of this Contract to generate the graphic displays. All process variables shall be displayed on their associated display (s) in engineering units. The Engineer/Owner shall approve color standards for the equipment symbols, process piping, etc..

8. Analog trend displays shall display the value of a minimum of eight (8) assigned points versus time. The intent is to depict the type of plot produced on an analog recorder on the HMI display. Each point shall be trended in a different color. Each of the assigned points shall have a point identification number, point name, point description, current value and instrument range display in the color used for its trend. The time period shall be selected and be either current or historical. The time period selected and time and date of start shall be displayed. The values displayed on a historical trend shall consist of the stored values for each variable trended. Current trends shall be updated at the scan frequency of the variable. A trend display shall not be considered a graphic display.

9. Manual laboratory data summary displays shall consist of all laboratory inputs, displaying the tag numbers, tag name, the current value and the date and time that the value was entered.

10. Alarm summary displays shall consist of all points currently in alarm and shall include the tag number, description, true time of occurrence and present status, (high, low, normal, etc.). The alarm summary shall identify alarm points by severity (event, attention, caution and urgent) by utilizing distinct colors for each severity category. The severity classification shall be easily changeable by the Owner.

11. System status displays shall summarize the error status of all system devices capable of reporting errors to the CPU (i.e., printers, communication devices, etc.). The display shall indicate if an error is detected or a failure occurs. It shall also allow assignment of those items capable of acting as back up to other devices. These displays shall be used primarily for maintenance purposes.

12. Single point configuration / status displays shall be of the HMI software manufacturer's standard format.

D. Alarm / Equipment Status Reporting

1. The alarm log shall display all alarms as they occur. The alarm message shall include the time occurrence, tag name, tag number and whether it is a low, high or failure alarm. When the point in alarm returns to normal, the time, point identification number and "return to normal" shall be displayed. All reports shall include the plant equipment number of the associated device.

2. Equipment status shall be logged whenever a change in status occurs (i.e., start, stop). The status monitoring shall be capable of being disabled and/or suppressed from the operator workstation. The equipment status log shall include the time, equipment name, tag number and the particular change in status.

3. All alarms and events shall be displayed on the display and archived. No alarm or event shall be printed automatically; however, alarms and events shall be available for printing on demand for operator-specified time periods. Alarm information shall consist of point identification number, point name, time of occurrence and type and priority of alarm.

4. All alarms shall be placed in a separate historical file and be easily accessible for use as needed. The PICS shall maintain ninety (90) days of "as logged" raw data and twelve (12) months of partially compressed raw data on the server. The PICS shall recommend the number of additional days or month's data may be retained based on the capacity of the new system.

5. The equipment and point status summary report shall log the status of all points in the system, including contact inputs, real variables with analog inputs and calculated variables. When required this printout will be initiated manually and shall consist of the tag number, tag name and its current status (i.e., Running, Off, High, Low, Active, Disabled, On-scan, Off-scan, etc.).

6. The summary printout shall summarize all alarms for the previous 24-hour period. Normally, this printout shall be initiated manually but provision shall be made so that it may be initiated automatically every day, if desired. The printout shall be generated on-line from stored data. This printout shall consist of all data in the initial alarm occurrence and return to normal, as specified.

7. The current alarm summary printout shall print all points currently in alarm. This printout shall be initiated manually, as required. The printout shall be generated on-line from stored data. This printout shall consist of all points currently in alarm.

8. The capability shall be provided to sort both daily and current alarm summary reports by operator defined groups. (i.e., print all power failure alarms, etc.).

9. The alarm summary printout shall be initiated manually, as required, be generated from stored data on the server and shall consist of the point identification number and the point name.

E. Historical Data Management.

The following features shall be provided for processing and storage of system historical data:

1. Data Processing and Storage. The real time instantaneous values shall be stored in a historical log file on the server. The PICS shall maintain ninety (90) days of "as logged" raw data and twelve (12) months of partially compressed raw data on the server. The PICS shall recommend the number of additional days or month's data may be retained based on the capacity of the new system.

2. Data Archiving. Historical data shall be automatically alarmed and stored on the harddrive. The intent is to ensure that a long-term record of historical information is available to support future studies, etc.

3. Each system point (analog or digital, real or pseudo) shall have the capability of being historically logged. A point shall have the capability of being deleted from the historical log at any time. It shall be easy to add or delete system points using minimal keystrokes.

4. Displays used for historical analysis (such as historical trends, alarms/events summary, etc.) shall have similar capabilities to those used for real time data review. The source of data shall be the HMI's database.

5. The ability to produce ASCII and CSV files which can be used in most of the commercial spreadsheet programs (e.g., Lotus and Excel) and database programs (e.g., Paradox, Oracle, Access) shall be provided.

F. Report Definition.

1. Exact report formats and data to be reported shall be determined by the Owner and be developed by the PICS.

PART 2 PRODUCTS

A. The Human Machine Interface shall be the latest version of Wonderware or Intellution.

PART 3 EXECUTION

3.1 TESTING

A. Refer to Section 13400.

B. In addition to the tests specified in Section 13400, perform the following:

1. Building and loading the database

2. Conduct online modifications to the database

3. Demonstrate operability of the interfaces (hardware and software)

4. Demonstrate all system software functions specified

5. Demonstrate operability of all process control strategies, graphic screens and reports

6. Verify the displays and all interactive capabilities of the operators workstations

7. Simulate selected operating conditions to verify the performance of the monitoring and control functions

8. Demonstrate the performance of the historical database

9. Demonstrate the performance of the alarm and event logging system

10. Demonstrate the ability to share data between operator workstations

11. Demonstrate the ability of each workstation to print reports and graphic displays

12. Demonstrate the ability for each workstation to read and write to and from designated files from other workstations over the LAN

SECTION 13660

SURGE PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Comprehensive surge protection for all instrumentation devices supplied as part of these Specifications.

B. The drawings do not depict all the surge protection devices required. The PICS is responsible for the comprehensive surge protection outlined in this specification.

1.2 SUBMITTALS

A. Submit detailed product data.

1.3 QUALITY ASSURANCE

A. It is the responsibility of the PICS to provide appropriate protection against transients and surges for all field instruments, field wiring, and devices interfacing with control panels including but not limited to:

1. All instrument signal wiring, control wiring, telephone wiring and data transmission wiring which enters or exits buildings shall be protected against lightning spikes, and other transient surges at all control panel termination points.
2. All instrument signal wiring, control wiring, telephone wiring and data transmission wiring which terminates in outdoor control panels shall be protected against lightning spikes, and other transient surges at all control panel termination points.
3. All AC control power wiring shall be protected against lightning spikes, and other transient surges at all control panel termination points. Lightning and surge devices shall protect the system from induced surges in analog, discrete and control circuitry and power supply lines.

B. The protective devices shall not interfere with the normal operation of the panel hardware and shall be designed not to have a maximum clamping voltage in excess of what the protected device is capable of withstanding.

C. All field instruments located indoors or outdoors provided by the PICS under this contract shall be supplied with surge protection for 120 VAC power to the instrument.

D. Surge protectors shall include a combination of surge suppression technologies including, metal oxide varistors, gas discharge tubes, diodes, and 3AG size fuses for line-to-line and line-to-ground protection.

E. Surge protectors in controls panels shall be DIN rail-mounted with plug-in modules.

F. Where the length of the wire or cable with surge protection is greater than 90 feet, provide surge protection on each end.

G. All surge and lightning protection shall have UL or FM approval. PICS shall verify approvals.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Field Instruments - Analog Signals

1. Direct mounted surge protectors for analog signals shall screw directly into the unused conduit entry hub of the instrument. The surge protector housing shall be 304 stainless steel minimum. Surge protectors shall be specifically manufactured for protecting field instruments.

2. Where direct mount is not possible, the surge protectors for analog signals shall be located as close to the field instrument as practical. The surge protector shall be rated NEMA 4X, or shall be mounted in a stainless steel NEMA 4X enclosure.

B. Field Instruments - Discrete Signals

1. Surge protectors for discrete signals wiring shall be located as close to the field instrument as practical. The surge protector shall be NEMA 4X, or shall be mounted in a 304 stainless steel NEMA 4X enclosure.

C. Control Panels

1. All instrument analog and discrete signal wiring, data transmission wiring and 120 VAC power supply wiring which enters or exits buildings or which terminates in outdoor control panels shall be individually protected against lightning spikes, and other transient surges at all control panel termination points.

2. Provide surge protectors for all power wiring to control panels whether located indoors or outdoors.

3. Provide surge protection for all telephone connections.

D. Instrument Power Wiring

1. Provide surge protectors for all power wiring to individual instrument devices whether located indoors or out-of-doors. For instrument devices, protection shall be located as close to the device as practical. The surge protector shall be NEMA 4X, or shall be mounted in a NEMA 4X enclosure. Enclosures shall be NEMA 4X, stainless steel.

E. Antennas

1. Provide RF surge protectors for all antennas.

F. MISCELLANEOUS DIGITAL EQUIPMENT

1. Provide surge protection for all computers, printers, uninterruptible power supplies, digital equipment power supplies, PLCs, fiber optic modems, telephone modems, digital signal converters and other miscellaneous digital hardware to include communications wiring and 120 VAC power supply wiring for each device.

2.2 ACCESSORIES

A. Spare Parts

1. Provide 10 percent spare surge protectors of each type used with a minimum of 5 of each type used.

2.3 SOURCE QUALITY CONTROL

A. Acceptable Products

1. Surge protection shall be equal to the following:

Surge Protector Acceptable Model Numbers		
	Telematic	Phoenix Contact
Field Instrument Analog Signals Direct Mounted	TP48	S-PT1-2PE-24VDC
Field Instrument Analog Signals Remote Mounted	SD Series	PT1X2 Series
Analog Signals Control Panel	SD Series	PT1X2 Series
120 VAC Power Control Panel	MA Series	PT2-PE/S 120AC
Discrete lnputs/Outputs Control Panel	SD Series	PT2X1 Series
RS-232	NP Series	Data PT, D-UFB Series
RS-485	NP Series	Data PT, D-UFB Series
Telephone Line	DP200 Series	TELETRAB-4X Series
Ethernet	NP Series	D-LAN Series
Antenna Cable	CA Series	COAXTRAB Series

2. Protection on 120 VAC power circuits may be also by Isolatrol (Model “Elite”).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all surge protection equipment in strict accordance with manufacturer’s guidelines.

B. For surge protectors located outdoors and for antenna surge protectors, surge protector grounding shall use individual ground rods located as close to the surge protector as possible. The grounding conductor shall be sized in accordance with manufacturer’s recommendations and be routed via the shortest path possible. Bends in the grounding

conductor shall be avoided. If bends in the grounding conductor are unavoidable then the number of bends shall be kept to an absolute minimum.

C. Provide installation for all field mounted surge protection equipment. Provide for all wiring terminations for surge protection equipment.

D. If a particular piece of equipment is protected by two surge protectors in series, ensure that the resulting equipment protection is not diminished.

END OF SECTION

SECTION 16010

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish and install all materials, equipment, labor, supervision and services necessary to complete all electrical work specified herein, and shown on the Drawings.

B. Principal Features
   1. Complete system of conduits, cables and conductors to supply electrical energy throughout the facility.
   2. Lighting fixtures, ballasts, and lamps.
   3. Motor control centers, distribution and lighting panels.
   4. Switchboard.
   5. Standby generator and ATs
   6. Ethernet Cables
   7. Fiber Terminations
   8. Coordination with Manufacturer's Equipment
   9. Coordination with utility companies for:
      a. Incoming electrical service.
      b. Incoming telephone service.

1.2 APPLICABLE STANDARDS AND CODES

A. Local, State, and National Electrical Codes.

B. National Electrical Code, latest edition.

C. Rules of the Electrical Utility and the National Electrical Safety Code.

D. Life Safety Code 101.

E. NECA Standard of Installation.

F. NFPA (National Fire Protection Association).

1.3 FEES AND TESTS

A. Contractor shall be responsible for all fees for permits, inspections, and tests necessary to complete this work. Contractor shall demonstrate to the Owner and the Engineer that all items of equipment installed are completely operational and free of defects in all modes.

1.4 COORDINATION WITH OTHER TRADES

A. Furnish and locate all anchor bolts, inserts and supports for installation by the other trades as required. Coordinate the location of all fixtures, outlets, equipment, and devices with other trades to avoid conflicts.

1.5 LIST OF PROPOSED MANUFACTURERS

A. List of Proposed Materials: The Contractor shall submit a complete list of the proposed manufacturers for each of the items listed in the following electrical specifications. Additional submittal data, sufficient to determine equality, shall be required if the Contractor proposes to substitute another manufacturer's equipment.
   1. Intent of Drawings
      a. Electrical plan drawings show only general locations of equipment, devices and raceways, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of raceway, subject to the review of the Engineer.
   2. Departures from Contract Documents
      a. Submit to the Engineer in writing details of any necessary, proposed departures from these Contract Documents, and the reasons therefore. Submit such requests as soon as practicable and within 30 days after award of the Contract. Make no such departures without written approval of the Engineer.

PART 2 PRODUCTS

2.1 REFERENCE TO DRAWINGS

A. Reference shall be made to Drawing Schedules, Details, Notes, and Specifications for: Manufacturer, model, catalog number, size, capacity, performance, ratings and installation of equipment and material.

2.2 CHOICE OF MATERIALS AND EQUIPMENT

A. In submitting substitutions, bidders should note the following minimum considerations: (1) capacities shown are absolute minimal and must be equaled, (2) physical size limitations for space allotted, (3) structural properties, (4) noise level, (5) interchangeability, (6) compatibility with other materials and assemblies, (7) similar items shall be same manufacture and style wherever possible.

B. All material and equipment, for which a UL, ANSI, or a NEMA Standard is established, shall be so approved and labeled or stamped.

C. Adhesives are not acceptable as a mounting, supporting, or assembling technique, unless noted otherwise.

2.3 ELECTRICAL EQUIPMENT

A. NEMA Standards shall be taken as minimum requirements for electrical equipment.

B. Equipment shall operate properly under a plus or minus 10 percent voltage variation.

2.4 SUBMITTALS DURING CONSTRUCTION

A. Provide complete manufacturers' descriptive information and shop drawings for all equipment, material and devices furnished under Division 16, Electrical, including certified outline drawings, arrangement drawings, elementary (schematic) diagrams,

interconnection and connection diagrams, in accordance with provisions elsewhere in these Contract Documents. Provide the number of copies specified herein for the Engineer, Contractor and Operation and Maintenance Manuals.

B. Provide certified shop drawings, literature and requested samples showing items proposed for use, size, dimensions, capacity, special features required, schematic (elementary) control diagrams, equipment schedules, rough-in, etc., as required by the Engineer for complete review and for use during installation. Use NEMA device designations and symbols for all electric circuit diagrams submitted. Make content of the schematic (elementary) connection or interconnection diagrams in accordance with the latest edition of NEMA ICS 1.

C. Manufacturer's standardized elementary diagrams will not be acceptable unless applicable portions of the diagram have been clearly identified and non-applicable portions deleted or crossed out.

D. The following submittals shall be made in accordance with Division 1, General Requirements.

E. Certified arrangement drawings, outline dimensions, and weights for all major (engineered) equipment including, but not limited to:
   1. Low voltage switchgear.
   2. Transformers.
   3. Motor control centers.
   4. Engine – generators.
   5. Variable frequency drives.

F. Functional description or logic diagrams for all control systems furnished under Division 16, Electrical.

G. Characteristic curves for all protective devices.

H. Certified drawings and descriptive literature for all equipment and devices furnished under Division 16, Electrical, and not listed above.

I. Schematic (elementary drawings for any electrical control and bills of material for equipment including, but not limited to:
   1. Switchgear
   2. Motor control
   3. Control systems furnished under Division 16, Electrical.
   4. Engine – generator sets.
   5. Variable frequency drives.

J. Connection diagrams showing all internal wiring and all required field connections for the following:
   1. Low voltage switchboard
   2. Low voltage motor control centers

K. The interconnection diagrams shall show terminal points, intermediate connections, device designation, terminal numbers, polarity of dc circuits, conductor identification, and any other information necessary to show which conductor connects to which

point; the Contractor shall review and sign off on the control interconnection diagrams.

L. In addition to submittals for specific items mentioned above, furnish shop drawing information on the following items:
   1. Low voltage fuses.
   2. Panelboards.
   3. Separately mounted circuit breakers, fused switches, and nonfused disconnect switches.
   4. Conduit, tubing, and fittings.
   5. Power conductors.
   6. Wireway.
   7. Outlet and device boxes.
   8. Pull boxes and junction boxes.
   9. Terminal junction boxes.
   10. Manholes and handholes.
   11. 600-volt conductors.
   12. Control cable.
   13. Lighting fixtures.
   14. Emergency lighting units.
   15. Ballasts: fluorescent, high-pressure sodium, metail halide.
   16. Light poles and luminaires.
   17. Receptacles.
   18. Light switches.
   19. Device plates.
   20. Push-button indicating lights, selector switches: devices and station.
   21. Control relays and timers.
   22. Speed control systems.
   23. Dry type small power transformers, 0-600V primary.
   24. Telephone systems.
   25. Surge suppressors
   26. Fiber Optic Cable.

PART 3 EXECUTION

3.1 WIRING ELECTRICALLY OPERATED EQUIPMENT

A. The Contractor shall be responsible for electrical connections to all equipment requiring electrical power. This responsibility applies to equipment furnished under this and other Divisions and by the Owner.

3.2 RECORD AND AS-BUILT DOCUMENTS

A. Maintain at the job site a set of Contract Documents kept current by indicating thereon all changes, revisions and substitutions, between work as specified and as installed.

B. Furnish Owner with complete set of Operation and Maintenance Manuals.

3.3 EQUIPMENT OPERATION

A. This Division is responsible for: (1) proper rotation, (2) observing that lubrication has been properly performed, (3) that motors operate within nameplate limits, and (4) adjustment of circuit breaker and MCP trip settings.

3.4 CLEANING AND PAINTING

A. Fixtures, panels and equipment shall be thoroughly cleaned. All equipment shall be touched up or repainted as required to present a clean professional appearance. Paint all ferrous metal that is not otherwise protected against corrosion. Paint exposed pipe threads with Bitumastic No. 50.

3.5 IDENTIFICATION

A. Identify all major items of equipment including controls, panels, switches, contactors, motor starters, junction boxes and metering by permanent nameplates, with wording approved by Engineer. Secure metal nameplate frame with screws or brads. Adhesives are acceptable on components within NEMA 1 enclosures.

B. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on record drawings.

C. All conduits shall be identified with a stamped stainless steel tag system (Brady or approved equal). Conduit tags shall be permanently attached to each exposed end of conduit runs such as in manholes, pull boxes, panels, MCC's, junction boxes, etc. and at each point of entry into a structure or building. Each tag shall be stamped with the appropriate conduit number per the conduit and cable schedules.

D. Each instrument shall be identified with a stamped stainless steel tag system (Brady or approved equal). Instrument tags shall be permanently attached to each individual instrument and stamped with the appropriate number per instrument specification section.

E. Each cable shall be identified with a permanent labeling system (Brady Catalog Number B-292 with printed legends or approved equal). Instrumentation cables shall be labeled with the appropriate instrument number of the originating signal (Ex. FT-2020-1). Multiplex cables, power and control cables shall be labeled with the appropriate cable number per the conduit and cable schedules.

F. All switchgears, MCC's, MCC compartments, power panels, lighting panels, control panels, control cabinets, etc. shall be identified with permanently mounted phenolic labels.

G. All power and lighting panels shall have typed schedules mounted on panel doors.

H. All terminals and associated wires shall be numbered and labeled respectively, and wiring diagrams shall be installed in the MCC or electrical panel doors.

3.6 TEST PERIOD

A. Each piece of equipment shall continue to meet performance specifications throughout the first year of actual operation. Contractor shall replace or repair any defect due to faulty workmanship or material which shall develop within 1 year from date of acceptance. This guaranty shall cover both material and labor.

B. For first year after final acceptance, Contractor shall provide, at no cost to Owner, any required maintenance and service necessary to assure the proper operation of the system. Date of acceptance shall be certified by Engineer as that date on which the contract has been satisfactorily completed in accordance with the Contract Documents.

3.7 GROUNDING

A. See Specification 16450.

3.8 ELECTRICAL TESTING AND START-UP

A. General
   1. Prior to energizing any equipment, the electrical contractor shall thoroughly vacuum clean the equipment with an industrial type vacuum cleaner. The outside of all electrical equipment shall be cleaned and paint touched up as required to leave equipment in an "as purchased" condition.
   2. During start-up of new equipment, the electrical contractor shall provide sufficient personnel to aid with start-up of the electrical equipment to remove any faults, and to make the necessary adjustment for proper operation of electrical equipment and installation. This includes sufficient personnel to aid equipment service personnel in their check-out of the electrical equipment and service.
   3. All testing equipment shall be furnished by the Contractor.
   4. All failures under tests due to defective material or poor workmanship shall be corrected by the Contractor at no expense to the Owner.
   5. The electrical contractor shall not, under any circumstances, energize any electrical equipment covered by these Specifications without first obtaining permission from the Engineer.

B. Grounding
   1. After all connections have been made to the ground, ground tests shall be made to verify its adequacy.

C. Typewritten directories shall be inserted in all panels showing the designation of each circuit. All power and replacement fuses necessary for testing shall be furnished and paid for under this item.

D. Circuit Continuity
   1. Complete installation shall be free of short circuits, open circuits, and other defects. Insulation Resistance and Continuity Tests shall be performed in accordance with Section 16120-3.2 to prove that all parts of the installation are intact.

3.9 INSTALLATION OF EQUIPMENT

A. The electrical contractor shall coordinate with the Contractor and Owner in order to have electric power available when required.

3.10 TEMPORARY ELECTRIC POWER

A. Refer to General Conditions in these Contract Documents for necessary provisions for electric power used during construction.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide all labor, equipment and materials required to complete the installation specified herein, and shown or scheduled on the Drawings. Since the drawings are schematic, all fittings, connectors, etc. are not shown, but shall be furnished as required for a complete functional installation.

1.2 QUALITY ASSURANCE

A. Where not otherwise specified, all material and methods shall be of the highest industrial quality suitable for the application. All panelboards, motor starters, transformers, and other electrical equipment that is stored prior to installation, or that is installed outdoors, shall be protected from corrosion and rust with a product equal to Zerust Vapor Capsules or Cutler-Hammer Oxidation Inhibitor Capsules.

1.3 SHOP DRAWINGS

A. Shop Drawings are required for the following items: Safety Switches, Motor Control Centers, Wire, Manholes, Handholes and Covers, Starters, Circuit Breakers, Lighting Fixtures and Poles. A list of product manufacturers is required for all other items covered by these Specifications.

PART 2 PRODUCTS

2.1 HAZARDOUS AREAS

A. Provide devices, materials, and equipment for installation in hazardous areas that are specifically approved for installation in hazardous areas of the Class, Division and Group indicated, and are of construction that will ensure safe performance under conditions of proper use and maintenance. Provide devices, materials, and equipment meeting the requirements of the 2005 NEC, applicable state and local codes, and the authority enforcing these codes. Acceptable manufacturers: Crouse Hinds, or Appleton.

2.2 MATERIALS

A. Conduits
   1. See section entitled “Conduits” of these Specifications.

B. Wires and Cables
   1. See section entitled “Wire and Cable” of these Specifications.

C. Outlet Boxes and Covers
   1. Outlet Boxes: Raco, Steel City, or equal.

2. Outlet Box Covers:
    a. Switch: Sierra Cat. No. S-1N, S-2N, etc.; Hubbell 93071, or equal.
    b. Weatherproof Covers: Sierra Cat. No. WPD-8, or equal.

D. Switches
1. Heavy-Duty, AC quiet, premium, specification grade, toggle type. Federal Specification W-S-896E. UL Test UL 20.120/277 volts AC, 20 amps; gray toggle. General Electric, Hubbell, or equal. Provide watertight switches in NEMA 4X enclosures for wet areas.

E. Receptacles
1. Two-pole, 3-wire, straight blade, heavy-duty grounding. Federal Specification W-S-596d. U. Test UL 498. 125 volts AC, 20 amps, gray urea face. Bryant, Leviton, or equal.
2. Provide special purpose receptacles where shown. Coordinate ampere rating and receptacle configuration with power feeder circuit and equipment to be served.

F. Device Plates
1. Satin finished, Type 430 Stainless Steel - ganged as required for non-air conditioned areas. Impact resistant lexan (Brown, Gray or Ivory as necessary to match wall finish) for other interior areas.

G. Safety Switches
1. Furnish and install fusible and non-fusible, 3-pole, heavy-duty, safety switches where shown on the Drawings. All safety switches shall be NEMA Heavy Duty Type TH and Underwriter's Laboratories listed. All switches shall be of dead front construction with blades fully visible when in the "OFF" position with the door open. Mechanism shall be quick-make, quick-break with provisions for up to 3 padlocks in the OFF position. All exterior switches shall be of code gauge (UL98), stainless steel, NEMA 4X, or foamed thermoplastic NEMA 4X. Enclosures shall be Carlon, Hoffman or equal, or as furnished by the electrical equipment manufacturer. Safety switches shall be equal. General Electric, Cutler-Hammer, Square D or equal.

H. Panelboards
1. General
    a. Furnish panelboards as described herein and with protective devices of the required number, rating and type as shown on plans. Panelboards shall be listed and labeled by Underwriter's Laboratories under requirements of UL 67 and UL 50. Panel shall bear UL short circuit rating level in addition to the UL panel label. Panels shall meet NEMA PBI, U.S. Federal spec. WP 115a, and shall comply with NEC code. Circuit-breakers shall be bolt-in type. Plug-in breakers or "load-center" type construction is not acceptable. Panels shall be Square D, GE, Cutler-Hammer or equal. Panels shall have pole spaces as shown on the drawings.
2. Electrical Rating
    a. Panels rated for 120/208 volts shall be 3-phase, 4-wire, solid neutral, 60 Hz and 22,000 A.I.C. Panels rated for 277/480 volts shall be 3-phase, 4-wire, sold neutral, 60 Hertz rated for 42,000 amps RMS symmetrical.

3. Boxes and Fronts
    a. Boxes shall be galvanized code gauge steel, minimum of 4 inches of wiring gutters at all points. Fronts, complete with trim clamps, shall be of code gauge sheet steel, painted light grey over a rust inhibitor and shall be equipped with door, hinges, cylinder lock and directory card. All locks shall be keyed alike. After installation, directory card shall be typed with circuit designations corresponding to circuit breaker numbering.
4. Interiors
    a. Complete factory assembled interiors shall consist of a reinforced galvanized sheet steel frame with bus bars and circuit breakers properly supported to prevent vibration, breakage in handling, and to withstand the indicated short circuit currents. All terminals shall be solderless type suitable for copper or aluminum cable of sizes indicated. Bus bars shall be tin-plated copper and sequence phased. Neutral bar, when required shall be located on the opposite end of the panel from mains, and shall be insulated.
5. Circuit Breakers
    a. Circuit breakers shall be fully interchangeable without disturbing adjacent units. Breakers shall be quick-made, quick-break, and trip indicating. All 2- and 3-pole breakers shall have common trips. All single pole 15- and 20-amp breakers shall be UL listed for switched duty. Where indicated on plans furnish ground fault breakers UL listed in accordance with UL 943 Class A - Group 1, 5 millamp sensitivity.
    b. Provide circuit breakers and panels suitable for 75 degrees C wire at full NEC ampacity.
6. Drawings: Drawings shall be submitted showing: Mains - type and locations, schedule of branch devices, bus rating, lug sizes, box dimensions, and panelboard short circuit rating.

I. Supporting Devices
1. Expansion and/or Deflection Fittings
    a. O.Z. Gedney, Appleton, Spring City or equal.
2. Channel Support
    a. Unistrut, Kindorf, Super Strut, or equal. Supports shall be PVC coated galvanized steel or PVC coated aluminum. Uncoated galvanized steel shall not be used. Cut ends of supports shall be recoated with a PVC like coating. Stainless steel, type 316 may be used in lieu of PVC coated supports.
3. Fastening Devices
    a. Caddy, Appleton, or equal.
4. Cable Ties
    a. Panduit, Thomas & Betts, or equal.

J. Wall and Floor Seals
1. Wall seals are required for all wall penetrations below grade. Floor seals are not required for slab on grade penetrations but are required for floors below grade. Seals shall be Spring City, O.Z. Gedney, or equal.

K. Dry Type (General Purpose) Transformers
1. General
    a. This specification covers requirements for 600 volts class dry-type distribution transformers of the sizes, types and ratings as indicated on the applicable drawings.

b. Transformers shall meet the latest applicable Standards of IEEE, NEMA, ANSI and UL.

2. Design Features
   a. Encapsulated, Totally Enclosed Types
      1) Transformers 0.5-25 kVA single-phase and 3-15 kVA three-phase shall have the core and coils totally enclosed, encapsulated.
      2) The case shall be steel with welded seams to provide a rugged design suitable for indoor or outdoor application.
      3) Insulation system and average winding temperature rise shall be manufacturer's standard.
      4) Construction shall consist of a core and coil assembly completely encapsulated in a mixture of electrical-grade resin and aggregate suitably proportioned to provide a hard, durable, airtight, shock free seal.
      5) Transformer leads shall be located in a terminal compartment below the core and coil assembly with provision for conduit connection to 90 degree C minimum insulation feeder cables.
   a. Open, Ventilated, Drip-Proof Types
      1) Single-phase transformers rated 37.5 kVA and above, and three-phase rated 30 kVA and above shall be enclosed in an open, ventilated, drip-proof enclosure, self bracing, with removable front and rear cover panels to provide easy access to a terminal compartment located below the core and coils.
   b. Sound Levels
      a) Transformers shall have average sound levels that do not exceed the levels established by NEMA ST 20 and ANSI Standards.
   c. Voltage Taps
      1) Transformers shall have at least four 2 ½ percent voltage taps; two full-capacity above normal (FCAN) voltage rating, and two full-capacity below normal (FCBN) or as indicated on the drawings.

3. Finish
   a. Enclosure shall be degreased, cleaned, primed and finished with gray enamel paint.
4. Mounting
   a. Provide wall brackets for single-phase units 15 – 25 kVA and three-phase units rated 15 kVA. Larger transformers shall be floor-mounted.
5. Approved Manufacturer
   a. Cutler Hammer, Square D, GE, or approved equal.

L. Motor Starters
   1. See section entitled "Motor Starters and Motor Control Centers" of these Specifications.

M. Motor Control Centers
   1. See section entitled "Motor Starters and Motor Control Centers" of these Specifications.

N. Terminal Blocks 0 to 600 Volts
   1. Provide 600-volt terminal blocks for termination of all control circuits entering or leaving equipment, panels, or junction boxes. Provide screw clamp compression,

dead front barrier-type terminal blocks with current bar providing direct contact with wire between the compression screw and yoke. Provide yoke, current bar and clamping screw constructed of high strength and high conductivity metal. Utilize yoke that guides all strands of wire into the terminal. Utilize yoke that guides all strands of wire into the terminal. Utilize current bar providing dependable vibration proof connection. Supply terminals constructed to allow connection of wire without any special preparation other than stripping. Rail mount individual terminals to create a complete assembly and provide terminals constructed such that jumpers can be installed with no loss of space on terminal or rail.

2. Size all terminal block components to allow insertion of all necessary wire sizes and types. Supply terminal blocks with marking system allowing the use of preprinted or field-marked tags. Supply CSA certified and UL approved terminal blocks.

O. Magnetic Contactors
   1. NEMA ICS 2, UL 508
   2. Electrically actuated by dual acting, single-coil mechanism.
   3. Inherently interlocked.
   4. Main Contacts:
      a. Power driven in both directions
      b. Double-break, continuous-duty, rated as shown on the Drawings, to withstand 42,000 Amps RMS symmetrical at 480-volts ac
      c. Marked for switching of electric discharge lamps and other resistive (non-motor) loads, such as radiant heaters.
      d. Position not dependent on gravity, hooks, latches, or semi-permanent magnets
      e. Capable of operating in any position
      f. Visual indication of each contact
   5. Control: As shown on drawings
   6. Provide one normally-open and one normally-closed auxiliary contact (for remote indication of status).
   7. Enclosure:
      a. NEMA 250, Type 12, dust-tight, industrial use for dry areas
      b. NEMA 250, Type 4X for process areas
   8. Cutler Hammer, Type CN35, GE, Class 360, or approved equal.

PART 3 EXECUTION

3.1 CONDUIT INSTALLATION

A. See section entitled “Conduit” of these Specifications.

3.2 CUTTING AND PATCHING

A. Provide all cutting and patching required to perform this work.

B. Do not cut into any major structural element without approval of Engineer.

C. Patching shall be of quality equal to, and of appearance matching, existing construction.

3.3 EQUIPMENT MOUNTING

A. Wherever any electrical component, such as panels, raceways, pipes and conduits, will be in contact with surfaces which may become damp or wet, mount using spacers to hold electrical work ¼ inch away from damp surfaces.

3.4 PULL-BOXES, TERMINAL JUNCTION BOXES, DISCONNECT SWITCHES AND WIRING DEVICES

A. Furnish equipment and installation methods in accordance with the following (unless otherwise shown):

1.	Indoor Finished Areas (Dry)	NEMA 1
2.	Indoor Unfinished Areas (Dry)	NEMA 12
3.	Indoor Wet Areas	NEMA 4
4.	Indoor Wet and Corrosive Areas	NEMA 4X
5.	Outdoor Areas	NEMA 4X

END OF SECTION

SECTION 16111

CONDUIT

PART 1 GENERAL

1.1 SCOPE

A. Work covered by this section includes furnishing all labor, equipment, and materials required to install electrical conduit and fittings as specified herein and/or shown on the Drawings.

B. The Contractor's attention is called to the fact that all conduits and conduit fittings are not necessarily shown completely on the Drawings, as the Drawings are more or less schematic. However, the Contractor shall furnish and install all conduits and conduit fittings indicated or required for the proper connection and operation of the equipment.

1.2 SHOP DRAWINGS AND ENGINEERING DATA

A. Shop drawings and engineering data shall be submitted in accordance with requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.3 STORAGE AND PROTECTION

A. Store and protect conduit and fittings in accordance with the manufacturer's recommendations and requirements of the section entitled "General Equipment Stipulations" of these Specifications. Conduit shall be stored aboveground and adequately supported.

1.4 GUARANTEE

A. Provide a guarantee against defective equipment and workmanship in accordance with requirements of the section entitled "Warranties and Bonds" of these Specifications.

PART 2 PRODUCTS

2.1 GENERAL

A. Unless otherwise shown or specified, all conduits shall be rigid metal. Aluminum conduits and boxes shall not be installed. See the paragraph on Conduit Application for additional information.

B. Conduit terminations at electrical equipment such as electric motors, dry type transformers and heaters shall be made using liquid-tight, flexible metal conduit.

C. Damaged, dented, flattened, or kinked conduit shall not be used.

2.2 RIGID METAL CONDUIT

A. Rigid metal conduit shall be heavy wall, mild steel conduit conforming to ANSI C80.1 and Federal Specification WW-C-581, hot dip galvanized both inside and out. All conduits shall bear the approved stamp of the Underwriters Laboratories.

2.3 RIGID NONMETALLIC CONDUIT

A. Rigid nonmetallic conduit for voltages 600V and less shall be Schedule 40 heavy wall polyvinyl chloride (PVC) electrical conduit rated for 90 degrees C conductors and conforming to NEMA TC-2, Type EPC-40-PVC. It shall be listed by Underwriters Laboratories in conformance with the National Electrical Code. Conduit fittings, elbows, and joint cement shall be produced by the same manufacturer as the conduit. Conduits shall be as manufactured by Carlon, Borg-Warner, or equal.

B. Rigid nonmetallic conduit for voltages higher than 600V shall be polyvinyl chloride (PVC) power duct rated for 90 degrees C conductors and conforming to NEMA TC-6, Type EB. Conduit fittings, elbows, and joint cement shall be produced by the same manufacturer as the conduit. Conduit shall be as manufactured by Carlon, Olin, or equal.

2.4 PLASTIC-COATED RIGID METAL CONDUIT

A. Rigid metal conduit prior to application of plastic coating shall conform to Part 2.02, Rigid Metal Conduit, of this section.

B. Plastic coating shall be polyvinyl chloride (PVC) bonded to the metal a uniform thickness of 40 mils the full length of the conduit except the threads. The bond between the metal and PVC coating shall be equal or greater than the tensile strength of the PVC coating.

C. A coupling shall be furnished loose with each length of conduit and shall have a PVC sleeve extending 1 pipe diameter, or 2-inches, whichever is least, beyond the end of the coupling. Elbows shall have the same thickness of PVC coating as on the conduit. All threaded conduit and elbow ends shall have plastic thread protectors.

D. The rigid steel galvanized PVC coated conduit and fittings shall be KorKap as manufactured by Plastic Applicators, Houston, Texas; Plasti-Bond as manufactured by Pittsburgh Std. Div. of Robroy Industries, Verone, Pa.; or equal.

E. PVC-coated rigid conduit shall meet the ASTM D870 Boil Test.

2.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Flexible conduit shall have an oil-resistant, liquid-tight jacket in combination with flexible metal reinforcing tubing and shall be designed for use with waterproof fittings. An integral ground wire shall be included. Flexible conduit shall be American Brass Sealtite Type UA as manufactured by Electric-Flex Company; Flexible Metallic Conduit as manufactured by Ideal Industries, Inc; or equal. Only Underwriter's Laboratories approved fittings shall be used.

2.6 CONDUIT FITTINGS AND BUSHINGS

A. Wherever conduits terminate in sheet steel boxes, double bonding type locknuts and bushings shall be used except when terminating in cast hubs. All bushings shall be insulated metallic type, equal to O. Z. Electrical Manufacturing Company, Type B; T & B Company, 1200 Series; Appleton Electric Company, Type BU-I; or equal.

B. Where conduits terminate in steel or cast NEMA 4 enclosures with no factory-installed threaded hubs, a threaded hub shall be installed equal to Myers Electric Products, Inc., Type ST or STG; Appleton Electric Company, Type HUB; Crouse-Hinds, Type HUB; or equal.

C. All conduits terminating at motor control centers shall be suitably grounded to the motor control center ground bus using grounded type insulated bushings equal to O. Z. Electrical Manufacturing Company, BLB or IGB; Appleton, Type BIB; Thomas and Betts, 3800 Series; or equal.

D. Conduit expansion fittings shall be O. Z. Electrical Manufacturing Company, Type EX with Bonding Jumper, Type XJ; Appleton, Type SJ with Type XJB4 Bonding Jumpers; Crouse-Hinds, Type XJ with GC100 Bonding Jumper; or equal.

2.7 CONDUIT BOXES

A. Exposed conduit boxes and pulling elbows shall be of die-cast, copper-free aluminum with threaded body and removable neoprene- gasketed cover. Conduit boxes shall conform to Federal Specification W-C-586a and shall be Crouse-Hinds “Condulet,” Appleton “Unilet Form 85,” or equal.

PART 3 EXECUTION

3.1 GENERAL

A. Minimum size conduit shall be 3/4 inch aboveground and 1 inch below ground except where noted otherwise, and no conduit shall have more than 40 percent of its internal area occupied by conductors.

B. During construction all installed conduits shall be temporarily plugged, capped, or otherwise protected from the entrance of dust, trash, moisture, etc., and any conduits that may become clogged shall be replaced. No conductor shall be pulled in until all work that might cause damage to the conduit or conductors has been completed.

C. Conduit connections to sheet metal enclosures shall be securely fastened by double lock nuts inside and outside and shall have grounding bushings.

D. Conduit straps or brackets secured to concrete, brick, or masonry shall be by means of expansion bolts, toggle bolts, or approved drill anchors. No wood plugs will be permitted.

E. Conduits supported from building walls shall be installed with at least 1/4-inch clearance from the wall using pipe spacers equal to Appleton Electric Company, Steel

City, or equal. Clamp back to prevent the accumulation of dirt and moisture behind the conduit.

F. Unless otherwise shown or specified, exposed rigid conduit shall be installed parallel or at right angles to structural members, surfaces, and building walls.

G. Two or more conduits in the same general routing shall be parallel with symmetrical bends.

H. Conduits shall be at least 12 inches from high temperature piping, ducts, and flues.

I. Conduit installed horizontally shall allow headroom of at least 7 feet, except where it may be installed along structures, piping, equipment, or in other areas where headroom cannot be maintained because of other considerations.

J. Wherever necessary conduit boxes and pulling elbows shall be inserted in the lines. Gaskets shall be used to ensure a dust and watertight installation on all conduit boxes and fittings.

K. All bends and turns in conduits shall have a bend radius of not less than 6 times the internal diameter of the conduit. Bends shall be made using an approved bender to provide smooth bends with no kinks, dents, or flattening.

L. All concealed conduit shall be placed in walls, floors, ceilings, or slabs at the proper time in accordance with the progress of the work. The Contractor shall cooperate in every respect in meeting schedules and shall not delay the structural work unnecessarily. Conduits embedded in concrete shall be blocked and braced in place by use of adequate conduit separators to prevent displacement during pouring of the concrete. Where conduit interferes with structural steel, steel reinforcement, or in the opinion of the Engineer occupies too much space in the slab, the conduits shall be rearranged or installed exposed as directed by the Engineer. No additional payment will be made for such rearrangement of conduit whether or not additional conduit or fittings might be required.

M. Conduit wall seals with water stops shall be installed in outside walls below grade for all incoming or outgoing underground conduit emerging directly into the building area. The conduit wall seals shall have a pressure ring and sealing grommet to ensure a watertight installation.

N. Conduit expansion fittings and ground bonding jumpers shall be installed on all conduits passing through building expansion joints to provide movement in the conduit system.

O. Where groups of conduits terminate together or pass through floors, provide template to hold conduits in proper relation to each other and to building.

P. Conduits shall be plugged or capped with plastic caps during construction to protect threads and prevent entrance of dirt and water.

Q. Conduits shall be adequately supported at intervals as required by the National Electrical Code. One to two exposed conduits running parallel to each other may be

supported by strap anchors, or 1-hole clamps (walls only). Exposed conduits larger than 2 inches or groups of more than 2 conduits run parallel shall be supported by means of minimum 12 gauge, slotted steel channels fitted with 2-piece, bolted pipe clamps. All conduit supports, clamps, straps and brackets shall be heavily hot dip galvanized for corrosion resistance.

R. Runs of conduit shall not contain more than four 90-degree bends (360-degrees total) between conduit boxes panelboards, or terminations. In general and to the extent practical length of conduit runs between conduit boxes or similar means of access shall not exceed 100 feet.

S. Exposed service entrance conduits and main feeder conduits shall be identified using stenciled letters at intervals not to exceed 20 feet. Size of letters shall be equal to one-half the diameter of the conduit or 2 inches, whichever is less.

T. All conduits located in conditioned spaces (office, labs, restrooms, work areas, etc.) shall be concealed.

3.2 INSTALLATION OF RIGID METAL CONDUIT

A. Terminations and connections of rigid metal conduit shall be threaded. Conduits shall be reamed free of burrs and terminated with insulated metallic conduit bushings.

B. Conduit threads shall be coated with a petroleum base corrosion-inhibitor with low electrical contact resistance before assembly equal to Burndy Engineering Company, Inc., Penetrax “A” or equal screw thread lubricant (zinc-petroleum or zinc-chromate compounds are permissible).

C. All conduits shall be suitably grounded to the plant ground grid using grounded type insulated bushings, O. Z. Electrical Manufacturing Company, Type BLG or IGB, T & B Company, Appleton Electric Company, or equal.

D. Conduit across structural joints where structural movement is allowed shall have bonded, weathertight expansion and deflection fitting the same size as the conduit.

E. Support spacing for conduits 1 inch and smaller shall not exceed 6 feet, and conduits 1¼ inches and larger shall not exceed 10 feet. Supports shall be as specified under basic electrical materials and methods. Conduits 1½-inch and smaller may be supported by 1-hole conduit straps and 2 inches and larger shall be supported by 2-hole conduit straps. Conduit racks shall be as manufactured by Unistrut, Kindorf, or equal. Conduit racks shall be PVC coated or 316 stainless steel.

F. Conduit joints shall be made up tight using a pipe wrench. Channel lock pliers will not be permitted, and unions shall be used as necessary to aid in the installation. Conduits shall be cut square and the ends reamed smooth after threading to prevent injury to conductors. Conduit joints in concrete or exposed to weather or damp locations shall be drawn up tight and coated with insulating paint before casting in concrete or painting exposed conduit system.

G. Plastic-coated rigid metal conduit and fittings shall be installed in accordance with the manufacturer’s specifications and recommendations. Any damage to the plastic

coating shall be repaired in accordance with the manufacturer's requirements. The manufacturer shall certify the installers before installation can be started.

3.3 INSTALLATION OF RIGID NONMETLALIC CONDUIT

A. Field bending of polyvinyl chloride conduit shall be made with appropriate equipment. No torches or flame-type devices shall be used.

B. When joints are to be made with polyvinyl chloride conduit, the conduit shall be cut with a fine-tooth saw and deburred. Conduit ends shall be wiped clean of dust, dirt, and shavings and shall be dry. Solvent cement shall be applied to bond the joint. The joint should be watertight.

C. Polyvinyl chloride conduit shall be installed in accordance with the manufacturers' specifications and recommendations.

3.4 INSTALLATION OF LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Terminations at motors shall be made with flexible liquid-tight metal conduit from conduit stub to terminal box; flexible connection shall be made as short as possible. Flexible conduit shall be Type UA, black. Underwriter's Laboratories approved flexible liquid-tight conduit connectors shall be as manufactured by Thomas and Betts Company, Appleton Electric Company, or equal.

B. Uncoated flexible metal conduit may be used for short connections between junction boxes and lighting fixtures or speakers installed in suspending ceiling systems. Flexible metal conduit shall be connected using Underwriters Laboratories approved grounding connectors.

3.5 INSTALLATION OF UNDERGROUND CONDUIT

A. All underground conduits shall be concrete-encased unless otherwise noted on the Drawings or directed by the Engineer. No conduit shall be concealed or encased until the Engineer has inspected the conduit for proper installation and accurate placement.

B. The Contractor shall be responsible for all excavating, draining trenches, forming of duct assembly and protective concrete envelope, backfilling, and removal of excess earth.

C. Underground conduit shall be installed with a minimum 3-inch per 100-foot downward slope for drainage. Drains shall be provided at all low points.

D. Bends and turns shall be made using long sweeps. Ninety-degree bends will be used only where required and shall be kept at a minimum.

E. Where rigid nonmetallic conduits emerge from underground, an adapter from rigid nonmetallic conduit to rigid metal conduit shall be installed and all exposed conduit shall be rigid metal conduit.

F. All rigid metal conduit risers shall be protected with 2 coats of a Bitumastic compound before concrete is poured from a point 12 inches below grade to a point not less than 6 inches above grade or surface of concrete. All stub-ups shall extend

upward with one length of rigid metal conduit until after concrete is poured to assure vertical alignment.

G. Conduits shall be encased in concrete with 3-inch minimum concrete cover all around.

H. Concrete for concrete encasement shall be Class B concrete conforming to requirements of the section entitled "Cast-In-Place Concrete," of these Specifications. Longitudinal and lateral steel reinforcement shall be provided as shown on the Drawings.

I. All underground conduit runs for voltages less than 600 volts shall be at least 24 inches below grade and shall have a minimum conduit separation of 4 inches.

J. All underground conduit runs for voltages over 600 volts shall be at least 36 inches below grade and shall have a minimum conduit separation of 4 inches. Conduit shall have a minimum 4-inch concrete cover on all sides.

K. All underground conduit runs shall be rodded and a mandrel drawn through followed by a swab to clean out any obstructions that may cause cable abrasions. The mandrel shall be 12 inches in length and the diameter ½ inch less than the inside diameter of the conduit.

L. All underground conduit runs shall be marked by a strip of permanently colored red polyethylene tape, 0.004 inch thick and 6 inches wide, buried above the conduit and 6 inches below finished grade.

M. All spare conduits shall be provided with permanent waterproof caps at stub-ups and shall be furnished with a No. 8 aluminum pulling wire. Waterproof raceway tags shall be attached to the pulling cords, at each end and at each intermediate pulling point. The raceway tags shall identify the origin and destination of the conduit.

3.6 CONDUIT APPLICATION

A. Install the following conduit types, unless otherwise shown on the drawings.
   1. Outdoors, Exposed (Not Buried): PVC Coated Rigid
   2. Indoors
      a. Dry Areas Rigid Aluminum
      b. Wet Areas Rigid Aluminum
   3. Underground (Under Slabs-on-Grade, Encased or Embedded in Concrete)
      a. PVC Schedule 40
   4. Hazardous Gas Areas
      a. Galvanized Rigid Steel
   5. Corrosive Areas
      a. PVC Schedule 40
   6. Transition Areas and Final Connections to Equipment
      a. Motor Connections – Flexible metal, liquid-tight conduit.
      b. Light Fixture Connections – Flexible metal non liquid-tight conduit in dry areas and liquid-tight in wet areas.

END OF SECTION

SECTION 16120

WIRE AND CABLE

PART 1 GENERAL

1.1 SCOPE

A. Work covered by this section includes furnishing all labor, equipment, and materials required to install, connect, and test all wire and cable, including splices, terminations, connectors, and accessories for a complete installation as shown on the Drawings and/or specified herein.

B. The Contractor's attention is directed to the fact that all wires and cables are not necessarily shown on the Drawings, which are more or less schematic. However, the Contractor shall be responsible for furnishing and installing all wire and cable indicated or required to properly connect and place into operation all equipment and services requiring such wiring and/or cable.

1.2 QUALITY ASSURANCE

A. Samples of all wire and cable, clearly marked and long enough to show complete identification, shall be submitted to the office of the Engineer for approval prior to wiring installation.

B. No defective or damaged wire and cable shall be incorporated into the work.

1.3 SIZING OF CONDUCTORS

A. Unless otherwise required or directed by the Engineer, conductors shall be furnished in the sizes shown on the Drawings. No wire for lighting, power, or motor control circuits shall be smaller than No. 12 AWG. Motor control circuits carrying less than 8 amps may be No. 14 AWG. No wire for instrumentation and low-level signal transmission pairs shall be smaller than No. 16 AWG for single pairs or No. 20 AWG for bundled cable.

B. All wires and cables shall be of such size as to conform to the regulations of the current edition of the National Electrical Code for current carrying capacity.

C. Where the size of lighting wiring is not given on the Drawings, it shall be of such size that the voltage drop from the main panel to the lighting panel is not more than 1 percent, and the drop in the branch circuit is not more than 2 percent. The voltage drop in motor feeder, when the wire size is not specified, shall not be more than 3 percent at full load from the Motor Control Center to the motor terminal.

1.4 SHOP DRAWINGS AND ENGINEERING DATA

A. Complete shop drawings and engineering data shall be submitted in accordance with requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.5 STORAGE AND PROTECTION

A. Store and protect all wire and cable in accordance with the manufacturer's recommendations and requirements of the section entitled "General Equipment Stipulations" of these Specifications.

B. Wire and cable shall be stored indoors in a dry and warm location and in its original packaging.

1.6 GUARANTEE

A. Provide a guarantee against defective materials and workmanship in accordance with requirements of the section entitled "Warranties and Bonds" of these Specifications.

PART 2 PRODUCTS

2.1 CONDUCTORS - GENERAL

A. Conductors shall be solid or Class B concentric stranded, soft or annealed, uncoated copper free from kinks and defects in accordance with ASTM B 3 or B 8.

B. Conductors should have a conductivity not less than 97 percent.

C. The wire and cable shall have size, grade of insulation, voltage, and manufacturer's "E-Number" permanently marked on the outer covering at not more than 2-foot intervals.

D. All wires shall conform to the latest Standards of the ASTM and ICEA and shall be tested for their full length by these Standards.

E. Insulation thickness shall be not less than that specified by the National Electrical Code.

F. All control circuit wiring and all wiring No. 8 AWG and larger shall be stranded. Lighting branch circuits No. 12 and No. 10 AWG may be solid. Wiring shall be stranded as follows:
   1. No. 14 thru No. 2 AWG shall have a minimum of 7 strands.
   2. No. 1 thru No. 4/0 AWG shall have a minimum of 19 strands.
   3. No. 250 MCM thru No. 500 MCM shall have a minimum of 37 strands.
   4. All circuits except control and instrumentation circuits shall have a separate grounding conductor carried in the conduit.

2.2 CONDUCTORS FOR WIRE AND CABLE

A. XHHW - For service entrance, motor branch, and feeder circuits operating at 240 and 480 volts, the conductors shall be single-conductor, cable rated, 600 volts. The single-conductor cable shall consist of uncoated annealed copper, Class B stranded per ASTM B 8 and insulated with corona, ozone, heat and moisture resisting cross-linked polyethylene insulation rated to withstand a copper temperature of 90 degrees C, Underwriter's approved Type XHHW and shall be as manufactured by Southwire, General Cable Corporation, Okonite Company or equal.

B. THWN-2 - For general lighting and receptacle branch circuits operating at 115 volts, the conductor shall be single-conductor cable rated 600 volts. The single-conductor cable shall be uncoated annealed copper. No. 12 and No. 10 AWG may be solid, or stranded; larger cables shall be stranded per ASTM B 8 and insulated with polyvinyl chloride insulation rated to withstand a copper temperature of 75 degrees C, Underwriter's approved Type THWN-2, and shall be as manufactured by Southwire, General Cable Corporation, Okonite Company, or equal.

C. For lighting fixture drop wire or for running in fluorescent units, the conductors shall be single-conductor cable rated 600 volts. The single-conductor cable shall be stranded tinned copper with a 31-mil-thick wall silicone insulation and a glass braid jacket overall rated to withstand a copper temperature of 150 degrees C, Underwriter's approved silicone insulated fixture wire type SFF-2, and shall be as manufactured by General Cable Corporation, General Electric Company, or equal.

D. For control circuits the conductors may be single or multi-conductor cable rated 600 volts. The conductors shall consist of uncoated annealed copper Class B stranded per ASTM B 8 and shall be No. 14 or No. 12 AWG, 7-strand, identified at each end using Brady wire markers B-500 vinyl cloth, Thomas and Betts "E-Z Code" wire markers, or equal.
   1. Single-conductor cable shall have 45-mil-thick wall of cross-linked polyethylene or polyvinyl chloride insulation, color red, to withstand a copper temperature of 90 degrees C, Underwriter's Laboratories approved Type RHH-RHW, and shall be as manufactured by General Electric Company, Phelps Dodge, General Cable, Okonite, or equal.
   2. Multi-conductor cable shall consist of single-conductor cables rated 600 volts and insulated to withstand a copper temperature of 90 °C cabled together to form a cable assembly which is Underwriter's Laboratories approved for installation in conduit. The core shall be color coded in accordance with ICEA, Method 1, with a plastic tape cover and a PVC or neoprene jacket overall.

E. Bare grounding conductor shall be Class A or B medium hard drawn, high conductivity bare copper, sized as shown on the Drawings. Conductors No. 6 AWG and smaller may be solid. Conductors No. 4 AWG and larger shall be stranded.

F. Flexible power cords shall be moisture-resistant, oil-resistant, neoprene-sheathed service cable designed for extra hard usage, Type SO, rated 600 volts at 90 degrees C continuous conductor temperature. Flexible heater cords shall be moisture-resistant, oil-resistant, neoprene and cotton sheathed service cable designed for extra hard usage, Type HSO, rated 600 volts at 90 degrees C continuous. Insulation shall be thermoplastic ethylene-propylene conforming to ICEA S-68-516. Neoprene shall conform to ASTM D 752. All flexible cords shall be UL listed.

2.3 INSTRUMENTATION AND THERMOCOUPLE EXTENSION WIRING

A. Instrumentation and low level DC signal wiring shall be shielded, twisted pair conductors. Single twisted pairs shall consist of 2, Class B stranded, No. 16 AWG annealed copper conductors, 1 white and 1 black, with 15 mils of PVC insulation rated for 600 volts and 90 degrees C minimum continuous conductor temperature. Pairs shall be twisted to a lay of 1.5 to 2.5 inches. A 0.35 mil by 0.50 mil aluminum-mylar tape shield with stranded, bare No. 18 AWG, tinned copper drain wire in contact with the aluminum side of the shield shall be applied helically around the

twisted pair. An overall jacket of 90 degrees C black PVC at least 30 mils in thickness shall be applied to the outside. Shield coverage shall be full 100 percent. All instrumentation wiring shall be UL listed.

B. Twisted, Shielded Triad Instrumentation Cable for RTD circuits: Stranded copper conductors, size #16 AWG. Insulate conductors individually with color-coded PVC. Provide shield for each triad and tinned-copper drain wire. Provide flame-retardant PVC outer jacket. Cable shall be rated 600 volts and 90 degrees C. Cable shall be designed for noise rejection for use in process control signals.

2.4 AUDIO SIGNAL WIRING

A. Audio signal wiring for public address and sound systems shall be shielded, twisted pair instrumentation cable with 2 No. 16 AWG conductors constructed in accordance with the requirements of Part 2.03 of this section.

2.5 ETHERNET CABLE

A. Ethernet cable shall be Category 7, 23 gauge indoor/outdoor rated cable.

2.6 TELEPHONE AND COMMUNICATION WIRING

A. Indoor telephone and communication cable shall consist of solid, minimum No. 22 AWG, annealed copper conductors insulated and standard telephone color coded with polyethylene and twisted together in pairs. Pairs shall be cabled together and protected with a metal tape shield and a polyethylene or PVC jacket overall. Cable shall be suitable for installation in ducts.

B. Buried telephone cable shall be REA approved for aerial installation on messenger wire, installation in underground ducts, and direct burial. Cable shall consist of solid, minimum No. 22 AWG annealed copper conductors insulated and standard telephone color coded with polypropylene or polyethylene and twisted together in pairs. Each pair shall be twisted to a different lay length. Cable with more than 25 pairs shall be assembled from oscillated, bundled, 25-pair subunits. Bundled pairs shall be covered by a nonhygroscopic tape, an inner jacket of polyethylene, a shield of aluminum or tinned copper, and an outer jacket of black, high-molecular weight polyethylene copolymer. Cable core shall be completely filled with a nontoxic, petrolatum-polyethylene weatherproofing compound. Jacket shall be sequentially marked to indicate footage.

2.7 SPLICES AND TERMINATIONS

A. Splices, taps and attachment of fittings and lugs shall be electrically and mechanically secure, and approved solderless lugs and connectors shall be used. Lugs and connectors shall be top quality product of Burndy, O-Z, Thomas and Betts, or equal manufacturer. Conductors shall not bind at bushings. Lugs shall be of the correct sizes for the conductors joined and strands shall not be cut from a conductor.

B. Splices, taps, and terminations of cable rated 600 volts and less requiring tape shall be half lap and at least 3 layers. Taping shall be neatly done and form a permanent insulation equal in mechanical and electrical strength to the insulation of the conductor. Taping shall be as follows:
   1. Rubber Insulation
      a. Inner Layer: Okonite Rubber Tape, 3M "Scotchfil" Electrical Insulation Putty, Plymouth "Plysafe" Tape, or equal.
      b. Outer Layer: 3M "Scotch No. 88" Tape, Permacel No. 295 Tape, Slipknot Grey Tape, or equal.
      c. Thermoplastic Insulation: 3M "Scotch No. 88" Tape, Permacel No. 295 Tape, Slipknot Grey Tape, or equal.
   2. Terminations at motor junction boxes shall be sealed with 3M "Scotchkote" Electrical Coating over the outer layer of tape. All splices 600 volts and less in No. 8 AWG and larger sizes shall be made using approved bolted connectors properly taped as specified herein.

C. For No. 10 AWG and smaller branch circuit and fixture conductors operating at 277 volts or less, live spring pressure connectors rated for 600 volts may be used for splices and junctions. When installed in a fixture, connectors shall be rated for 1,000 volts.

2.8 GROUND RODS

A. Ground rods shall be Copperweld, sectional type. Ground rods shall be UL listed and REA approved and shall conform to ANSI C33.8.

B. Connections between grounding conductors and grounding rods shall be mechanical if above ground, thermal if underground.

PART 3 EXECUTION

3.1 INSTALLATION

A. All interconnecting wiring shall be installed in approved conduit or cable trays and connected as shown on the Drawings and/or specified herein. Unless otherwise shown or specified, all wiring shall be run in conduit.

B. Unless otherwise shown on the Drawings, wiring shall be run by the most direct route keeping overall circuit length to a minimum.

C. Instrumentation and low level signal wiring shall not be located in the same conduit as motor wiring, feeder wiring, branch circuit wiring, or control wiring. Control wiring shall not be located in the same conduit as feeder wiring, or instrumentation wiring.

D. All control and circuit wiring in cabinets, boxes, gutters, etc. shall be neatly tied and held using nylon cable ties and mounting brackets.

E. After installation, conductors shall not have dents, scars, cuts, pressure indentations, abraded areas, etc.

F. Conductors 600 volts and below shall not be bent to a radius less than 12 times the cable diameter. Conductors above 600 volts shall not be bent to a radius of not less than 24 times the cable diameter.

G. Wiring run in metallic conduits shall be arranged such that there are an equal number of conductors of each phase in each conduit. Under no circumstances shall metallic conduits contain one single conductor or several conductors of only one phase. This requirement shall not apply to single, bare grounding conductors run in conduit to grounding rods or grids.

H. Conductors may be coated with talc, soapstone, Ideal "Yellow 77" or "Wire Lube", Electro-Compound "Y-ER EAS," or equal, to facilitate pulling into raceways, but in no case may they be greased or coated with any substance injurious to conductor insulation and jacket. Pulling tension shall be exerted primarily on the strongest component of conductors, normally the metallic conductors themselves and not on the insulation jacket. When installing cable in conduit with pulling eye attached to copper conductor, the tension shall not exceed 0.008 pound per circular mil area of the conductor nor 5,000 pounds, whichever is smaller. When a basket grip is used over the outer jacket of the cable, the maximum pulling tension shall not exceed 0.008 pound per circular mil area of the conductor nor 1,000 pounds, whichever is smaller. In no case shall pulling tensions recommended by the wire manufacturer be exceeded. The maximum sidewall pressure exerted on the insulation and sheath at a cable bend shall not exceed 300 pounds per foot of conduit bending radius. Conductors shall not be pulled "through" any outlet, condulet or box. Separate "pulls" shall be made on each side of such point.

I. Unless otherwise specified, splices shall be made at outlet or conduit boxes, pull or junction boxes, manholes, or vaults. No splice shall be drawn into a conduit. Splices in wiring rated 600 volts and below shall be made with enough spare wire for 2 splices to be remade with the wire at the same location.

J. All instrumentation and thermocouple extension wire shields shall be grounded. Shields on individual circuits shall be electrically continuous and shall be grounded at only 1 point in the circuit. Shields on thermocouple extension wire shall be grounded at the thermocouple only.

K. Surge suppressors shall be installed with the shortest line lead possible, but in no case longer than 18 inches unless otherwise shown on the drawings.

L. Inside manholes, all cables are to have racks with insulator supports. Supports are to be within 6 inches of each side of a splice and spaced not farther than 3 feet apart.

M. All conductors are to be identified. Branch circuits, motor feeders, and lightning wiring shall be identified by color coding as follows:

	277/480V	**120/208/240V**
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Neutral	Grey	White
Ground	Bare	Bare or Green

N. The color coding on No. 8 AWG and smaller conductors shall be continuous in length. No taping, painting or other means of coding will be acceptable. Conductors No. 6 AWG and larger and conductors operating above 600 volts shall be black with color coded tape visible at each point of access or view.

O. All circuits shall be identified at each termination and at all accessible locations such as manholes, hand holes, and pull-boxes. A circuit name shall be assigned based on the equipment at the load end of the circuit. Add a suffix letter if necessary to make the circuit number unique. Utilize sleeves for conductor sizes #2 AWG and smaller, and marker plates attached with nylon tie cords for larger conductor sizes. Taped-on markers or markers relying on adhesives shall not be allowed.

P. Conductors used for temporary construction power shall not be used for the permanent installation, and the permanent conductor system shall not be used for construction power unless authorized in writing by the Engineer. Circuit protective devices shall never be temporarily bypassed.

Q. Cables shall be pulled and installed without splices. Splices shall only be made with the Engineer's approval.

R. Apply fireproofing tape to cables in hand holes and manholes, and in other locations such as vaults, throughout their exposed length. Follow the tape manufacturer's installation instructions closely.

S. All fiber terminations shall be done by a factory certified personnel.

3.2 TESTING

A. Perform visual and mechanical inspection of each individual exposed power cable #6 AWG and larger for physical damage, correct terminations in accordance with the Drawings, cable bends in accordance with bending radius requirements, proper circuit identification, proper lug type, tightness of bolted connections with proper torque level per NETA ATS, Table 10.12 or manufacturer's specifications, and proper grounding.

B. Perform Insulation Resistance Testing of all conductors #6 AWG and larger with respect to ground and each adjacent conductor. Apply 1,000 volts dc for one minute on 600 volts insulated conductors in accordance with NETA. Minimum insulation resistance values shall not be less than 50 meg-ohms. Investigate all deviations between adjacent phases.

C. Perform Continuity test by ohmmeter method to ensure proper cable connections of all conductors #6 AWG and larger.

D. Perform fiber testing on all fiber terminations. Submit data to engineer for approval.

END OF SECTION

SECTION 16130

BOXES

PART 1 GENERAL

1.1 SCOPE

A. All boxes required throughout the electrical raceway system shall be furnished and installed in accordance with the requirements which follow.

1.2 SECTION INCLUDES

A. Outlet boxes.

B. Pull and junction boxes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Boxes shall be equal to Appleton, Crouse Hinds, Raco, or Steel City.

2.2 MATERIALS

A. Outlet Boxes

1. Sheet Metal Outlet Boxes: NEMA OS-1, UL 514; galvanized steel, with ½ inch male fixture studs where required.
2. Cast Boxes: Cast feralloy with galvanized or cadmium finish, deep type, gasketed cover, threaded hubs for use with steel conduit, UL 514.
3. Floor Boxes: Full adjustable, steel, water and concrete tight equal to T&B model number 68 D.
4. Except as indicated otherwise on the drawings or in these specifications, all junction boxes or pull boxes 4 inch trade size or smaller in any dimension shall be galvanized malleable iron or acceptable equal cast ferrous metal for use with steel conduit.

B. Pull and Junction Boxes

1. Junction boxes and pull boxes shall be as indicated on the drawings and as specified in these specifications. Where no type or size is indicated elsewhere for junction boxes or pull boxes, they shall be in accordance with the requirements of the NEC, Article 314, Paragraphs 28, 29, 40 and 41 for use on systems with a nominal rating of 600 volts and less, and Section IV for use on systems with a nominal rating of over 600 volts.
   a. Sheet Metal Boxes: NEMA OS-1; galvanized steel. Boxes larger than 12-inches in any dimension are hinged enclosure. Equal to Hoffman Bulletin A-51.

b. Cast Metal Boxes: NEMA 250; Type 4, galvanized cast iron box and cover, neoprene gasket, stainless steel cover screws, UL listed as raintight. Provide flat-flanged type for surface mounting and outside flange recessed cover type for underground use. Boxes for sidewalk or other traffic areas to have appropriate duty cover with non-skid finish.

c. Corrosion Resistant Boxes: UL 508 Type 4X, gasketed screw cover. For boxes larger than 12-inches in any dimension provide hinge on one side and stainless steel toggle latches (equal to Hoffman A-FC412SS) on the other three sides. Equal to Type 304 stainless steel equal to Hoffman Bulletin A-51.

d. Floor Boxes: Floor boxes shall be cast iron with bolted covers. The boxes shall be approximately 12 inches square and 10 inches deep, and shall be located as shown on the drawings with the lid flush with the finished floor. Floor boxes shall be Neenah No. R-7517-DB or alternate acceptable to the Engineer.

2. Electrical enclosures, except junction boxes and pull boxes 4 inch trade size and smaller and other enclosures of cast metal, shall be constructed from steel plate reinforced as required to provide true surfaces and adequate support for devices mounted thereon.

3. Except as indicated otherwise in these specifications or on the drawings, all junction boxes and pull boxes larger than 4 inch trade size for use in indoor locations shall be sheet steel hot-dip galvanized after fabrication and those for use in outdoor locations shall be 316 stainless steel.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordination of Box Locations

1. Provide boxes as shown on Drawings, and as required for splices, taps, wire pulling and equipment connections.

2. Box locations shown on the Drawings are approximate unless dimensioned. Verify box locations prior to rough-in. Coordinate mounting heights and locations of outlet mounted above counters, benches, backsplashes, and other furnishings. Any outlet may be relocated by up to 10 feet before it is permanently installed without incurring additional cost.

3.2 INSTALLATION

A. Box Installation

1. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.

2. Locate boxes in masonry walls to require cutting of masonry unit comer only. Coordinate masonry cutting to achieve neat openings for boxes.

3. Support boxes independently of conduits openings.

4. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
5. In inaccessible ceiling areas, position outlets and junction boxes within 6-inches of recessed luminaires to be accessible through luminaire ceiling opening.
6. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
7. Align wall-mounted outlet boxes for switches, thermostats, and similar devices. Align adjacent devices at different elevations in one vertical line. Set floor boxes level and flush with finish flooring material.
8. Unless otherwise noted, use only cast outlet boxes. Galvanized steel boxes shall be used only in finished areas where they are completely concealed within walls or ceiling.
9. Conduit openings in boxes shall be made with a hole saw or shall be punched. Field locate holes in junction and pull boxes so as to afford the maximum bending radius for the conductors.
10. Boxes mounted on concrete shall be secured by self-drilling anchors. Mounting on steel shall be by drilled and tapped screw holes, or by special support channels welded to the steel, or by both. Boxes larger than 4 inch trade size shall be leveled and fastened to the mounting surface with not less than 1/4 inch air space between the enclosure and mounting surface. All mounting holes in the enclosure shall be used.
11. Except as prevented by the location of other work, all junction boxes and outlet boxes shall be centered on structures.
12. Label cover of junction boxes with circuit numbers of conductors in the box.
13. Unless indicated otherwise on the drawings or in these specifications, electrical enclosures, except junction boxes and pull boxes 4 inch trade size and smaller, shall be as follows:

Location	Enclosure Type
Indoor (Nonhazardous) Dry Areas	NEMA 1
Areas where moisture conditions are more severe than those for which NEMA 1 enclosures are intended	NEMA 4
Outdoor (Nonhazardous)	NEMA 4X
Class 1, Division 2	NEMA 7

END OF SECTION

SECTION 16155

MOTOR STARTERS AND MOTOR CONTROL CENTER

PART 1 GENERAL

1.1 SCOPE

A. Provide motor starters and motor control centers as specified herein and shown on the drawings.

B. Work covered by this section includes furnishing all labor, equipment, and materials required to install motor starter enclosures and motor control centers.

C. The electrical rooms have been sized based on Cutler-Hammer or GE/ABB's equipment. If an alternate manufacturer is used, the contractor shall take responsibility that the alternate manufacturer's equipment will fit the space. Electrical room layouts will also be required to be submitted for alternate manufacturer.

1.2 SUBMITTALS

A. Itemized bill of materials.

B. Descriptive information.

C. Dimensional layout drawings.

D. List of starters, feeders, and type of circuit protection and trip settings.

E. Complete wiring and schematic diagrams.

F. One-line diagrams.

G. Spare parts data.

H. Operations and maintenance manuals.

1.3 REFERENCES

A. Underwriter's Laboratories, Inc. (UL).

B. National-Electrical Manufacturer's Association (NEMA).

C. American National Standards Institute (ANSI).

D. National Fire Protection Association (NFPA).

PART 2 PRODUCTS

2.1 MOTOR STARTERS

A. Motor starters shall be full voltage, non-reversing (FVNR), combination MCP magnetic motor starters unless otherwise shown on the contract drawings. The starters shall be NEMA size 1 or larger.

B. Enclosures shall be NEMA 12 for indoor dry areas and NEMA-4X stainless for outdoor use.

C. Motor Circuit Protector (MCP), with 65,000 sym I.C. at 480 volts. Shall be provided as a minimum. Current limiters shall be used where necessary.

D. Square D, ABB/GE, or Cutler-Hammer.

E. Three, ambient temperature compensating, Class 20 bimetallic, thermal overload relays - manual reset shall be provided on all motor starters.

F. 120 volt control power transformer with 100 VA extra capacity and fuses, push-to-test run light (red), auxiliary normally open contact for use with data logging system, provide on-off selector switch, or start-stop push-buttons or hand-off-automatic switches and other control devices and indicating lights as shown on the electrical drawings.

G. Manually operated starters for single-phase fractional horsepower motors shall be full-voltage, non-reversing with overload protection. Provide red run indicating light and auxiliary contact for interlocking.

2.2 MOTOR CONTROL CENTERS

A. General
1. Motor Control Centers shall be tested in a high power laboratory to prove adequate mechanical and electrical capabilities. All major components shall be individually tested and guaranteed by the manufacturer. Wiring shall be NEMA Class I.
2. The type of enclosure shall be in accordance with NEMA Standards for Type 1 with gasketed doors. All enclosing sheet steel, wireways and unit doors shall be gasketed.
3. The Motor Control Centers shall be suitable for operation on 480-volt (480V), 3-phase, 60-Hertz system.
4. Equipment shall meet the applicable NEMA, ANSI and UL standards.

B. Structure Arrangement
1. Structures shall be totally enclosed dead front, freestanding assemblies. They shall be 90 inches high and 21 inches deep for front-mounted units. Structures shall contain a horizontal wireway at the top, isolated from the horizontal bus and shall be readily accessible through a hinged cover. Adequate space for conduit and wiring to enter the top or bottom shall be provided without structural interference and safely accessible without disrupting service.

2. Compartments for mounting control units shall be incrementally arranged such that not more than 6 sizes starters may be mounted within each vertical structure. Guide rails shall be provided for all units.
3. 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.

C. Bus Arrangement
1. Each structure shall contain a main horizontal copper bus, with minimum capacity of 600 amperes or rated as shown on the drawings. Vertical busses feeding unit compartments shall be 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 a minimum rating of 300 amperes for front mounted units and 600 amperes for back-to-back mounted units.
2. The vertical bus shall be completely isolated and insulated by means of a labyrinth design barrier. It shall effectively isolate the vertical busses to prevent any fault-generated gases to pass from one phase to another. In addition, a shutter mechanism shall close the stab openings upon removal of unit and shall automatically open upon reinsertion of the unit.
3. Buses shall be braced for 65,000 amperes symmetrical. Provide 100,000 amperes symmetrical, if required by the short circuit study.

D. Unit Construction
1. See electrical drawings – electrical schematic diagrams – for additional requirements.
2. All full voltage starter units through NEMA size 5 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 into the bus compartment. Interior of all units shall be painted white for increased visibility. Units shall be equipped with side-mounted, pull-apart terminal blocks rated at 300 volts. Knockouts shall be provided for the addition of future terminal blocks. In addition, a master terminal block shall be Draw out and shall be located in the bottom wireway, readily accessible through a hinged cover. Incoming service feeder shall enter the MCC at the bottom.
3. 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. Each unit compartment shall be provided with an individual front door.
4. 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 from 1 to 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.
5. Combination starter units shall be full voltage non-reversing unless shown otherwise and shall utilize Motor Circuit Protectors (MCP). Reduced voltage

starters shall be of the solid-state soft start design. Each combination unit shall be rated at a minimum 65,000 A.I.C. symmetrical at 480V. The MCP shall provide adjustable magnetic protection and be provided with pin insert to stop the magnetic adjustment at 1300 percent motor nameplate full load current to comply with NEC requirements. A current limiter attachment with 100,000 amps, I.C. shall be provided if required by the short circuit study results. The current limiter shall be coordinated with the MCP such that the MCP will always open all three phases when the current limiter opens any phase.

6. Starters shall be electrically operated, electrically held, 3-pole assemblies with arc extinguishing characteristics and shall have silver-to-silver renewable contacts. They shall have provisions for at least 2 N/O or 2 N/C electrical interlocks. The overload relay assembly shall be of the thermal bimetallic type. Overload relays shall be reset from outside the enclosure by means of an insulated button.
7. Each starter shall be equipped with a fused control power transformer with 100 VA extra capacity. Each starter shall be supplied with indicating lights, control switches, auxiliary contacts and associated components as shown on the electrical drawings.
8. Phase failure relays shall be provided to detect open phase and phase reversal conditions were indicated on Contract drawings.
9. Reduced voltage solid-state (RVSS) combination starters shall include a thermal magnetic circuit breaker (or MCP) for short-circuit protection and quick disconnect means, a solid-state starter unit, a cooling fan, and overload protection. The reduced-voltage solid-state starter shall have an integral running duty bypass contactor that shall allow the motor to run across the line, once it has come up to speed. The switchover action shall occur automatically to reduce heat buildup in the soft start controller, and therefore lengthen its life. Provide the following control functions:
    a. Selectable torque ramp start or current limit start
    b. Adjustable kick start time or torque
    c. Adjustable smooth stop ramp time
        1) The torque ramp soft start shall raise the motor voltage to a corresponding initial adjustable torque value. The motor voltage will then be increased gradually from the initial value to 100 percent during the acceleration ramp time adjustment.
        2) The current limit start feature allows setting of the starting current as a percentage of the motor full-load current.
10. Individual feeder breakers shall be molded case circuit breakers of the thermal magnetic type or with integral current limiting fuses if required with an interrupting capacity of 65,000 amps I.C. at rated voltage.
11. Adjustable frequency drives shall be as specified in specification Section 16157.
12. Drawings: Drawings shall be submitted under the section entitled, “Shop Drawings, Product Data and Samples,” of these Specifications showing: complete electrical rating including short circuit withstandability of bus and interrupting rating, outline dimensions including space available for conduits, schedule of units showing starter type, control devices, etc., and unit elementary wiring diagrams showing numbered terminal points in accordance with NEMA Class I control centers.
13. Pilot Devices: Pushbuttons and selector switches, unless otherwise specified or required, shall be heavy duty, oil-tight, momentary contact devices. Each device shall be color-coded to indicate motors of similar function.

a. Indicating lights shall be of the heavy duty, oil-tight, push-to-test type, and shall be color coded as follows:

Indication	Color
Equipment Running	Green
Equipment Off	Red
Alarm	Amber

14. Nameplates: Each compartment shall be provided with a suitable engraved nameplate. Standard, engraved nameplates with 3/16 inch high letters nameplates shall be laminated plastic, engraved through the black surface to form white letters. Relays and special devices inside the control center shall have permanent identification matching wiring diagrams.
15. Terminals: All terminals and wires shall be clearly labeled, and the wiring diagrams shall be mounted in the MCC doors.
16. Spare Parts: The following spare parts shall be furnished with the motor control centers:
    a. One coil for each size of starter furnished
    b. Indicating lamps – 5 each type
    c. Fuses-10 each size and type
    d. Overload heaters – 1 each size
17. All spare parts shall be suitable protected against corrosion and impact for long-term storage. All parts shall be clearly labeled and identified by manufacturer's name and part number.
18. Instruments and Electronic Power Meters
    a. Provide switchboard class voltmeters and ammeters where shown on the drawings. Furnish associated Current Transformers (CTs), Potential Transformers (PTs), and Selector Switches as required.
    b. Provide electronic power meters where shown. Furnish associated CTs required. Power meters shall have the following features as a minimum:
        1) Solid state design with LED displays.
        2) Local display of volts, amperes, kilowatts, and kilowatt-hours.
        3) Analog output signal (4-20 mA) for kilowatts.
        4) Direct sensing of voltage up to 600 volts.
19. SPD
    a. Standards
        1) ANSI/IEEE C62.41 & C62.45
        2) UL 1449 2nd Edition
        3) NEMA LS-1
        4) UL1283
    b. Performance
        1) SPD units shall be rated 250kA per phase unless otherwise noted on drawings.
        2) The service entrance SPD shall be tested and suitable for ANSI/IEEE C62.41 Category C3 environments.
        3) Voltage let-through, per UL 1449 2nd edition, shall not exceed 800V L-N, L-G, N-G and shall not exceed 1500V L-L.
    c. Assembly
        1) The SPD equipment shall be mounted within the assembly by the manufacturer of the assembly at the manufacturer's factory.

2) The SPD shall be provided with a circuit breaker disconnect sized according to the SPD manufacturer's recommendation.
3) The SPD shall be installed on the load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.
4) All monitoring diagnostics features such as indicator lights, trouble alarms and surge counter, shall be mounted on the front of the assembly.
5) The SPD shall be mounted in a drawout unit

d. SPD Design
1) The SPD shall be a hybrid design utilizing MOV's and a high-performance EMI/RFI noise rejection filter.
2) The SPD shall have integral overcurrent protection of 200kAIC.
3) The SPD shall incorporate additional thermal fusing to protect the unit from low level faults due to temporary overvoltage conditions.

e. Diagnostics
1) Individual phase status lights, a Form-C output contact, and an audible alarm shall be provided for faults or power loss.

f. Warranty
1) The manufacturer shall provide a 10 year warranty on the SPD unit.

E. Finish - The control center is to be given a phosphatize pretreatment. Manufacturer's standard color (baked-on enamel) shall be used as a finish.

F. Nameplates - Each unit will have 1.0 by 2.5-inch hot stamped nameplate. The lettering shall be white 3/16 inch high, in a black background.

G. Approved Manufacturers - All major components shall be by the same manufacturer as the Motor Control Center. The Motor Control Center shall be manufactured by Square D, GE/ABB, Cutler-Hammer or approved equal.

H. Provide line reactors and filters where shown on the one line diagrams.

PART 3 EXECUTION

3.1 INSTALLATION AND TIELD TESTING

A. Install equipment in accordance with submittal drawings and manufacturer's recommendations.

B. Make adjustments and settings in accordance with the short circuit and coordination study results.

C. Perform an infrared (hot spot) thermal imaging testing of the MCC. The test shall be performed during periods of maximum loading (not less than 40 percent of rated load). Verify all electrical connections in accordance with NETA Standards for Power Distribution Equipment and Systems, and provide photographs.

3.2 MANUFACTURER'S SERVICES

A. Furnish manufacturer's representative to perform the following services:

1. Installation assistance and inspection of installation (8 hours minimum)
2. Functional testing (8 hours minimum)
3. Training of owner's personnel (8 hours minimum)

END OF SECTION

SECTION 16157

VARIABLE FREQUENCY AC MOTOR DRIVE

PART 1 GENERAL

1.1 SCOPE

A. The contractor shall furnish and install all Variable frequency AC motor drive equipment including accessory equipment, wiring and specialties as specified herein. All conduit and wiring between panels and between all AFDs (Variable frequency drive) and motors, power supplies, and control panels shall be furnished and installed as required for a complete operating drive system.

B. The contractor shall be responsible for coordination of the AFD and its associated motor to match torque, speed, voltage, horsepower, current and other particular characteristics to meet the specified motor-driven equipment criteria. The minimum full load output current of the controller shall be equal to the equivalent motor horsepower plus 10 percent as listed by National Electrical Code Table 430-150 or the actual nameplate rating of the associated multipole motor, whichever is greater.

C. The Variable frequency controller shall be UL and CSA certified and shall comply with the latest applicable standards of ANSI, IEEE and NEMA.

D. The Variable frequency controller manufacturer shall maintain, as part of a national network, engineering service facilities within 250 miles of the project, to provide start-up service, emergency service calls, repair work, service contracts, maintenance, and troubleshooting training of customer personnel.

E. See one line diagrams for dV/dT, Line Reactor, and Torque requirements.

F. All Variable frequency drives shall be from the same manufacturer. Variable frequency controllers shall be GE/ABB, Cutler Hammer, or Square D.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 16010, General Electrical Provisions.

B. Section 16050, Basic Electrical Materials and Methods.

1.3 SUBMITTALS

A. Shop Drawings and data shall be submitted in accordance with the section entitled “Shop Drawings, Product Data and Samples” of these Specifications.

B. Complete drawings shall be furnished for approval and shall consist of wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the Variable frequency controller. Suitable outline drawings showing details necessary to locate conduit stub ups and field wiring shall be furnished for approval before proceeding with manufacture.

C. Furnish system operating description and literature for all control devices.

D. Harmonic Analysis Report showing individual and total harmonic content (voltage and current) reflected in the power system at the MCC that powers the drives.

1.4 NAMEPLATES

A. AFD controllers shall be supplied with embossed nameplates mounted in visible locations and containing as a minimum, the following information:
   1. Manufacturer
   2. Model Designation
   3. Horsepower rating
   4. Maximum Current Rating, Amperes
   5. Power factor
   6. Operating voltage
   7. Frequency range

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES - GENERAL

A. Variable frequency drives shall be provided for equipment as shown on the drawings and equipment specifications.

B. Warranty
   1. The drive manufacturer shall provide a complete warranty for a period of 1 year from the system substantial completion/Owner acceptance date. Warranty shall cover on-site service during working hours in the case of malfunction and include parts, labor and per diem expenses.

C. Current and Voltage Harmonic Distortion
   1. The drives shall meet all requirements of IEEE 519-1992 for each individual and total harmonic voltage and current distortion as indicated in this specification. Individual and total harmonic content reflected in the system in-coming power feeders shall be minimized.
      a. As per Table 10.2 of IEEE 519, individual or simultaneous operation of the drives shall not add more than 3% total harmonic voltage distortion while operating at full load and speed from the utility source, or more than 5% while operating from standby generator source.
      b. As per Table 10.3 of IEEE 519, maximum allowable total harmonic current demand distortion limits for each drive operating at full load and speed shall not exceed 5% as calculated and measured at the point of common coupling ($I_{sc}/I_l < 20$).
      c. The point of common coupling for all harmonic calculations and field measurements for both voltage and current distortion shall be defined as the drive input terminals.
   2. The supplier must submit a harmonic analysis report. The drives will not be approved without a completed harmonic analysis report.
      a. Calculations shall be performed for both normal utility and standby generator power sources.

b. Calculations shall be performed for all drives running, including future drives. (See plant one-line diagrams).
c. The contractor shall be responsible to provide information on the standby generators, as well as pertinent information from the power systems short circuit analysis required for the harmonic calculations.

3. If distortion limits exceed specified limits, the supplier will be required to design and install harmonic filters within the drives to reduce the distortions.
4. Harmonic compliance shall be verified with onsite field measurements of both the voltage and current harmonic distortion at the drive input terminals, with and without the drives operating. A recording type Fluke 41 or equivalent harmonic analyzer, displaying individual and total harmonic currents and voltages must be utilized.

D. All drive components, including power factor correction, harmonic filter, and phase-shifting transformer shall be integral to the drive lineup, factory wired, and tested as a complete system.

E. The drives shall be suitable for use with any standard NEMA MG-1 Design B squirrel-cage induction motor having a 1.15 service factor and nameplate data as shown in the pump specifications. The drives can be located up to 300 feet from the motor without requiring special cabling or separate motor protection devices. Provide output line reactors if required to overcome the cable resonance problems (long-lead effect).

2.2 VARIABLE FREQUENCY AC CONTROLLERS

A. General
1. The AFD motor controller shall convert 480 Volts, three-phase, 60-Hertz input power to an Variable voltage (0 – 480 volts) and frequency (0 - 60 Hz.), three-phase, ac output power for step-less motor speed control with a capability of 10:1 speed range, under variable torque or constant torque load, as required by the driven equipment.
2. All drives shall be from the same manufacturer.
3. Provide drive systems consisting of AFD controllers and all auxiliary devices for a complete operating system. Coordinate with pump motor supplier and furnish drives rated on actual load nameplate current rating.
4. Other equipment is being powered from the same bus as the AFDs. Ensure proper operation of the drives and the other loads under normal and standby power source conditions.

B. Service Conditions
1. The controller shall be designed and constructed to operate within the following service conditions:
a. Elevation up to 3300 feet without derating
b. Ambient temperature range: 0°C to 40°C
c. Atmosphere: Non-condensing relative humidity to 95%
d. AC line voltage variation: -10% to +10%
e. AC line frequency variation: ±3 Hertz

C. Drive Design
1. The Variable frequency controller shall be a Pulse-Width Modulated (PWM) type converter design. Distributor or package modifications to a third-party

standard product will not be acceptable. The inverter output shall be generated by Insulated Gate Bipolar Transistor (IGBT) technology.

2. The controller shall produce an Variable ac voltage/frequency output. It shall have an output voltage regulator to maintain correct output volts/ Hz ratio despite incoming voltage variations.
3. The controller shall have a continuous output current rating of 100% of motor nameplate current.
4. Six pulse converters shall be acceptable for motor horsepower rating less than 50 hp.
5. Provide clean power (18-pulse) converters for all motors rated 50 hp and above.
6. Provide an Input Line Reactor to attenuate line side transients and input current harmonics.
7. The drive system shall maintain a 0.95 minimum true power factor throughout the entire speed range.
8. Furnish an Input Circuit Breaker to disconnect incoming power and provide overcurrent protection for the drive. The Input Circuit Breaker shall be interlocked with the enclosure door, with a through-the-door handle to provide positive disconnect of incoming ac power. The circuit breaker shall be rated 65,000 Amps RMS symmetrical.

D. Enclosure
   1. NEMA 250, type 1 enclosure.
      a. Wall-mounted for drive rating less than 50 hp.
      b. Freestanding for larger drives.

E. Protective Features
   1. The drive shall be able to withstand an open-circuited output that may occur during operation without damage.
   2. The drive shall be to withstand a short-circuited output that may occur during operation without damage.
   3. The drive shall be to withstand failure to connect to the motor without damage.
   4. Instantaneous overcurrent and overvoltage trip.
   5. Undervoltage and power loss protection.
   6. Power unit overtemperature alarm and protection.
   7. Responsive action to motor winding temperature detectors or thermostatic switches.

F. Controls and Operator Interface
   1. Controls
      a. Mount drive local control on front door of enclosure and include control switch and membrane type keypad for the following minimum operator functions:
         1) Start and Stop (when in local mode)
         2) Speed Increase and Decrease (when in local mode)
         3) LOCAL/OFF/REMOTE control switch. In Remote position, accept a remote RUN command digital input and Speed Increase/ Decrease via remote a 4-to-20 mA analog signal.
         4) RUN at a preset speed.
         5) Fault RESET (Manual for all faults except for loss of ac voltage that shall be automatic upon return if within a preset time)
   2. Password Protection

3. Control circuit disconnect shall de-energize circuits in units that are not de-energized by main power disconnect device.
4. Alphanumeric Display
    a. During normal operation and routine test, the following parameters shall be available:
        1) Motor current (percent of drive rated current)
        2) Output frequency
        3) Output voltage
        4) Running time
        5) Local/remote indicator
        6) Status of digital inputs and outputs
        7) Analog input and output values
5. Variable Parameters
    a. Frequency, range, minimum, maximum.
    b. Preset speed (Variable, preset operating point).
    c. Provision for adjustment of minimum and maximum pump speed to be furnished as function of 4-to-20 mA remote speed signal.
6. Historic Log and Fault Log
    a. The drive shall record and display selectable control variables and fault information.
7. Power Circuits
    a. Provide 120V single-phase ac circuit for motor space heater, if the motor is furnished with a space heater to prevent moisture condensation. Switch this circuit ON when the drive is not running.
    b. Provide power for drive enclosure space heater
    c. Provide 120V single-phase ac control voltage for motor thermistor relay.

G. Signal Interface
1. Digital Inputs
    a. Accept a remote RUN command contract closure input
    b. When motors (typically from 100 hp to 200 hp) are furnished with motor high temperature contact and/or field-mounted motor temperature monitoring relay, the drives shall include circuitry to interface with the temperature monitoring relay as required.
    c. Accept a high discharge pressure input. Shut off drive the when high pressure persists for an Variable preset time.
    d. Drives for submersible dry pit and wet pit pump motors shall be furnished with circuitry to interface with the motor leak and temperature protection modules (such as the Flygt CAS module). Coordinate with the pump supplier and obtain the CAS module for mounting in the VFD enclosure as required. See the pump schematic diagram shown on the drawings for additional information.
2. Digital Outputs
    a. Furnish discrete outputs for the following. Outputs shall be dry contact closures rated 5 amps at 120 volts ac.
        1) DRIVE RUNNING
        2) DRIVE OFF
        3) DRIVE FAULT (common contact for all fault conditions)
        4) DRIVE IN REMOTE MODE
        5) See Schematic Diagram for additional Outputs for monitoring of Submersible Motors (LEAK FAIL, HI BRG TEMP, HI WNDG TEMP).

3. Analog Inputs
    a. When LOCAL/OFF/REMOTE switch is in REMOTE, the drive speed shall be controlled from a remote 4-to-20 mA dc signal. Make provisions for adjustment of minimum and maximum motor speed that shall result from this signal.
    b. If the motor is provided with RTD's (generally for motors 250 hp and above), the drive shall include a Motor Protection Relay (MPR) to accept six RTD inputs and provide interlocking and output alarm contacts.
4. Analog Outputs
    a. Furnish two 4-20 mA speed signals as shown on the drawings.

2.3 ON-SITE AFD STORAGE

A. The Variable frequency controller shall be protected against damage at all times. The Controller shall be stored in a clean, dry environment with temperature and humidity within the range as specified by the controller manufacturer. Space heaters shall be energized during storage, as recommended by the manufacturer.

2.4 DRIVE SYSTEM SPARES

A. The manufacturer shall provide 1 spare for each plug-in type PC card in the unit. These spares shall be color-coded or otherwise keyed to its original counterpart such that improper installation of spare cards is impossible. In addition to the cards, the manufacturer shall provide 3 spares for all expendable items for each rating such as fuses, pilot lamps, and 3 complete power semi-conductor assemblies and 1 spare rectifier pack for each rating supplied.

B. All spare printed circuit cards shall be sealed in a conductive packing to prevent damage from static electricity and moisture.

C. All spares shall be clearly and permanently labeled on the outside of the packaging as to the manufacturer's name and equipment model number.

2.5 FACTORY TESTS AND CHECKS

A. Variable Frequency Controller power transistors, GTOs, SCRs, and diodes shall be 100 percent inspected and tested, including temperature cycling (0°C to 65°C) and ambient high temperature (65°C) load testing.

B. All integrated circuits shall be 100 percent inspected and tested.

C. All printed circuit boards shall be tested under a temperature cycling (0 to 60°C) 20-hour load test and then functionally tested via faultfinder bench equipment prior to unit installation.

D. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults. Variable frequency controller shall trip electronically without device failure.

E. After all tests have been performed, each Variable frequency controller shall undergo a 40-hour burn-in test.

F. After the burn-in cycle is complete, each Variable frequency controller shall be put through a 30-minute cycling motor load test before inspection and shipping.

G. The Variable frequency controller manufacturer shall provide certification that all of the testing above has been performed.

PART 3 EXECUTION

3.1 START-UP SERVICES

A. Testing, checkout, and start-up of the Variable frequency controller equipment shall be performed under the technical direction of the manufacturer's service engineer. The drive system shall not be energized without authorization from the manufacturer's representative.

B. The Variable frequency controller manufacturer shall provide at no additional cost to the owner, start-up service for all Variable frequency controllers provided. Service shall include inspection, final adjustments, operational checks, functional checks of spare parts and a final report for record purposes. The service package shall include a 2-year parts warranty from date of shipment for all Variable frequency controllers provided. A factory service engineer shall provide the start-up service. The engineer shall be permanently located within 250 miles of the installation for service after start-up, if required by the owner.

C. A copy of all test reports performed in the field, complete with meter readings, where applicable, shall be submitted to the owner for his record.

3.2 TRAINING

A. System supplier shall provide operation and maintenance training for owner's personnel to ensure their adequate knowledge of use of the system. Minimum training time shall be four hours.

END OF SECTION

SECTION 16160

PANELBOARDS

PART 1 GENERAL

1.1 SCOPE

A. Panelboards shall be furnished in the quantities and with components, devices, and materials meeting the requirements indicated in the panelboard list on the drawings.

B. Panelboards shall be designed and fabricated in accordance with NEMA standards for panelboards. Each panelboard, or all current controlling devices in each panelboard, shall bear the UL label.

1.2 SECTION INCLUDES

A. Panelboards.

1.3 SUBMITTALS

A. Submit shop drawings.

1.4 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of panelboards and devices herein specified shall be in accordance with the standards of the below listed organizations.

1. American National Standards Institute (ANSI)
2. National Electrical Manufacturers Association (NEMA)
3. National Fire Protection Association (NFPA)
4. National Electrical Code, NFPA-70 (NEC)
5. Underwriters Laboratories, Inc. (UL)

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Equipment shall be manufactured by ABB/General Electric, Siemens, Square D, or Eaton/Cutler- Hammer.

2.2 MATERIALS

A. Panelboards: NEMA PB-1; UL 67.

B. Rating: Voltage and ampere ratings are shown on the Drawings. Unless otherwise indicated, interrupting ratings (RMS symmetrical) are 14,000 amps for 480 volt panelboards and 10,000 amps for 240 and 208 volt panelboards.

C. Cabinets: Indoor panelboards shall be in NEMA 1 cabinets. The cabinet shall be code gage gasketed steel. It shall consist of a box with a removable front complete with hinged door, latch and master keying lock. The box shall be flanged galvanized sheet steel. Boxes shall be a minimum of 20 inches wide and 5-7/8 inches deep. Code gauge galvanized steel; sized to accommodate devices indicated and afford wire bending space in accordance with NEC requirements.

D. Fronts: Surface or flush as indicated, door-in-door construction, finished in light grey enamel over a rust inhibitor. Furnish flush lock for fronts less than 48-inches high and vault type handle with three point catch for fronts 48-inches and higher. Key all locks alike.

E. Bus:
1. Rigid buses of copper or copper alloy shall be installed to provide consecutive phasing of branch circuit connections.
2. The solid neutral bus shall have solderless connectors, numbered to agree with branch circuits. The bus shall be insulated from the cabinet with provisions for grounding.
3. The equipment grounding bus with main lug shall have solderless connectors, numbered to agree with branch circuits.

F. Circuit Breakers:
1. NEMA AB-1; molded case type, thermal-magnetic trip with internal common trip on multi-pole breakers.
2. Protective overcurrent devices for branch circuits shall be of the size and type indicated on the drawings.
3. Panelboard branch circuit breakers shall be the thermal magnetic, bolt-in, individually front replaceable type and shall indicate "On", "Off", and "Tripped". Circuit breakers indicated as multiple pole shall be common trip.
4. Continuous and interrupting ratings shall be as shown on the drawings. Provide breaker fully rated for interrupting ratings noted; series ratings are not acceptable.

G. Provide engraved nameplates giving the voltage rating and panel designation as indicated. Provide a UL service entrance label for panelboards used as service entrance equipment.

H. Surge Protection: Where indicated, provide transient voltage surge suppressors.

PART 3 EXECUTION

3.1 INSTALLATION

A. All panelboards shall be installed so that circuit breakers are not more than 6 feet above the finished floor and not lower than 24-inches above the floor. Panels shall be installed in accordance with the requirements of NEC Article 312 Paragraph 8, Article 408 and the following articles.

B. The cabinets shall be leveled and securely fastened to the mounting surface, utilizing all of the mounting holes provided in the panelboard cabinets.

C. Each cabinet shall be installed, conduits connected, and wires pulled before the panel interior is installed. A heavy cardboard panel front shall be temporarily secured to the front of the panelboard to protect the interior from dirt or damage until the permanent metal front is installed.

D. Each panelboard front shall be carefully aligned and adjusted until its edges are parallel to the panelboard interior and the building lines, and then shall be firmly secured with the fasteners provided.

E. For flush mounted panels provide a 3/4-inch empty raceway for each three unused spaces and spare poles. Terminate in a junction box located above the ceiling or other approved accessible location for future extension.

F. Prior to energizing panelboards clean out construction dirt and debris. Paint any scratches on the trims or dead front barriers. Megger each phase to phase and ground to insure that no short circuits exist.

G. Adjust panel barriers so that no openings occur between them and panel front. Provide filler plates and plugs as necessary to maintain dead front integrity.

H. A circuit directory cardholder and card with a clear plastic covering shall be provided on the inside of each cabinet door. The directory card shall provide a space to identify each circuit in the panelboard. The directory for each panelboard shall be accurately typed with the names of the load served by each breaker to permit ready location of the protective devices controlling circuit loads. Note spare circuits in pencil.

I. Each panelboard shall be identified with a suitable engraved nameplate mounted at the top of the front plate. Each nameplate shall be engraved with the panelboard identification indicated on the drawings.

END OF SECTION

SECTION 16170

MOTOR DISCONNECT SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Three phase motor disconnect switches.

B. Single phase motor disconnect switches under 1 horsepower.

C. Single phase motor disconnect switches over 1 horsepower.

1.2 SUBMITTALS

A. Submit shop drawings.

PART 2 PRODUCTS

2.1 THREE PHASE MOTORS

A. Disconnect switches for three phase motors shall be a heavy duty type rated 600 volts, and shall be UL listed. Outdoor switches shall be in NEMA 4X enclosures; indoor switches in non-corrosive atmospheres shall be in NEMA 1 enclosures; indoor switches in corrosive atmospheres shall be in NEMA 4X enclosures.

B. Switches shall be single throw non-fusible with provisions for padlocking the handle in the open position.

C. Unless noted otherwise, disconnect switches shall be rated for 600V.

2.2 SINGLE PHASE MOTORS UNDER 1 HORSEPOWER

A. Disconnect devices for single phase motors up to 1 horsepower, not controlled with magnetic starters, shall be toggle operated manual motor starters rated 240 volts ac. Outdoor switches shall be in NEMA 3R enclosures; indoor switches in non-corrosive atmospheres shall be in NEMA 1 enclosures; indoor switches in corrosive atmospheres shall be in NEMA 4 enclosures.

B. Switches shall be non-fusible type with a thermal overload trip assembly. The handle shall include a handle guard with provisions for padlocking the handle in the open position. Continuous ratings shall be as shown on the drawings.

2.3 SINGLE PHASE MOTORS OVER 1 HORSEPOWER

A. Disconnect switches for single phase motors over 1 horsepower in non-corrosive atmospheres and having separate overload protection and

control shall be general duty rated for 240 volts ac. Outdoor switches shall be in NEMA 4X enclosures and indoor switches shall be in NEMA 1 enclosures.

B. Disconnect switches for single phase motors over 1 horsepower in corrosive atmospheres and having separate overload protection and control shall be heavy duty rated for 600 volts ac in NEMA 4X enclosures.

C. Switches shall be 2 pole non-fusible, single throw type with provisions for padlocking in the open position. Continuous ratings shall be as shown on the drawings.

2.4 NAMEPLATES

A. Nameplates shall be provided for each motor disconnect switch to identify the load served. Nameplates shall be engraved with 3/16 inch minimum height black letters on a white background, and shall be mounted on the front of the enclosure with stainless steel screws.

2.5 ACCEPTABLE MANUFACTURERS

A. Disconnect switches shall be manufactured by ABB/General Electric, Cutler Hammer, Square D, or Engineer approved alternate.

PART 3 INSTALATION

3.1 INSTALLATION

A. Install in accordance with the manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. TESTS
1. Megger each bus, phase-to-phase and phase-to-ground.

END OF SECTION

SECTION 16231

GENERATOR AND ATS

PART 1 GENERAL

1. REFERENCES

B. The equipment covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards of ANSI, NEC, ISO, U.L., IEEE and NEMA.

1. RELATED SECTIONS

C. Division 3 - Concrete

D. Division 15 - Mechanical

1. WORK INCLUDED

E. The work includes supplying a complete integrated emergency generator system. The system consists of a diesel generator set with related component accessories and Automatic Transfer Switch as specified herein and on the drawings.

F. The Contractor shall provide a full tank of diesel fuel after the completion of all testing.

G. A complete system load test shall be performed after all equipment is installed.

H. The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a Manufacturer who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

1. MANUFACTURERS

I. There shall be one source responsibility for warranty, parts and service through a local representative with factory trained service personnel.

J. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (Listed in Alphabetical Order)

1. Generator Set:

(a) Caterpillar

(b) Kohler

(c) Onan-Cummins

2. Automatic Transfer Switch:

(a) ASCO

(b) Eaton/Cutler Hammer

(c) Kohler

(d) Cummins

1.2 SUBMITTALS

A. Engine-generator submittals shall include the following information

1. Factory published specification sheet indicating standard and optional accessories, ratings, etc.
2. Manufacturer's catalog cut sheets of all auxiliary components such as Automatic Transfer Switches, battery charger, control panel, enclosure, main circuit breaker, etc.
3. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
4. Weights of all equipment.
5. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, jacket water heater, remote alarm indications.
7. Engine mechanical data including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.
8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
9. Generator resistances, reactances, and time constants.
10. Generator motor starting capability.
11. Control panel schematics.
12. Oil sampling analysis, laboratory location, and information.
13. Manufacturer's and dealer's written warranty.

1.3 WARRANTY

A. The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of substantial completion and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Warranty service calls shall not include a deductible cost. Submittals received without written warranties as specified will be rejected in their entirety.

1.4 PARTS AND SERVICE QUALIFICATIONS

A. The engine-generator supplier shall have service facilities within 75 miles of the project site and maintain 24-hour parts and service capability. The distributor shall stock parts as needed to support the generator set package for this specific project.

B. The dealer shall maintain qualified, factory trained service personnel that can be reached within 10 minutes of an emergency call and can respond on site within 4 hours of notification, 24 hours per day.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The generator sets shall be Standby and have a kW rating as shown on the one line diagram. The ratings shall be at 1800 RPM, 0.8 power factor, 480Y/277 VAC, 3 phase, 4 wire, 60 hertz, including radiator fan and all parasitic loads.

B. All materials and parts comprising the unit shall be new and unused.

2.2 DIESEL ENGINE

A. The engine shall be as manufactured by one of the approved manufacturers listed above. The engine shall be water-cooled inline or vee-type, four cycle compression ignition diesel. The engine shall be equipped with fuel, lube oil, and intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter, gear-driven water pump.

B. The engine shall include a Closed Crankcase Ventillation (CCV) system. If the engine does not have integral CCV, an exteernal system, by Racor or equal, shall be added. System shall filter crankcase fumes, returning the filtered air to the engine intake and the captured oil back to the oil pan.

C. The complete engine block shall be machined from one casting. Designs incorporating multiple blocks bolted together are not acceptable.

D. The engine shall utilize a gear-type, positive displacement, full pressure lubricating oil pump and water-cooled lube oil cooler. Pistons shall be spray-cooled. Provide oil filters, oil pressure gauge, dipstick and oil drain.

E. Fuel filter and serviceable fuel system components shall be located to prevent fuel from spilling onto generator set batteries.

F. The engine shall be equipped with an isochronous electronic governor to maintain 0% droop from no load to full load and +/- 0.25% steady state frequency variation. The governor shall be equipped with speed adjustment.

2.3 GENERATOR

A. The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling.

B. The insulation material shall meet NEMA standards for Class H insulation and be vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed NEMA class F (105° C rise by resistance over 40° C ambient). The excitation system shall be of brushless construction.

C. The brushless exciter shall be independent of main stator windings (either permanent magnet or auxiliary windings) and shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressors shall be included to protect the diodes from voltage spikes. Generator shall have the ability to sustain short circuit current of 300% of rated current to allow protective devices to operate.

D. The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The

regulator shall be a totally solid state design which includes electronic voltage buildup, volts per Hertz regulation, three phase sensing, over-excitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed.

2.4 CIRCUIT BREAKER

A. Provide a generator mounted circuit breaker, molded case or insulated case construction. Breaker(s) shall be 100% rated, UL Listed and sized as shown on the drawing(s). Breaker shall include a 12 or 24 VDC shunt trip, and shall have auxiliary position contacts wired to the genset control panel for local and remote annunciation of the circuit breaker position. The breaker shall be connected to engine/generator safety shutdowns. Breaker shall be housed in NEMA 1P22, enclosure(s)mounted on the side of the generator. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing(s), shall be supplied on the load side of breaker. Breaker shall include long term, short term, and instantaneous.trip settings. All breakers rated 1000 Amps and above shall include ground fault indication.

2.5 CONTROLS

A. Generator Mounted Control Panel:

1. Provide a generator mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation, adjustable cycle cranking, digital LCD AC metering (0.5% true rms accuracy) with phase selector switch, digital engine monitoring, shutdown sensors and alarms with horn and reset, adjustable cooldown timer and emergency stop push-button. Panel shall incorporate self-diagnostics capabilities and fault logging. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged lid.
2. Provide the following digital readouts on the Generator Mounted Control Panel:
   Engine oil pressure
   Coolant temperature
   Engine RPM
   System DC Volts
   Engine running hours
   Generator AC volts
   Generator AC amps
   Generator frequency
3. Control Panel Annunciation - Provide the following indications for protection and diagnostics according to NFPA 110 level 1:
   Low oil pressure
   High water temperature
   Low coolant level
   Overspeed
   Overcrank
   Emergency stop depressed
   Approaching high coolant temperature

Approaching low oil pressure
Low coolant temperature
Low voltage in battery
Control switch not in auto. position
Low fuel main tank
Battery charger ac failure
High battery voltage
Generator supplying load

2.6 COOLING SYSTEM

A. The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 122° F ambient air entering the room or enclosure (If an enclosure is specified) without derating the unit and 50/50 anti-freeze mixture. The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

2.7 FUEL SYSTEM

A. Filter/Separator - In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine.

B. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted.

C. Flexible fuel lines shall be rated for 300 degrees F and 100 PSI.

2.8 EXHAUST SYSTEM

A. A critical type silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation.

B. The silencer shall be located inside the generator set enclosure. The silencer shall be mounted so that its weight is not supported by the engine.

C. Exhaust pipe size shall be sufficient to ensure that exhaust back pressure does not exceed the maximum limitations specified by the engine manufacturer.

2.9 STARTING SYSTEM

A. A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

B. Jacket Water Heater: A unit mounted thermal circulation type water heater. The heater watt rating shall be sized by the manufacturer to maintain jacket water temperature at 90 degrees F in an ambient temperature down to -20 Deg F. Heaters <= 6000W shall be 208 – 240V single phase, 60 Hz. Heaters greater than 6000W shall be 208 – 240V, three phase, 60 Hz.

C. Batteries: A lead-acid storage battery set of the heavy duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system. The battery set shall be rated no less than 140 ampere hours and 1300 CCA. Necessary cables and clamps shall be provided.

D. A battery tray shall be provided for the batteries and shall conform to NEC 480-7(b). It shall treated to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over battery electrolyte shall be contained within the tray to prevent a direct path to ground.

E. Battery Charger: A current limiting battery charger shall be furnish to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input. Ac input voltage shall be 120 volts, single phase. Charger shall have LED annunciation for low DC volts, rectifier failure, loss of AC power, high DC volts. Amperage output shall be no less than ten (10) amperes. Charger shall be wall mounting type in NEMA 1 enclosure, installed in the generator set enclosure.

2.10 GENERATOR SET ENCLOSURE – SOUND ATTENUATED AND WEATHER PROTECTIVE

A. The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, weather protective enclosure mounted on the fuel tank base.

B. The enclosure shall be constructed of corrosion resistant steel with electrostatically applied powder coated baked polyester paint. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel.

C. The enclosure shall reduce the ambient noise level at full load to a maximum of 75 dB at 23 feet.

D. Number of doors on enclosure shall be as required so that all normal maintenance operations, such as lube oil change, filter change, belt adjustment and replacements, hose replacements, access to the control panels, etc., may be accomplished without disassembly of any enclosure components. Access doors shall be fabricated of the same material as the enclosure walls and shall be reinforced for rigidity.

E. Handles shall be key lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel. Fasteners shall be zinc plated or stainless steel. Doors shall be of a lift off design allowing one person to remove door if necessary.

F. Air handling will be sized and designed by the manufacturer for 0.5” static pressure drop through enclosure.

G. Air intake openings shall include fixed louvers with motorized dampers (120VAC power to close, fail open) and shall be screened to prevent the entrance of rodents.

H. Radiator air exhaust shall include fixed louvers with gravity type dampers, and sound attenuated exhaust plenum with vertical discharge.

I. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves. Radiator access shall be through a hinged, lockable cover on enclosure. Cooling fan and charging alternator shall be fully guarded to prevent injury.

J. Lifting points shall be provided on base frame suitable for lifting combined weight of base tank, generator set and enclosure.

K. A dual wall fuel tank base of 24 hour capacity at 100% load shall be provided as an integral part of the enclosure. It shall be contained in a rupture basin with 110% capacity. The tank shall be pressure tested for leaks prior to shipment and have all necessary venting per UL142 standards. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

L. The genset enclosure and fuel tank base shall be constructed such that the height of the top of the genset control panel, all circuit breaker handles, and the oil level dipstick shall be no higher than 6' above the genset pad. If these items are above 6' the genset vendor shall supply a service access platform. The platform shall be of aluminum construction, shall be a minimum of 48" wide, shall provide room for full enclosure door opening, and shall include stairs and handrails per OSHA requirements. Platforms will be required on all sides / ends of the enclosure with door openings. Platform height shall be such that the control panel, breaker handle(s), and oil level dipstick shall all be within 6' from the top of the platform after installation. Installing contractor shall coordinate any additional concrete requirements to support the platform with generator supplier.

2.11 AUTOMATIC TRANSFER SWITCHES

A. GENERAL

1. The transfer switch shall be an 800A, NEMA 1, 480/277V, 4W, 3 Pole Automatic Transfer Switch with solid neutral and center off position.
2. The transfer switch shall be rated for the voltage and ampacity as shown on the plans and shall have 600 volt insulation on all parts in accordance with NEMA standards.
3. The current rating shall be a continuous rating when the switch is installed in an unventilated enclosure, and shall conform to NEMA temperature rise standards. Designs which require cabinet ventilation are unacceptable and do not meet this specification.
4. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
5. As a precondition for approval, all transfer switches complete with accessories shall be listed by Underwriters Laboratories, under Standard UL 1008 (automatic transfer switches) and approved for use on emergency systems.
6. The withstand current capacity of the main contacts shall not be less than 20 times the continuous duty rating when coordinated with any molded case circuit breaker established by certified test data.
7. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of

the units to carry their rated currents within the allowable temperature limits.

8. Transfer switches shall comply with the applicable standards of UL, CSA, ANSI, NFPA, IEEE, NEMA and IEC.
9. The transfer switches shall be supplied with a solid state control panel as detailed further in these specifications.

B. SEQUENCE OF OPERATION

1. The ATS shall incorporate adjustable three phase under-voltage sensing of the normal source.
2. When the voltage of any phase of the normal source is reduced to 80% of nominal voltage, for a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.
3. The ATS shall incorporate adjustable single phase under-voltage sensing of the emergency source.
4. When the emergency source has reached a voltage value within 10% of nominal voltage and achieved frequency within 5% of the rated value, the load shall be transferred to the emergency source after a programmable time delay.
5. When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be re-transferred to the normal source after a time delay of 0 to 30 minutes (programmable). The generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.
6. If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.
7. The transfer switch shall be equipped with a solid state control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position and source availability.
8. The control panel shall include indicators for timing functions, and ATS test switch.
9. The control panel shall be provided with calibrated pots (accessible only by first opening the lockable cabinet door) to set time delays, voltage and frequency sensors. The ATS shall be capable of being adjusted while the controls are energized and the unit in automatic mode. Designs which force a “programming mode” or require the controls be de-energized during adjustment are unacceptable.
10. The control panel shall be opto-isolated from its inputs to reduce susceptibility to electrical noise and provided with the following inherent control functions and capabilities:
    An LED display for continuous monitoring of the ATS functions.

    Test switch to simulate a normal source failure.
    Time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds (continuously adjustable via a calibrated potentiometer factory set at 3 seconds.

Time delay on retransfer to normal source, continuously adjustable 0-30 minutes, factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.
Time delay on transfer to emergency, continuously adjustable 0-15 seconds, factory set at 1 second.
An in-phase monitor or time delayed neutral shall be provided to prevent excessive transient currents from switching motor loads.
An interval-type automatic clock exerciser with load/no load selectability shall be incorporated in the ATS.

C. CONSTRUCTION AND PERFORMANCE

1. The automatic transfer switch shall be of double throw construction operated by a reliable electrical mechanism momentarily energized. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.
2. The transfer switch shall incorporate a timed, center-off (neutral) position to allow for motor and inductive load decay. Transfer time shall be adjustable from 0 to 10 minutes on transfer to either source. A mechanical interlock shall be provided to positively ensure that both sets of power transfer contacts cannot be closed simultaneously (precluding the possibility of inadvertently paralleling the ATS input sources).

3. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability are not acceptable.
4. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.
5. The transfer switch manufacturer shall submit test data for each size switch required for this project, showing that it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Minimum UL listed withstand and close into fault ratings shall be as follows:

Any Molded Case Breaker*:

Size (Amps)	(RMS Symmetrical)
Up to 200	10,000
201 - 260	35,000
261 - 400	35,000
401 - 1200	50,000
1201 - 4000	100,000

Specific Coordinated Breaker*:

Size (Amps)	(RMS Symmetrical)
Up to 150	30,000
151 - 260	42,000
261 – 400	50,000
401 - 800	65,000
801 - 1200	85,000
1201 - 4000	100,000

Current Limiting Fuse*:

Size (Amps)	(RMS Symmetrical)
Up to 4000	200,000

*All values 480 volt, RMS symmetrical, less than 20% power factor.

Note: Actual necessary current withstand ratings for this project may be higher than the minimums listed above. Refer to electrical plans for exact requirements.

6. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.
7. All relays shall be continuous duty industrial type with wiping contacts. Customer interface contacts shall be rated 10 amperes minimum. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.
8. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
9. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
10. The switch shall be mounted in a NEMA 1 indoor enclosure unless otherwise indicated on the plans.
11. Switches composed of molded case breakers, contactors or components thereof not specifically designed as an automatic transfer switch will not be acceptable.
12. To afford the advantage of a single source of supply to the owner, the automatic transfer switch shall be supplied by the manufacturer of the engine generator set and covered under the same warranty program.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's recommendations, the project drawings and specifications, and all applicable codes. Installation of the system includes but is not limited to pouring a concrete pad for the generator set

and automatic transfer switch, receiving and offloading the equipment, providing all labor, permits and material to install the total system.

3.2 START-UP AND TESTING

A. Coordinate all start-up and testing activities with the Engineer and Owner.

B. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following:

1. Verify that the equipment is installed properly.
2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, remote annunciator, etc.
3. Test all alarms and safety shutdown devices for proper operation and annunciation.
4. Check all fluid levels.
5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.
7. Connect the generator to building load and verify that the generator will start and run all designated loads in the plant.

C. Perform a 4 hour resistive load bank test at full nameplate load using a load bank and cables supplied by the local generator dealer. Observe and record the following data at 15 minute intervals:

1. Service meter hours
2. Volts AC - All phases
3. Amps AC - All phases
4. Frequency
5. Power factor or Vars
6. Jacket water temperature
7. Oil Pressure
8. Fuel pressure
9. Ambient temperature

D. Operation and Maintenance Manuals

1. Provide three (3) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include parts manuals, final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 1 Section "Demonstration and Training."

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.

2. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data".
3. Schedule training with Owner, with at least seven days' advance notice.
4. Minimum Instruction Period: Four hours.

END OF SECTION

SECTION 16410

SEPARATELY ENCLOSED CIRCUIT BREAKER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Molded Case Circuit Breakers.

1. 2 RELATED SECTIONS

A. None.

1.3 REFERENCES

A. The circuit breaker(s) referenced herein shall be designed and manufactured according to the latest revision of the following standards.

1. NEMA AB 1 1993 - (National Electrical Manufacturers Association) Molded Case Circuit Breakers and Molded Case Switches

2. UL 489 - (Underwriters Laboratories Inc.) Molded Case Circuit Breakers and Circuit Breaker Enclosures

3. UL 943 - Standard for Ground Fault Circuit Interrupters

4. CSA C22.2 No. 5.1 - M91 - (Canadian Standard Association) Molded Case Circuit Breakers

5. Federal Specification W-C-375B/GEN - Circuit Breakers, Molded Case; Branch Circuit and Service

6. National Fire Protection Association NFPA - 70 (National Electrical Code)

7. UL® 50 - Cabinets and Boxes

8. NEMA® 250 - Enclosures for Electrical Equipment

1.4 SUBMITTALS

A. Submit shop drawings in accordance with NEMA classification as noted above and additional information as noted in the following paragraphs.

B. Reference Data: Submit one set of full size (11 x 14-inch) time current curves on log-log transparency paper for all overcurrent protective devices.

1.5 QUALIFICATIONS

A. To be considered for approval, the manufacturer shall furnish products listed by Underwriters Laboratories Incorporated (UL), or testing firm acceptable to the authority having jurisdiction as suitable for application specified.

B. The overcurrent protection device manufacturing facility shall be Registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9000 Series Standards for quality.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Molded Case Circuit Breakers shall be as manufactured by Square-D, AB/General Electric, Cutler Hammer or engineer approved alternate.

2.2 MOLDED CASE CIRCUIT BREAKERS

A. Molded Case Circuit Breaker Characteristics - General

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

2. Circuit breakers shall have not less than 35k ampere symmetrical interrupting rating at 480 volts.

3. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.

4. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.

5. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.

6. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.

7. Manufacturer shall provide electronic and hard copy time/current characteristic trip curves (and Ip & I^2t let through curves for current limiting circuit breakers) for each type of circuit breaker.

8. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position. All circuit breaker accessories shall be UL listed.

9. All circuit breakers shall be UL Listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.

10. Breaker shall include Long/Short/Instantaneous/Ground Fault adjustable trip settings.

11. Breakers with a frame size of 600 amp through 3000 amp shall be UL listed and labeled for 100% application per NEC

12. Service entrance breakers rated 1000 amperes and above for use on a 480Y/277 volt system shall be provided with built-in ground fault protection. The ground fault protection shall include adjustable pick-up and time delay settings. A neutral current transformer shall be provided with the ground fault protection system.

B. Thermal-Magnetic Circuit Breakers

1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.

2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40° C ambient temperature.

3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker.

2.3 ENCLOSURE

A. Circuit breaker enclosures shall be furnished and installed at locations as shown on the drawings. Enclosures shall be of the type approved, indicated, and specified herein.

B. Main Circuit breaker enclosures shall be identified for use as service equipment and are to be labeled for this application.

C. The circuit breaker operating handle shall be directly operable through the front cover of the NEMA Type 1 enclosure.

D. Provisions for padlocking the circuit breaker in the OFF position shall be provided.

E. The enclosure shall be finished with gray baked enamel paint which is electrodeposited cleaned, phosphatized steel.

F. The integrated equipment short circuit current rating shall be equal to the interrupting rating at the supply voltage marked on the circuit breaker installed, up to 200,000 rms symmetrical amperes short circuit current, or as shown on enclosure wiring diagram.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install circuit breakers in accordance with manufacturer’s instructions, the National Electrical Code and applicable local codes.

B. Provide engraved nameplates, with 3/16 inch minimum height black letters on a white background, mounted on the front of the enclosure with stainless steel screws.

END OF SECTION

SECTION 16450

GROUNDING

PART 1 GENERAL

1.1 STANDARDS

A. All electrical systems shall be grounded in accordance with the National Electrical Code, Local Codes, these Specifications and the contract drawings.

PART 2 PRODUCTS

2.1 CABLE AND EQUIPMENT

A. Use green colored and bare stranded copper conductors.

B. Use approved ground clamp manufactured for such purpose.

C. Use approved grounding electrodes and rod.

D. Make permanent ground connection with thermoweld method.

PART 3 EXECUTION

3.1 GENERAL

A. In general, alternating current circuits of 600 volts and below, surge suppressors, conductor raceway systems, and platform steel framework shall be effectively and permanently connected to a grounding system by means of copper conductors having cross section as required by the National Electrical Code and of capacity sufficient to ensure continuity and continued effectiveness of the ground connections under conditions of excess current. If some of the equipment to be grounded is not covered herein by detailed instructions or is not shown completely and clearly on the Drawings, such provisions of the National Electrical Code as may apply are to be considered minimum requirements for the work.

B. All metallic conduit systems, whether used for power or lighting wiring, shall be installed in such a manner as to produce electrical continuity and shall be bound together at one or more points and connected to the building system ground, except that isolated sections of conduit not exceeding 4 feet in length are not to be grounded or bonded unless specifically called for.

C. Rigid metal conduit systems made up with fittings, boxes, and apparatus housings having fully-threaded hubs need no additional provisions for continuity of ground. If the conduit system contains cutouts, pull boxes, junction boxes, switchboxes, etc., to which the conduit is fastened by means of locknuts and bushings, such interruptions in the grounding continuity shall be eliminated by bonding the conduit to the housings or by separately grounding each box and conduit sections, etc., that are so isolated.

Grounding wedge lugs shall be used between all bushing and metal boxes. Paint and other nonconducting material shall be removed from the surface of conduit, fittings, and metal housings prior to connecting grounding clamps, straps, or other devices.

D. Equipment Grounding: Panel, starters, lighting fixtures, motor control center, etc., for power and lighting constitute the fundamental center of the associated distribution systems. As such, the metallic enclosures, frames, and other noncurrent carrying metal parts of this equipment shall be connected by one or more grounding conductors to the grounding system. Install a ground connection from the ground bus of switchgears, MCCs, and other electrical panels with ground bus to the ground grid.

E. All motor frames shall be grounded. The ground conductor shall be run inside the conduit containing the power conductors. In the case of most 3-phase circuits, this means a fourth conductor in each branch circuit. The grounding conductor may be as large as the power conductor or as small as allowed by Section 250 of the NEC but shall not be smaller than No. 12 AWG. The grounding conductor shall be stranded, with green insulation through No. 4 AWG; larger sizes may be bare stranded. Ground connection at the motor shall be terminal lug or servit post inside motor conduit box and the other end connected to the ground bus in the motor control center.

F. Transformer Grounding: Bond the neutrals of outdoor substation transformers and distribution transformers within buildings to system ground network, and any additional grounding electrodes shown near the transformers. Connect the case of the transformer to the grounding system as well.

G. In making ground connections, the surfaces to all parts that will touch shall be thoroughly cleaned to ensure making good electrical contacts.

H. All clamped joints shall be made up firmly. Thermal joints shall be equal to Caldwell Type TA. Where exposed to mechanical injury, the grounding conductor shall be suitably protected by pipe or other substantial guard. If guards are iron pipe or other magnetic material, the grounding conductor shall be electrically connected to both ends of the guard to reduce impedance of the circuit.

I. Grounding conductors shall be without splice or joint if applicable and shall be straight and short except that when laid underground they shall be laid slack to prevent their being readily broken unless otherwise mechanically protected.

J. No fuse, switch, circuit breaker, or similar disconnecting devices shall be inserted in the grounding conductor or connection throughout the entire installation.

K. Grounding conductors shall be medium hard drawn, stranded bare copper wire sized as required by the National Electrical Code Article 250. Conductors Size No. 6 and smaller may be solid; Size No. 4 and larger shall be stranded. Ground wire shall be carried in conduit to the grounding point.

L. Ground rods where required, shall be of copper-clad steel not less than ¾-inch in diameter, 10 feet long or as shown on the Contract Drawings, and driven full length into the earth. The maximum resistance of a single driven ground shall not exceed 5 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, a minimum of 2 additional rods shall be installed not less than 10 feet on

center. Connections between grounding conductors and ground rods shall be mechanical if exposed, thermal if buried.

M. Except where specifically indicated otherwise, all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and neutral conductor of the wiring system shall be grounded. The ground connection shall be made at the main service equipment and shall be extended to driven rods on the exterior of the building.

N. All neutral conductor shall be continuous throughout the system and shall be grounded only at the point of origin of the service neutral.

O. All receptacles shall have provision for grounding conductor connection, and shall be grounded to the grounding conductor and outlet box.

P. All exposed steel columns, tanks, ladders, towers, and elevated platform shall be effectively grounded using No. 4/0 or larger bare copper grounding conductors and driven ground rods. Where multiple columns or tanks must be grounded, ground points shall be interconnected by minimum No. 4/0 bare copper grounding conductors buried approximately 18 inches below finished grade.

Q. Anchor bolts securing exposed electrical equipment, structures, metal enclosures, and tanks located outdoors shall be electrically connected to the steel reinforcement in the concrete foundation or footing. Connection shall consist of minimum No. 2/0 bare copper conductors and mechanical grounding clamps.

R. Surge arrestor ground terminals shall be connected to the equipment ground bus. Ground paths for lightning and surge arresters and capacitors shall be kept as short and direct as practical. If possible, arresters shall be connected in direct shunt relationship to the equipment terminals. Supporting brackets shall be connected directly to the equipment frame.

S. Grounding resistors, where specified, shall have a resistance within the boundary limits specified in IEEE Standard 142 in order to minimize transient overvoltages during ground faults. Ground fault current shall not be less than that required to operate protective devices or 25 amps, whichever is greater.

T. Lightning and surge arresters used with grounded-wye systems which do not have effectively grounded neutrals as defined by IEEE Standard 100 shall have a voltage rating not less that the maximum phase-to-phase voltage of the system.

U. The grounding system equivalent resistance shall not exceed 5 ohms for the entire system under normally dry conditions unless otherwise specified. After the grounding system has been installed and all connections made, tests shall be made by the Electrical Contractor to determine the resistance to earth. If the resistance of the entire system exceeds the specified maximum, additional ground rods shall be driven to reduce the resistance to this value.

V. Gas piping or piping conveying flammable liquids shall not be used as grounding electrodes.

W. The use of salts or electrolytes to reduce earth resistance shall not be permitted.

X. Permanently connect the green ground conductor to each receptacle junction box (self-tapping screw).

Y. Install a ground rod inside each manhole. Connect any metallic raceway and all noncurrent-carrying metal parts to the ground rod with a No. 6 AWG (min.) copper conductor. Similarly, provide a ground rod for every pole-mounted site lighting and make grounding connections.

Z. Bond the standby generator neutral to the grounding system with a properly sized grounding conductor. Ground the generator frame to the ground grid.

AA. Ground metallic fences when used to enclose electrical equipment.

3.2 TESTING

A. Ground resistance testing shall be done in accordance with IEEE standard 81-1993 to confirm that the resistance of the grounding system is 10 ohms or less (test shall not be run within 72 hours of last rain fall). Ground resistance testing shall be done with the power off and the grounding electrode conductor isolated from the utility, and the service to prevent coupling. The testing equipment shall use the fall of potential method of earth resistance measurement. The test equipment must be designed to reject the effects of stray ac and dc currents on readings.

B. A test report shall be submitted to the engineer and included in the O & M manual for the project. The report shall include but not be limited to:

- Date of test
- Time of day
- Weather condition (ex. 82^{o}F, 82% RH, cloudy)
- Date of last rain fall ≥ ½" in a 24 hour period
- Soil type
- Minimum of five (5) readings
- A plot of all readings indicating a level spot in the curve at the system resistance.

C. All ground resistance testing shall be done in the presence of the Engineer. If test measurements indicate a grounding system resistance of greater than 10 ohms, additional grounding cable shall be buried in locations and at the direction of the Engineer. Ground resistance testing as described herein shall be repeated after the additional ground cable has been installed. The installation of grounding cable and repeat testing shall be done until the 10 ohm grounding system resistance has been achieved.

D. Test equipment for ground resistance measurement shall be Vibroground by Associated Research, Megger null balance by Biddle, or alternate approved by the Engineer.

END OF SECTION

SECTION 16530

ELECTRICAL SITE LIGHTING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Work covered by this specification consists of furnishing all labor, equipment, supplies and materials, and performing all operations including cutting, chasing, trenching and backfilling, etc. necessary for the installation of a complete site lighting system as shown on drawings and as hereinafter specified.

B. Work shall include power, control, grounding and lightning protection for parking lot, building floodlighting and sign lighting.

1.2 QUALITY ASSURANCE

A. Installation shall comply with all laws applicable to electrical installations that are enforced by local authorities, with the regulations of National Electrical Code where such regulations do not conflict with local laws, and with regulations of the utility company that serves the facility. Contractor shall obtain all permits required by local authorities.

B. All materials shall be new and shall bear a U.S. label and be listed by Underwriters' Laboratories, Inc. as conforming to its standards where such a standard has been established for the particular type of material in question.

1.3 REFERENCES

A. All work shall conform to applicable standards of ANSI, IEEE, NEMA, UL, and NEC.

1.4 SUBMITTALS

A. Materials and Equipment Lists
   1. As soon as practicable and before starting installation of any materials or equipment, the Contractor shall submit for approval complete lists, in triplicate, of materials and equipment to be incorporated in the work. These lists shall include catalog numbers, cuts, and other descriptive data required to assure compliance with the specification requirements and to permit ready and complete identification. Approval of the proposed materials and equipment based on manufacturer's published data will be tentative only, and will be subject to submission of complete shop drawings indicating compliance with the Contract Documents.

B. Shop drawings shall be submitted for materials and equipment not readily identifiable from information submitted in materials and equipment lists. Departures from Contract Drawings will not be authorized without the written permission of the Engineer. If departures from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted as

soon as practicable or with the shop drawings. Approved departures shall be made at no additional cost to the Owner.

C. Shop drawings shall be submitted for the following list of items:
   1. Luminaires
   2. Ballasts
   3. Floodlights
   4. Poles, bases, anchor bolts
   5. Photoelectric cells
   6. Time clocks
   7. Contactors
   8. Fuse holders
   9. Surge arresters
   10. Lamps

D. Shop drawings and samples shall be thoroughly checked and coordinated by the Contractor for details and fulfillment of contract requirements prior to submittal. Approval of any item does not relieve Contractor of responsibility for coordinating dimensions and work required by other trades.

E. Where materials or equipment are specified to conform to the standards and requirements of the Underwriters' Laboratories, Inc., National Electrical Code, or the National Electrical Manufacturers Association, the Contractor shall submit proof that the items furnished under this section of the Specifications conform to such requirements. The label of or listing in the Underwriters' Laboratories, Inc., or the manufacturer's certification that the items comply with applicable Specifications, with NEMA standards, and with the manufacturer's standards will be acceptable as evidence that the materials and equipment conform to the applicable standards.

F. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of such products, and shall be of the latest standard designs that conform to the specification requirements.

1.5 DELIVERY, STORAGE AND HANDLING

A. All material shall be unloaded and stored in a manner to avoid physical damage or detrimental effects of exposure to weather.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Catalog numbers of devices, fixtures, equipment, etc. are used for ease in describing standard of quality desired. Devices, fixtures, equipment, etc. by other manufacturers, performing the same functions and considered equal in quality by the Engineer, will be acceptable.

2.2 BOXES

A. Boxes for exposed work shall be of cast alloy or cast steel type with threaded hubs.

B. Pull or junction boxes shall be constructed of code gauge galvanized sheet sized per NEC or as noted, continuously welded along seams, and fitted with screw-on cover plate secured with stainless steel covers.

C. All outlet or junction boxes of pressed or sheet steel type shall be galvanized, sheradized, bonderized or treated with a similar approved corrosion inhibitor.

2.3 GROUNDING

A. Install a ground rod at each pole-mounted site light.

B. Raceways, boxes, outlets, cabinets, etc. shall be bonded together to form a continuous metallic grounding circuit in accordance with NEC.

C. Metal light poles shall be grounded to the continuous grounding conductor and also to the embedded anchor bolt and ground rod. The anchor bolt shall be bonded to the reinforcing steel cage using compression (bronze) connector and a minimum #8 soft drawn copper wire.

2.4 LIGHTNING PROTECTION

A. Multi-pole lighting surge arresters shall be installed at selected pole locations to protect the exposed pole wiring and equipment and to reduce potential damage to indoor branch circuit devices.

B. Where 3-phase branch circuits are used for lighting, the surge arrester should be connected at the first exposed pole supplied from the lighting panel. As an alternate, a single 3-pole surge arrester may be installed at the outdoor lighting contactor.

2.5 CIRCUIT PROTECTION

A. Individual pole fixture circuits shall be equipped with weatherproof disconnecting fuse holders and fuses to provide reduced fixture tap wiring protection. The fuse holders shall be equal to Bussman KTK type HEB with boots connected per line/load side markings. Fuses shall be sized for 3 times ballast ampere rating.

2.6 FIXTURES

A. Provide fixtures and poles as shown on the drawings.

2.7 CONTROLS

A. Provide controls as shown on drawings.

PART 3 EXECUTION

3.1 VERIFICATION OF DIMENSIONS

A. The Contractor shall be specifically responsible for the coordination and proper relation of his work to the site lighting layout and to the work of all trades. The Contractor shall thoroughly familiarize himself with all details of the work and

working conditions, shall verify all dimensions in the field, and advise the Engineer of any discrepancy before performing any work.

3.2 PREPARATION

A. Wiring layouts are schematics and are not intended to show the exact location or routing of conduits. The Contractor shall refer to civil site layouts and building plans for dimensions and shall fit his work to conform to the details of project construction. The right is reserved to shift any pole or conduit 10 feet from its location shown on the drawings before it is permanently installed, without incurring additional cost to the Owner.

3.3 INSTALLATION

A. All materials and equipment shall be installed in accordance with approved recommendations of the manufacturer to conform to the contract documents. The installation shall be accomplished by workmen skilled in this type of work and shall conform to the National Electrical Code.

B. Furnish all labor; and furnish, install, connect, test and adjust all lighting system equipment and materials to form a complete operating installation. The electrical work shall be installed in such a manner and at such times as will require a minimum of cutting and patching of the site surfacing, landscaping and/or building structure.

C. All metallic raceways entering cabinets, panels and junction boxes shall be fitted with double locknuts and bushing. All raceway stubs shall be suitably capped or plugged during construction to prevent entry of water, debris, mortar, etc.

D. Lightning protection shall be installed at each site where indicated on the drawings. The surge arrester shall be grounded to pole foundation grounding system using a separate conductor for the purpose.

E. All lighting fixtures shall receive new correctly sized lamps, wired in accordance with phasing system shown on the drawings.

3.4 ADJUSTING AND CLEANING

A. Clean and lamp all lighting fixtures after installation and wiring. Install all fuses. All lighting fixtures and poles shall be clean at time of final acceptance.

B. Provide all wiring for testing and trials, for all required corrections, changes, additions, completions and adjustments until final acceptance of the work.

C. Coordinate numbers and label all field wiring between equipment of the various electrical suppliers.

D. Any damage to work already in place as a result of electrical work shall be repaired and made good at no expense to the Owner.

3.5 TESTING AND ACCEPTANCE

A. Prior to acceptance by the Owner, all lighting systems shall function as required, and control wiring shall be properly interconnected to all control devices for the proper functioning of the lighting equipment. Submit 1 blueline print of the contract drawings marked to show as-built locations and description of all electrical work.

3.6 GUARANTEE

A. The following equipment to be furnished under this section of the Specifications shall be guaranteed for a period of 1 year from the date of acceptance, either for beneficial use or final acceptance, whichever is earlier, against defective materials, design, and workmanship: luminaires, cable, floodlights, lamps, contactors, poles, time clocks, and photo controls. Upon receipt of notice from the Owner of failure of any part of the guaranteed equipment during the guaranty period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the Contractor.

END OF SECTION

Appendix A

SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION

Springville Sewer Plant Upgrade - CWSRF

March 12, 2024

PREPARED FOR

City of Springville
P.O. Box 919
Springville, Alabama 35146

PREPARED BY

CDG, Inc.
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March 12, 2024

City of Springville
P.O. Box 919
Springville, Alabama 35146

Attention: Mayor Dave Thomas

Reference: **Report of Subsurface Exploration and Geotechnical Engineering Evaluation**
Springville Sewer Plant Upgrade - CWSRF
Springville, Alabama
CDG Reference Number: R954719170

Dear Mayor Thomas:

CDG, Inc. (CDG) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Sewer Plant Upgrade project in Springville, Alabama. Our services were performed in general conformance to a *Scope of Work Document* included with an *Agreement Between Owner and Engineer for Professional Services* dated 10/2/23.

The purposes of this study were to determine general subsurface conditions at specific soil test boring locations and provide geotechnical recommendations relative to the site work and foundation phases of construction. This report presents the subsurface conditions encountered at the boring locations, laboratory test results of representative, on-site soil samples, and our recommendations associated with the proposed development.

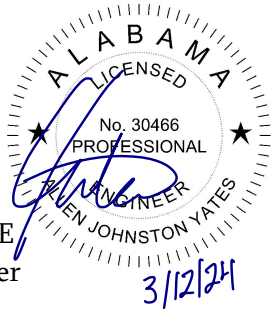
We appreciate the opportunity to work with you and look forward to our continued involvement during the construction phase of the project. Please call if you have any questions or need additional information.

Respectfully Submitted,

CDG, Inc.

Tyler Lawrence, EI
Project Professional

Allen Yates, PE
Senior Engineer



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APPENDICES

1.0 SCOPE OF SERVICES

In general, our services included performing a subsurface exploration, conducting field and laboratory soil tests, and preparing a geotechnical engineering report of our findings. Following is the specific scope of services performed for the Springville Sewer Plant Upgrade project:

- Site reconnaissance and soil test boring layout.
- Geologic map review.
- Mobilization of an ATV-mounted drilling rig and twelve (12) soil test borings in the proposed development area. Borings were performed on February 15 through February 19, 2023 and contained Standard Penetration Tests (SPT) at 2½-foot intervals in the upper 10 feet and on 5-foot centers thereafter. The borings extended to approximately 20 feet to 30 feet below the existing ground surface, at which depth the borings encountered auger refusal or were terminated.
- Laboratory tests to determine site-specific soil classification characteristics. Tests included the following: Natural Moisture Content (20 tests), Grain Size Analysis (7 tests), Atterberg Limits (7 tests), and One-Dimensional Consolidation (1 test).
- One (1) piezometer was installed in boring B-10 to establish a stabilized depth to groundwater.
- Evaluation of the information gathered during the subsurface exploration and laboratory testing program and preparation of this geotechnical engineering report. The report addresses the following items:
    - Site and project descriptions;
    - Local geology and its implications for the planned development;
    - Subsurface conditions encountered in the borings;
    - Groundwater measurements at the time of the fieldwork;
    - Laboratory test results;
    - Earthwork recommendations including subgrade preparation, excavation and fill placement, treatment of unsuitable soils and groundwater control;
    - Foundation recommendations including type, soil support parameters, expected total and differential settlements, and construction considerations;
    - Slab-on-grade support and modulus of subgrade reaction recommendations.

The current geotechnical scope of services did not include an environmental assessment of the site to determine the presence of wetlands, hazardous materials, buried wastes, contaminated soil, etc. An environmental assessment can be provided if requested by the client.

2.0 SITE AND PROJECT DESCRIPTION

The proposed development is located adjacent to the existing wastewater treatment lagoons in Springville, St. Clair County, Alabama. The site is bounded to the west, east and north by wooded areas and to the south by the existing lagoons. A *Site Vicinity Map* is included in **Appendix A**.

At the time of the field work (January 9, 2024), the site was developed and vegetated with short grasses. The site was previously graded to construct the existing lagoons. A barbed wire fence was observed around the existing lagoons. Old tractor trailers and vehicles were present on the northwest side of the proposed site. Overhead utilities were observed along the middle of the proposed plant.

Observations and available topographic information (*Springville WWTP*; dated November 2023) indicate that the point of highest elevation (EL 720') is located on the south side of the site adjacent to the existing lagoon. The point of lowest elevation (EL 715') occurs at the north end of the site adjacent to the existing mature trees and fence. Therefore, the site generally slopes from south to north away from the lagoons. The following pictures indicate typical site conditions at the time of the fieldwork.

East of site facing West

West of Site Facing East

The proposed improvements include two Sequencing Batch Reactor (SBR) treatment basins, a lift station, headworks, an office and electrical building, air blowers, and a backup generator. The two basins will be a combined ±7,000 square feet in plan area. Total and differential settlement tolerances were specified as 1 inch and ½ inch, respectively. Specific structural loads were not provided at the time of report preparation. However, the maximum water height is proposed to be 20 feet. Therefore, we have assumed maximum ground pressures exerted by the basins to be on the order of 2,000 psf.

A grading plan was unavailable at the time of report preparation. However, we understand that earthwork in the proposed development area is generally expected to consist of minor cuts and fills. Therefore, proposed grades were assumed to be within ±5 feet of existing elevations. Deeper excavations on the order of ±15 feet will be required for the headworks.

3.0 FIELD AND LABORATORY TESTING

3.1 Soil Test Borings

The field investigation included performing twelve (12) soil test borings in the approximate locations of the proposed sewer plant elements. The sampling and penetration procedures of the soil test borings were performed in general accordance with ASTM D-1586, using an ATV-mounted drilling rig. Standard Penetration Tests (SPT) were performed in the soil borings by driving a standard 1⅜-inch inside diameter and 2-inch outside diameter split spoon sampler with a 140-pound hammer falling 30 inches.

The number of hammer blows required to drive the sampler a total of 18 inches, in 6-inch increments, were recorded. The penetration resistance, or "N" value, is the sum of the blows required to drive the sampler the final two 6-inch increments. The N-values are indicated on the boring logs in adjacent to their corresponding depths. The penetration resistance is used as an indicator of various soil parameters from empirical correlations.

3.2 Laboratory Testing

During the field investigation, a representative portion of each recovered sample was sealed in plastic bags and transported to our laboratory for engineering classification (ASTM-2487) and laboratory testing. The description and stratification of the soil conditions, using the Unified Soil Classification System, are illustrated in the form of soil profiles on the *Boring Logs* in **Appendix C**. To aid in soil classification and determining site-specific soil characteristics, selected soil samples were tested for natural moisture content (ASTM D-2216), Particle Size Analysis (ASTM D-422), and Atterberg Limits (ASTM D-4318). Details of the laboratory testing are included in **Appendix D**.

4.0 LOCAL GEOLOGY

A review of geologic data (*Geologic Map of Alabama* dated 1988 and *Geology of Blount County, Alabama* dated 1988) indicates that the site is located in the Appalachian Plateau physiographic province. Specifically the site is underlain by the Bangor Limestone geologic formation. A *Site Geology Map* is provided in **Appendix A.**

The Bangor Limestone is composed of grey, dolomitic limestone with shale and chert nodules. The Bangor contains interbedded dusky red and olive-green mudstone in the upper portions of the formation. Mudstone is a sedimentary rock made up of clay particles. Mudstone differs from shale in that it lacks fissility or the appearance of layers.

The soil overburden of the Bangor is formed by the gradual decomposition of the underlying rock and typically consists of clay with various amounts of sand, silt, and rock fragments. The residual clay is often highly plastic. Plasticity is a measure of a soil's potential for volume change. Plastic soils shrink and swell with variations in natural moisture content.

Additionally, springs are often present in the geologic formation present at the site. Springs typically develop when water becomes trapped within the joints of the rock and in the overlying residual soils. The springs can be present continually; however, additional springs and greater flow rates are typically present during periods of high rainfall.

In limestone formations such as the Bangor Limestone, initial weathering occurs along joints and fissures in the rock. Water present in the rock joints accelerates the weathering process forming an irregular rock surface. Therefore, pinnacles, slots, caverns, and voids form within the rock. The depth to intact rock can vary greatly. Advanced weathering of rock pinnacles leads to the formation of boulders suspended within the residual soil matrix and deep, mud-filled slots. The consistency of the soil overburden often decreases with depth and the soil immediately overlying the rock can be very soft and wet, exhibiting a paste-like consistency.

Large, subsurface boulders and tightly nested chert beds are often encountered in limestone formations. Therefore, grading operations conducted in the geologic formation present at the site may encounter difficult excavation at elevations above the depth to continuous, intact rock.

Subsurface voids (dolines), depressions, and sinkholes occur in geologic formations containing soluble rock such as limestone. These formations are known as karst geologies. Circulating groundwater dissolves the carbonate portion of the limestone over geologic time. As the carbonate portion of the limestone dissolves, voids and caverns develop underground. The doline can propagate upward toward the ground surface and can result in subsidence or collapse of the overlying soil. Groundwater movement causing erosion of soil overburden is typically necessary for the formation of dolines in the karst geologies of Alabama. Available sinkhole data (digital GIS data from the Geological Survey of Alabama) indicates that documented sinkholes have not occurred within the proximity of the site. A portion of the data has been reproduced as the *Documented Sinkhole Location Map* in **Appendix A**.

Due to the geologic formation underlying the site and the presence of documented sinkholes, there appears to be an elevated risk of future sinkhole activity at the site. However, we note that the action of sinkholes is irregular and cannot be precisely predicted. Therefore, the site should be monitored for subsidence, depressions, and sinkholes. Additional engineering evaluation and remediation will be required should evidence of sinkhole activity be observed at the site during or after construction.

5.0 SUBSURFACE CONDITIONS

The subsurface exploration included twelve (12) soil test borings in the proposed development area. The boring locations were established in the field using hand-held GPS equipment and available site layout information (*Preliminary WWTP Site Layout*; provided on 12/11/23*;* prepared by CDG). Therefore, the boring locations indicated on the *Boring Location Plan* in **Appendix B** are approximate.

Details of the conditions encountered at the boring locations are contained on the *Boring Logs* in **Appendix C**. The stratification lines indicated on the logs represent the approximate boundaries between soil types. The actual transitions may be gradual. The soil conditions noted on the logs represent conditions encountered at the location and time tested. Significant changes in subsurface conditions can occur over a short distance or period of time. The general subsurface conditions encountered at the test locations are described below.

5.1 Topsoil

As previously indicated, the site was generally vegetated with grasses at the time of the field work. Therefore, an upper zone of topsoil and rootmat was initially encountered at the boring locations. The thickness of the upper, organic soil ranged from approximately 1 to 14 inches and averaged 6 inches at the tested locations.

5.2 Existing Fill

Previously placed fill was encountered at twelve (12) boring locations (B-1 through B-12). The fill appears to be associated with the existing development of the wastewater lagoons on site. The existing fill was encountered immediately beneath the topsoil and consisted of sandy silt and sandy clay or varying plasticity. Trace organics were encountered in portions of the fill. The fill extended to depths ranging from approximately 0 to 6 feet below the existing ground surface.

Standard Penetration Test (SPT) N-values in the fill ranged from 3 to 13 blows per foot (bpf) and averaged 7 bpf. The unconfined compressive strengths (PP_{qu}) of cohesive samples were measured using a hand-held penetrometer. PPqu values within cohesive samples of the fill ranged from 0.5 to 2.0 tons per square foot (tsf). Therefore, the existing fill exhibited a soft to stiff consistency.

The natural moisture contents of selected samples of the fill ranged from 18% to 24%. Tested samples of the fill exhibited a moderate degree of plasticity with Liquid Limit (LL) values of 32 and 49. Plasticity indices (PI) values were 13 and 20. Tested samples contained 69.7% and 77.4% fine-grained (silt and clay size) particles. Based on USCS classification guidelines, the tested soil samples are classified as sandy silt (ML) and sandy clay (CL).

5.3 Residuum

Residual soils are naturally occurring materials that appear to have been derived from the underlying geologic formation. Residuum of the Bangor Limestone geologic formation was encountered underlying the existing fill. The residual soil extended to the boring termination and auger refusal depths of ±25 to ±30 feet below the existing ground surface.

As sampled, the residuum consisted of varying mixtures of silty sand, sandy clay, and fat (plastic) clay. SPT N-values within the residual soils ranged from 2 to 21 bpf and averaged 11 bpf. PP_{qu} values within the residuum ranged from 0.25 to greater than 4.0 tons per square foot (tsf). The residual soils generally exhibited a high consistency in the area of the proposed headworks and electrical building. However, low-consistency residuum was encountered in borings B-4, B-5, B-9 and B-10 to depths extending from ±3 feet to ±17 feet. Additionally, in borings B-5 and B-6, the low consistency residuum began at depths of ±12½ and ±22 feet, respectively, and extended to the termination or refusal depth.

The natural moisture contents of selected samples of the residual soils ranged from 19% to 50%. Tested samples of the residuum exhibited a moderate to high degree of plasticity with LL values ranging from 31 to 95 and PI values ranging from 8 to 36. The tested samples contained between 71.6% and 95.2% fine-grained (silt and clay size) particles. Based on USCS classification guidelines, the tested soil samples were classified as a sandy clay (CL), sandy silt (ML) and fat clay (CH)

5.4 Groundwater

Groundwater levels were measured in the borings at the time of drilling. Additionally, a piezometer was installed in boring B-9 to obtain a delayed measurement. With the exception of the piezometer, the boreholes were backfilled upon completion of drilling operations. No groundwater was encountered during drilling in the borings. However, groundwater was encountered in the piezometer in boring B-9 at a depth of 27 feet below the ground surface. The reading was made 30 days after drilling.

The soils at the site contain a significant amount of fine-grained particles. The fine-grained soils exhibit a relatively low permeability. Therefore, long-term monitoring over several seasons would be required to fully evaluate the stabilized depth to groundwater. Groundwater depth is highly variable and will often fluctuate due to seasonal variations in precipitation.

6.0 EARTHWORK CONSIDERATIONS

Proposed grading information was not available at the time of the report preparation. However, we understand that earthwork in the proposed development area is expected to consist of minor cuts and fills. Therefore, proposed grades were assumed to generally be within approximately 5 feet of existing elevations. Deeper excavations on the order of 10 to 15 feet will be required for the headworks.

We are providing the following earthwork-related recommendations based on the provided grading and site layout information available at the time of report preparation. If significant changes are made to the development plans or if the assumed grading and site layout information is altered, CDG should be allowed to review our geotechnical recommendations in light of the changes to determine if additional testing and revised conclusions are needed. Following are our earthwork-related recommendations.

6.1 Subgrade Preparation

Prior to the start of excavation and fill placement, the proposed development area should be cleared of vegetation, topsoil, rootmat, and all organic materials. Topsoil was initially encountered at the boring locations and ranged from approximately 1 to 14 inches and averaged 5 inches at the tested locations.

Additionally, abandoned vehicles and equipment were observed during the site reconnaissance. Therefore, the site should be cleared of any existing improvements. Demolition should include all below-ground elements such as buried foundations and stem walls, basements, slabs, septic systems, wells, and utility lines. All debris including buried trash, organics, rubble, and other deleterious materials should be completely removed. Soils immediately underlying existing pavements, slabs, and other ground supported structures often exhibit a low-consistency. All soft soils exposed during demolition should be removed. Excavations resulting from site clearing should be backfilled in a controlled manner with structural fill.

The borings encountered existing fill and low-consistency soils to depths ranging from approximately 3½ to 17½ feet below the existing ground surface. The following table summarizes the locations and depths of low-consistency materials. The deepest zones of low-consistency soil were encountered beneath the proposed WWTP basins.

Table 6.1 – Summary of Low-Consistency Soils		
Test Location	**Proposed Structure(s)**	**Depths of Low-Consistency Materials**
B-1	Headworks	17+ feet
B-3	WWTP Basins	0 to ±6 feet
B-4		0 to ±12½ feet
B-5		0 to ±12½ feet
B-6		22+ feet
B-7		0 to ±3½ feet
B-8		0 to ±6 feet
B-9		±3½ feet to ±17½ feet
B-10		0 to ±8½ feet
B-12	Office and Electrical Building	0 to ±3½ feet

In addition to the low-consistency materials noted above, a zone of high-plasticity, saturated clay was encountered in several borings beginning at a depth of 17½ to 22 feet below the existing ground surface. One-dimensional consolidation theory was used to estimate consolidation of the clay beneath the proposed SBR basins. The consolidation calculation utilized inputs obtained from the laboratory testing program. The basin foundation type (reinforced concrete mat) and dimensions were assumed based on our experience with similar projects. Our analysis indicates that total consolidation of the basins supported on a wide-area reinforced concrete mat foundation may be on the order of ±4.5 inches.

Structures supported on low-consistency soils and clays subject to consolidation are likely to experience differential settlement and resultant distress. Typical distress consists of cracking in rigid structures such as concrete and masonry elements, and misalignment of utility connections, windows and doors. Therefore, it is our opinion that the on-site soils, in their current condition, are not suitable for support of the proposed structures.

6.1.1 Lightly-Loaded, Ancillary Structures (Partial Undercut and Replacement)

Where lightly-loaded, ancillary structures (headworks, equipment pads, and building pads) are planned, **subgrade preparation should include complete over-excavation of the existing fill and low-consistency soils in the proposed structure areas. The excavation should extend to a minimum depth of 36 inches below the original ground surface.** It will be critical that a representative of CDG be present to verify excavation of unsuitable soils during undercutting and that the subgrade be evaluated by the Engineer prior to backfill with structural fill. Engineering evaluation typically includes proofrolling with a loaded dump truck or other equipment capable of applying a high pressure. Soils exhibiting instability during the proofrolling process or otherwise identified as unsuitable should be scarified, moisture conditioned and re-compacted or removed and replaced. Placement of structural fill may proceed following demonstration of a stable subgrade.

6.1.2 SBR and EQ Basins (Rammed Aggregate Piers)

Due to the depth of the unsuitable soils and anticipated foundation dimensions for the basin structures, mass over-excavation of unsuitable soils to mitigate potential settlement/consolidation does not appear to be a cost-effective alternative for support of the SBR and EQ Basins. Therefore, we recommend that a rammed aggregate pier system be utilized to improve ground support conditions at the locations of the SBR and EQ basins. Installation of the pier system results in a reinforced, composite subgrade that increases the allowable bearing pressure and reduces estimated settlements under vertical loading.

Rammed aggregate pier systems are typically a proprietary design-build technology. The design-build company will select the most appropriate system for construction, specify spacings, quantities, and lengths based on soil conditions, foundation loads, and performance criteria. The design-build contractor will produce engineer-sealed shop drawings, calculations, an installation schedule, and quality control package which will then be installed by a licensed contractor.

There are multiple rammed aggregate pier systems available with specialty tooling and installation techniques adapted to improve a wide variety of soil conditions. For this site, we anticipate a "drill and fill" style rammed aggregate pier system. This is due to the cohesive, non-caving soils that stay open during drilling that were encountered at the site. The mandrel itself serves as a temporary casing during installation of the rammed aggregate pier. After the auger has been advanced to the proposed treatment depth, the tooling is raised and lowered in a specified stroke pattern. During this process, aggregate is funneled from a top mounted hopper, down through the hollow mandrel and into a widened compaction chamber where it is forced into the soil at the bottom of the tooling. The installation process results in vertically compacted lifts, similar to a conventional, drilled aggregate pier system.

Piers are expected to be installed after final subgrade elevation is established in the building pad. Following ground improvements with the pier system, shallow foundations are typically designed for increased allowable bearing pressures ranging from 4,000 to 8,000 psf. Settlement tolerances are typically specified as being limited to 1 inch for the total settlement case and ½ inch for the differential settlement case. Specific foundation recommendations for this site are discussed in **Section 7** of this report.

Installation of the rammed aggregate pier system should be observed by a representative of CDG. The observer will keep records of the date, depth of penetration, bearing material, and additional pertinent data regarding each individual rammed aggregate pier. The effective use of rammed aggregate piers to improve bearing conditions is highly dependent on proper construction techniques. Therefore, it will be critical that CDG be on-site during installation to ensure the piers conform to the design requirements.

6.2 Water Control

Groundwater was not encountered in the borings at the time of the subsurface exploration. However, groundwater was encnoutered at 27 feet in the piezometer at B-9. Groundwater typically resides above rock, which was encountered at 27 and 30 feet. Therefore, it is possible that water seepage will be encountered during earthwork operations.

The volume of water encountered during grading is expected to vary based on recent precipitation levels. Therefore, the extent and method of dewatering will depend on the time of year earthwork is performed and can be determined in the field on a case-by-case basis. In general, water seepage present in excavations should be collected and removed from the site in a controlled manner with temporary sump pits and pumps or drainage ditches.

Permanent drains will be required in areas exhibiting continual seepage such as in natural drainage swales and where springs are encountered. The drain will serve to collect and remove water that continues to seep into the area and reduce the potential of water infiltrating the adjacent subgrade soils.

A typical trench drain should consist of a geosynthetic-lined trench, approximately 18 to 30 inches in width. The depth of the drain generally ranges from 24 to 36 inches and is determined based on field conditions. The geosynthetic should be a non-woven fabric designed for filtration (TerraTex SD or similar). A perforated drainpipe should be installed and the trench backfilled with free draining (less than 5% passing the #200 sieve), open-graded coarse aggregate (such as ASTM C-33 #57). The geotextile is then wrapped over the aggregate to completely enclose the drain.

6.3 Excavation Considerations

Maximum excavation depths of approximately 15 feet below the existing ground surface are expected to construct the headworks. The borings at the site encountered existing fill and residual soils deriving from the Bangor Limestone geology. The soils were primarily composed of sandy silts and sandy clays. Groundwater was encountered in the piezometer at B-9 at 27 feet. Auger refusal was encountered at borings B-9 and B-10 at 30 and 27 feet, respectively. Excavation is not expected near the depth of auger refusal. The existing fill and residual soils can typically be excavated during mass earthwork operations using conventional earthmoving equipment (e.g. hydraulic excavator or large dozer) in good working order.

The soils encountered at the boring locations contained significant fractions of coarse-grained soils. Additionally, springs are frequently encountered in the geologic formation underlying the site. Due to the presence of non-cohesive soils and the potential for groundwater seepage, the sides of excavations made at the site are expected to be unstable and likely to cave. Therefore, benching, sloping, temporary bracing or other appropriate measures will be necessary when making excavations.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. This report is not intended to address safety issues related to excavations. Job site safety and conformance to applicable codes and guidelines is solely the responsibility of the contractor.

6.4 Fill Placement

All material used as structural fill should be relatively free of organics and other deleterious materials. Soil fill should exhibit a Liquid Limit less than 50, a Plasticity Index less than 25, and a maximum dry density of at least 100 pcf. Soil fill should contain no more than 30% rock, and individual rock fragments in the fill should be less than 3 inches in largest dimension. Soil fill must be placed in an environment free of excess water. Therefore, free draining (<5% passing #200 sieve), coarse granular material (such as ASTM C-33 #57 crushed aggregate) should be used as the initial lift(s) of fill in areas containing water seepage. The aggregate fill should extend to a level above any water seepage in the excavation.

Fill should be placed in lifts not exceeding eight inches in loose measure. Individual lifts of fill should be moisture conditioned and compacted to a minimum of 98% of the Standard Proctor (ASTM D-698) maximum dry density within -1% to ±3% of the optimum moisture content. Soil may require wetting or drying to achieve proper compaction. Thinner lifts and manually operated equipment will be required to compact soils in limited access areas (e.g. around manholes, inlets and utility trenches).

Soil compaction testing should be performed during fill placement. Testing will give an indication of the contractor's performance with regard to soil density and moisture content requirements established in the project specifications. Compaction testing should be performed at random locations on each lift of fill placed to provide statistically relevant testing data. The frequency of density testing should be at least one test per lift for every 2,500 square feet of fill. Each lift of fill placed in utility trenches should be tested on 50-foot centers. A minimum of 3 tests should be performed on all fill lifts.

6.5 Use of On-Site Soils as Structural Fill

Site grading and subgrade preparation are expected to include excavation of existing fill and residual soils. The boring and laboratory testing data indicate widely varying soil properties. Soils encountered in the borings consisted of sandy clay, sandy silt and moderately to highly plastic clay. The upper, on-site soils composed of sandy silt and sandy clay are generally suitable for reuse as fill following proper moisture conditioning. However, the highly plastic (fat) clay, if encountered, is unsuitable for reuse.

It will be necessary to carefully segregate acceptable and unacceptable soils due to the variable nature of the on-site materials. The contractor will be required to ensure that suitable soils are kept separate from materials that do not conform to the requirements for structural fill.

We note that tested on-site soil samples exhibited natural moisture contents ranging from 18% to 26%. Therefore, portions of the on-site soils are expected to be ±5% wet or dry of their optimum moisture content. If the on-site soils are to be reused as newly placed fill, the contractor should be prepared to moisture condition (dry or moisten) the soils, as necessary.

The contractor should expect to spend significant time reconditioning the existing soils if they are to be reused as structural fill. Due to the fine-grained particles in the soils, drying may require repeated disking and turning of the soil over several days of dry weather and/or use of drying agents such as fly ash or lime. The soils may require blending with water during the drier times of the year.

6.6 Protection of the On-Site Soils

Tested, on-site soils contained a significant amount (69.7% to 95.2%) of fine-grained, silt and clay particles. Silt and clay tend to lose strength when exposed to excess moisture. Additionally, fine-grained soil can become soft and disturbed due to repeated trafficking and twisting or turning of wheeled construction equipment. Therefore, the on-site soils should be protected from surface water and construction disturbance.

Construction traffic should be controlled and routed so as to limit disturbance to the subgrade. Ponded water should not be allowed to remain on the soils and the site should be sloped to drain. Additionally, it will be important that surface water from on and off the site be intercepted and diverted away from the proposed development. Installation of temporary construction ditches may be necessary to control the flow of surface water so that construction operations can be performed in a relatively dry environment. Soils that become too wet or are disturbed should be moisture conditioned and re-compacted or removed and replaced with structural fill.

7.0 FOUNDATION RECOMMENDATIONS

Ground pressures exerted by the basins and ancillary structures were assumed to be on the order of 2,000 psf. As noted previously, ground improvement using rammed aggregate piers is expected to be performed at the locations of the SBR and EQ Basins after final subgrade elevation is established. **It will be critical that the piers be properly designed by a design-build contractor, properly installed by a licensed contractor, and observed by CDG during installation.** Undercut of low-consistency soils be required beneath the headworks, disinfection pad, and equipment pads. Following proper installation of a rammed aggregate pier system or undercut and replacement, it is our opinion that spread footings are an appropriate alternative for foundation support of the proposed basins and ancillary structures.

Following subgrade preparation and installation of the rammed aggregate pier system in proposed basin areas, foundations will bear on an improved, composite subgrade. In the lightly-loaded, ancillary structures (headworks, equipment pads, and disinfection pads), foundations will bear on newly placed fill. The following design values should be utilized for foundation design in each area.

Table 7.1 – Summary of Foundation Design Values

Improvement ~~or Stabilization~~ Method	Bearing Capacity	Coefficient of Friction
Rammed Aggregate Pier System	4,000 psf	0.35
Newly Placed Fill	2,000 psf	0.35

Continuous and column footings should have minimum widths of 18 and 24 inches, respectively. Footings should extend to a minimum depth of 24 inches below the lowest adjacent final subgrade elevation to provide confinement for the bearing materials.

Total and differential settlements for foundations are expected to be less than 1 inch and ½ inch, respectively. Foundations should be structurally isolated from ground-supported slabs to allow for differential movement associated with variable loading conditions. Alternatively, slabs should be jointed to prevent uncontrolled cracking at the interface with foundations. Foundations supported on the pier improved subgrade should be isolated from those supported on the newly compacted fill.

Excavation for foundations often results in loosened or disturbed soils at the bearing elevation. Therefore, the bottom of footing trenches should be thoroughly compacted with a piston tamp following excavation. As previously described, water seepage may be encountered when making foundation excavations. Foundation concrete must be placed in a relatively dry excavation; therefore, temporary dewatering may be required.

A representative of CDG should observe all foundation excavations prior to concrete placement to determine if the exposed materials conform to the design requirements. Should the engineer identify isolated zones of unsuitable material present at the proposed bearing elevation, the excavation should be extended to a suitable bearing stratum. Excavations may be returned to the original planned bearing elevation with lean concrete. Foundation bearing materials judged acceptable by the Engineer should be protected from disturbance, freezing, and excessive wetting or drying. Therefore, the footing should be constructed the same day as the excavation is made and evaluated by the Engineer. If the contractor's schedule requires a delay between excavation and foundation construction, the bearing materials should be protected with a thin seal of lean concrete.

Following construction, the foundations and underlying soils should be isolated from sources of excess water. Grades adjacent to the structures should be adjusted so that surface water flows away from the foundations. In no case should water be allowed to pond over newly constructed footings. Roof drains and downspouts should be directed away from the foundations. Additionally, soils adjacent to foundations should consist of properly compacted, structural fill to minimize water infiltration.

8.0 SLAB-ON-GRADE SUPPORT

As outlined in **Section 6.1** of this report, existing fill and low-consistency soils will be removed and replaced or improved with rammed aggregate piers. Provided the subgrade is prepared in accordance with our recommendations, the floor slabs can be supported on newly placed, structural fill compacted to the project requirements or improved in situ soils. Ground supported slabs may be designed based on a modulus of subgrade reaction of 150 pci. A higher modulus provided by the design-build contractor may be possible for slabs supported on soils improved with aggregate piers.

The on-site soils contain fine-grained particles and may be sensitive to changes in moisture content. Soils that are wet and disturbed will lose strength and become unsuitable for slab support. Therefore, the contractor should exercise care when preparing the subgrade. Soils should be protected from disturbance caused by construction traffic. Water should not be allowed to pond on the subgrade nor should the soils be allowed to become excessively dry.

Once final subgrade elevation is established in the floor slab area, the exposed soils should be evaluated by a representative of CDG. Proofrolling with a loaded dump truck should be performed to compact the upper soils and identify areas of instability. Unsuitable material should be moisture conditioned and recompacted or removed and replaced with compacted, structural fill. Should the contractor's schedule delay floor slab construction after preparation of a suitable subgrade, the soils should be reevaluated immediately prior to concrete placement. Drying or wetting and recompaction of the soils will likely be required.

To reduce the potential for water migration through the floor slab, ground-supported slabs should be underlain by a capillary break consisting of a minimum of 4 inches of compacted, clean (<5% passing the #200 sieve), free-draining, granular material (such as ASTM C-33 #57 crushed aggregate). Depending on the type of floor coverings to be used, the owner may also elect to install a vapor barrier typically consisting of 6-mil polyethylene sheeting. The sheeting will reduce the infiltration of water vapor through the slab and the potential for damage to floor coverings. However, we note that the use of a vapor barrier will increase the potential for plastic shrinkage cracking during curing of the concrete slab.

9.0 CONSTRUCTION PHASE SERVICES

We recommend that CDG be retained to provide observation and testing services during the construction phase of the project. Construction phase services typically include testing of materials such as soils and compacted fill and structural concrete. Additionally, engineering consultation and testing related to foundation support are recommended.

A comprehensive testing program by the Geotechnical Engineer of Record is an essential element of the geotechnical evaluation for the project. Design assumptions were made based on widely spaced borings. Therefore, variations in soil properties should be expected and may only become apparent during construction. Testing and observation by the engineer of record is especially important during the earthwork and foundation phases of construction due to the high degree of variation in subsurface conditions typically present on a site in general, and due the existing fill and low-consistency residual soils present on this site in particular.

CDG cannot accept responsibility for the interpretation of the recommendations contained in this report nor for the application of the recommendations during construction of the project if not retained to provide a complete scope of construction observation and materials testing services.

10.0 GENERAL REMARKS AND CLOSING

This report has been prepared for the exclusive use of City of Springville for specific application to the Sewer Plant Upgrade - CWSRF project in Springville, Alabama and is not transferable to a third party. The recommendations in this report are intended for use on the stated project and should not be used for other purposes. It will be important for the geotechnical Engineer of Record to review the final project plans and specifications to provide the appropriate interpretation of the recommendations contained in this report.

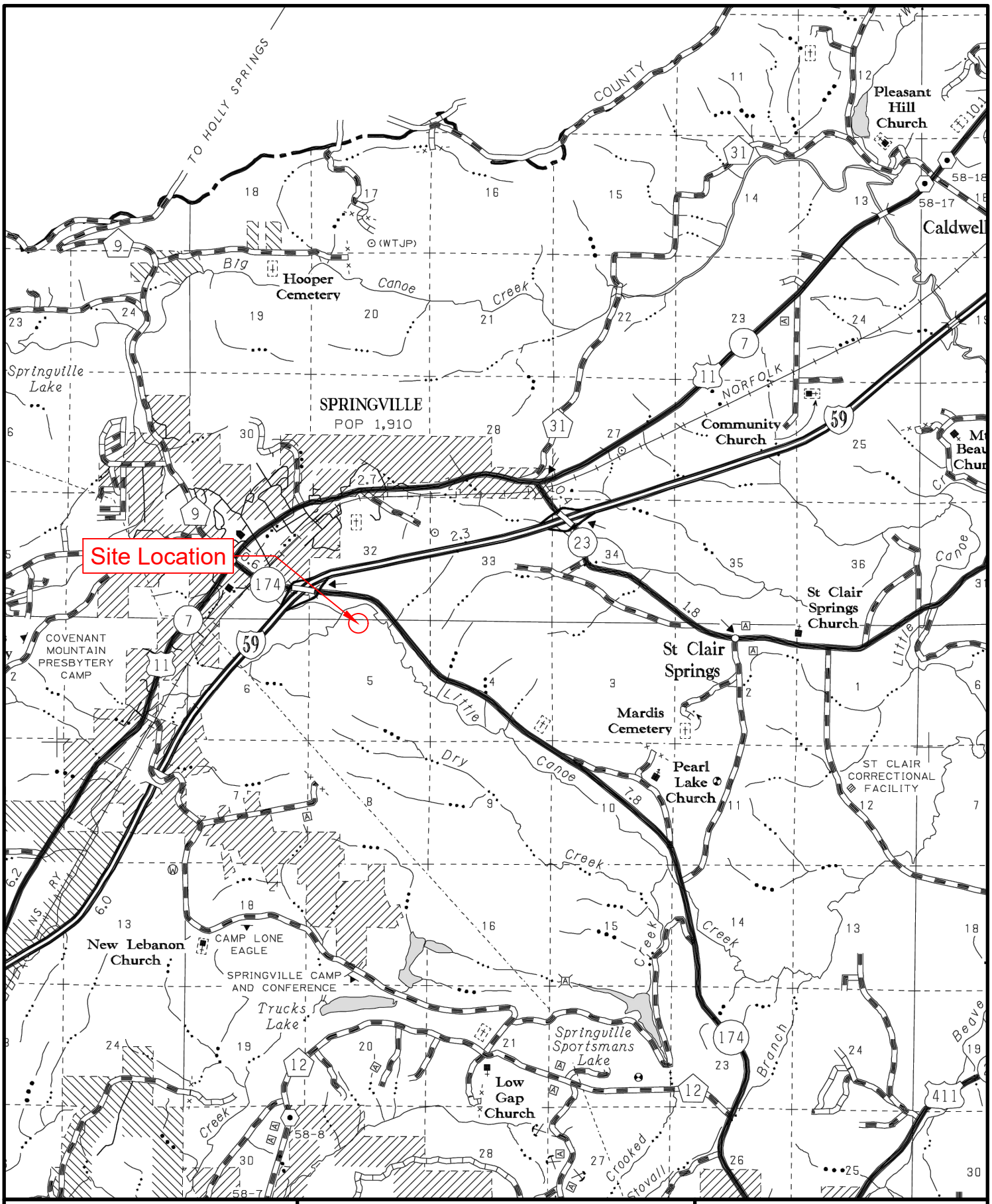
The conclusions, analyses, and recommendations presented in this report are based upon currently accepted engineering principles, practices, and existing testing standards in the area where the services were provided. No other warranty, expressed or implied, is made.

The recommendations in this report were developed based on our understanding of the proposed construction and from the limited information obtained from the subsurface exploration and laboratory testing programs. If significant changes are made in the scope of the project, CDG should be allowed to review our recommendations in light of the changes to determine if additional testing and revised conclusions are needed.

APPENDIX A

Project Maps

cdge.com

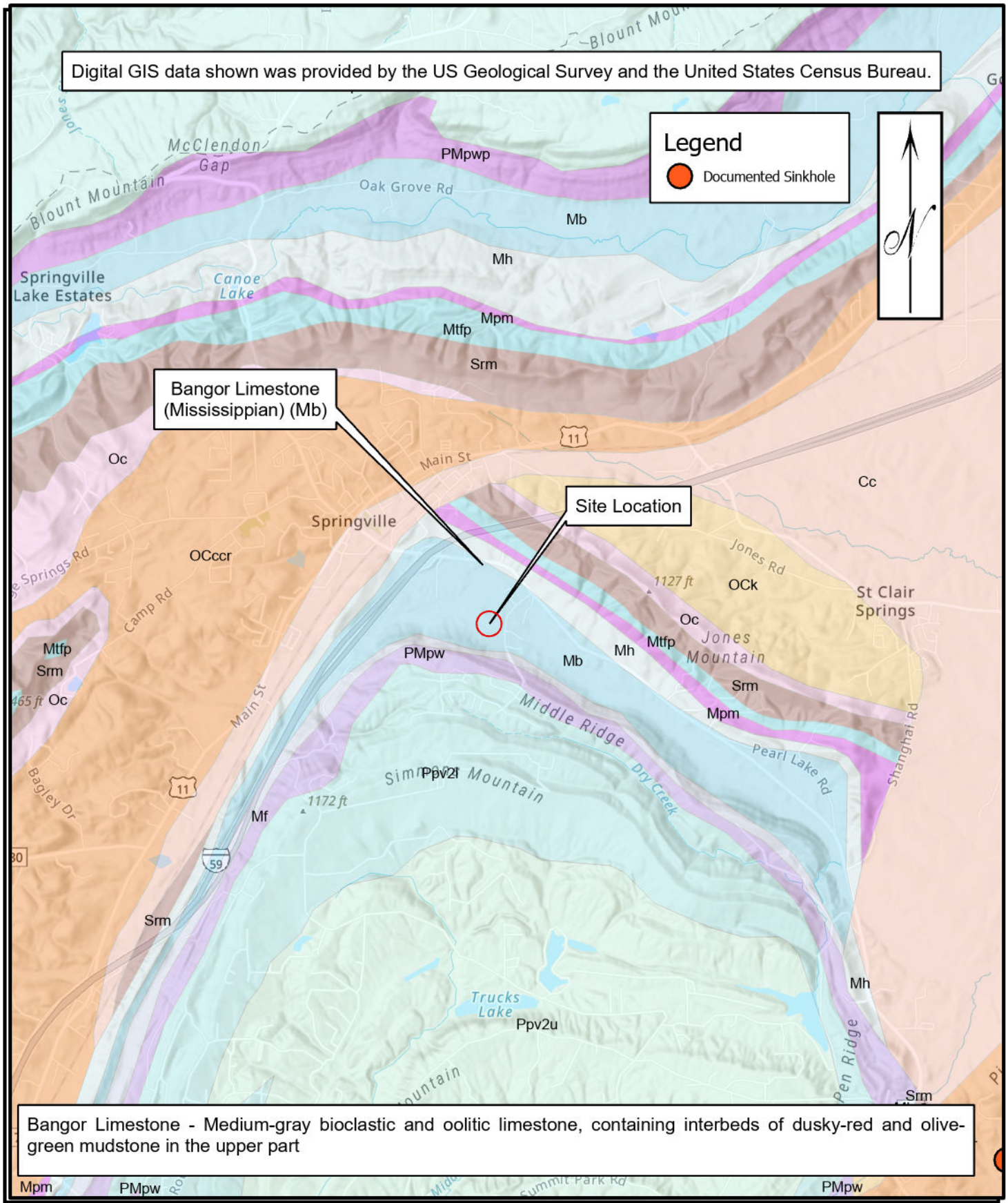


CDG
Engineering. Environmental. Answers.

Site Vicinity Map

Drawn By: TL	Scale: 1" = 1 mile	Date: 1/8/2024

Springville - Sewer Plant
Upgrade CWSRF
Springville, AL
CDG Project No. R954719170



CDG
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Site Geology & Documented Sinkhole Plan

Drawn By: TL	Scale: 1" = 1 mile	Date: 12/13/2023

Springville Sewer Plant
Upgrade CWSRF
Springville, Alabama
CDG Project No. R954719170

APPENDIX B

Boring Location Plan

cdge.com

Legend

B-1
Boring Location

Notes:

Boring locations are approximate.

This plan was based on a drawing entitled "Site Layout"; preapred by CDG, Inc.

Springville-Sewer Plant Upgrade
CWSRF
Springville, Alabama
CDG Project No. R175522107

Boring Location Plan

Date: 12/13/2023

Scale: N/A

Drawn By: TL

CDG Engineering Environmental Answers

APPENDIX C

Boring Logs

cdge.com

Boring ID: B-1

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76217	Logged By: Tyler Lawrence
Date Started: 01-15-2024	Longitude: -86.4554	Hammer Efficiency:
Date Completed: 01-15-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±4 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Stiff, red, fat CLAY		5-3-4	7						24		1.5	
3		-3.5 / 3.5	**(Residuum)** Stiff, red, fine sandy SILT		3-4-4	8						22			
6		-6 / 6	...tan and brown		4-5-6	11						19			
8		-8.5 / 8.5	...same		5-5-7	12				31	8	26	82.2		USCS = ML AASHTO = A-6
12		-12.25 / 12.25	...same		4-6-7	13						24			
17		-17 / 17	Medium, tan, fat CLAY		3-3-5	8						50		0.5	
20		-20 / 20	Boring terminated at 20 feet.												No groundwater encountered during drilling, Boring backfilled upon completion.

Boring ID: B-2

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76218	Logged By: Tyler Lawrence
Date Started: 01-15-2024	Longitude: -86.45553	Hammer Efficiency:
Date Completed: 01-15-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±2 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Loose, brown and black, fine sandy SILT		3-5-5	10									
3		-3.5													
4		3.5	**(Residuum)** Stiff, brownish red, fine sandy SILT		3-3-6	9								>4.0	
6		-6													
6		6	...same		3-4-9	13								4.0	
8		-8.5													
8.5			...same		3-4-5	9								3.0	
12		-12.25													
12.25			...tan with rock fragments		3-8-10	18								>4.0	
17		-17													
17			...same		6-9-9	18								>4.0	
20		-20													
20			Boring terminated at 20 feet.												No groundwater encountered during drilling, Boring backfilled upon completion.

Boring ID: B-3

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76215	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45574	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±2 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Medium, brown and black, fine sandy SILT with organics		2-3-2	5									
3		-3.5 / 3.5	...soft with trace organics		2-1-2	3									
6		-6 / 6	**(Residuum)** Stiff, brown, fine sandy SILT		4-6-7	13									
8		-8.5 / 8.5	...same		3-6-6	12									
12		-12.25 / 12.25	Stiff, tan, fine to medium sandy CLAY		4-5-5	10									
17		-17.25 / 17.25	...same		4-4-6	10									
22		-22 / 22	...same		4-4-6	10									No groundwater encountered during drilling, Boring backfilled upon completion.
25		-25 / 25	Boring terminated at 25 feet.												

Boring ID: B-4

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76216	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45592	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±3 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Medium, brown and black, fine sandy SILT with trace organics		3-3-3	6									
3		-3.5 / 3.5	...same		2-2-3	5									
6		-6 / 6	**(Residuum)** Soft, brown, fat CLAY		1-1-2	3								0.5	
8		-8.5 / 8.5	...medium		1-2-3	5								1.0	
12		-12.25 / 12.25	Stiff, brown, fine sandy CLAY		3-4-4	8								2.0	
17		-17.25 / 17.25	...very stiff		6-9-12	21								>4.0	
22		-22 / 22	...same with rock fragments		11-11-10	21								>4.0	No groundwater encountered during drilling, Boring backfilled upon completion.
25		-25 / 25	Boring terminated at 25 feet.												

Boring ID: B-5

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76215	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45613	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±12 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Soft, brown, fat CLAY		2-2-2	4									
3		-3.5 / 3.5	**(Residuum)** Very soft, brown, fat CLAY		1-1-1	2								0.25	
6		-6 / 6	...same		1-1-1	2								0.25	
8		-8.5 / 8.5	...medium		1-2-4	6									
12		-12.25 / 12.25	Stiff, tan, fine to medium sandy CLAY		2-3-4	7								1.5	
17		-17.25 / 17.25	...same with rock fragments		3-5-4	9								1.5	
22		-22 / 22	Stiff, tan, fat CLAY		3-3-4	7									No groundwater encountered during drilling, Boring backfilled upon completion.
25		-25 / 25	Boring terminated at 25 feet.												

Boring ID: B-6

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.762	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45574	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±6 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Stiff, brown, fine to medium sandy CLAY		2-4-5	9									
1															
2															
3		-3.5													
4		3.5	...same		3-4-5	9								2.0	
5															
6		-6													
7		6	**(Residuum)** Stiff, red, fine to medium sandy CLAY		3-4-6	10								2.5	
8		-8.5													
9		8.5	...same		3-4-5	9									
10															
11															
12		-12.25													
13		12.25	...tan												
14					4-4-7	11									
15															
16															
17		-17.25													
18		17.25	...same												
19															
20					3-4-6	10									
21															
22		-22													
23		22	...medium												
24					2-3-3	6									No groundwater encountered during drilling, Boring backfilled upon completion.
25		-25													
26		25	Boring terminated at 25 feet.												

Boring ID: B-7

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76199	Logged By: Tyler Lawrence
Date Started: 01-15-2024	Longitude: -86.45593	Hammer Efficiency:
Date Completed: 01-15-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±3 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Medium, brown, fine to medium sandy CLAY		2-3-3	6								1.0	
3		-3.5 / 3.5	...stiff		2-2-7	9									
6		-6 / 6	**(Residuum)** Stiff, red, fine to medium sandy CLAY		3-3-5	8								2.0	
8		-8.5 / 8.5	...same		4-4-6	10									
12		-12.25 / 12.25	...very stiff, tan with rock fragments		5-8-12	20								>4.0	
17		-17.25 / 17.25	Very stiff, tan, fat CLAY		3-6-7	13								>4.0	
22		-22 / 22	...same		4-5-7	12								>4.0	No groundwater encountered during drilling, Boring backfilled upon completion.
25		-25 / 25	Boring terminated at 25 feet.												

Boring ID: B-8

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76198	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45613	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±3 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Medium, brown, fine to medium sandy SILT with rock fragments		2-2-2	4									
3		-3.5 / 3.5	Medium, brown, fine sandy CLAY		2-2-4	6								0.5	
6		-6 / 6	**(Residuum)** Very stiff, tan, fine to medium sandy CLAY		3-5-7	12								>4.0	
8		-8.5 / 8.5	...same		3-7-10	17								>4.0	
12		-12.25 / 12.25	...same, with rock fragments		5-7-9	16								>4.0	
17		-17.25 / 17.25	...stiff		3-5-6	11								2.5	
22		-22 / 22	Stiff, tan, fat CLAY		3-3-5	8								1.5	No groundwater encountered during drilling, Boring backfilled upon completion.
25		-25 / 25	Boring terminated at 25 feet.												

RSLog / CDG Standard Boring Log / cdg.-inc. / tyler.lawrence / March 12, 2024 03:25 PM

Boring ID: B-9

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76207	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45583	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±6 inches of topsoil encountered at ground surface.												
0		0	**(Fill)** Stiff, brown and black, fine to medium sandy CLAY with rock fragments		5-6-7	13						18			
3		-3.5 / 3.5	...medium with organics		4-3-3	6				32	13	18	77.4	0.5	USCS = CL AASHTO = A-6
6		-6 / 6	**(Residuum)** Very soft, brown, CLAY with sand		1-1-1	2				32	16	19	78	0.25	USCS = CL AASHTO = A-6
8		-8.5 / 8.5	...medium		2-2-4	6						21			
12		-12.25 / 12.25	...tan		3-3-4	7				35	15	19	71.6		USCS = CL AASHTO = A-6
17		-17.25 / 17.25	...stiff with rock fragments		3-5-5	10						27			
22		-22 / 22	Stiff, tan, fat CLAY		3-3-4	7				95	63	36	95.2	2.0	
25		-25 / 25	...brown												

Boring ID: B-9

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76207	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45583	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
26			*(continued)*												
27			...brown												
28															
29					50/5							42			
30		-30 / 30	Auger refusal encountered at 30 feet.												No groundwater encountered during drilling, Boring backfilled upon completion.
31															
32															
33															
34															
35															
36															
37															
38															
39															
40															
41															
42															
43															
44															
45															
46															
47															
48															
49															
50															
51															
52															

Boring ID: B-10

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76207	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45602	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±14 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Medium, brown, fine sandy SILT with trace organics		3-3-5	8									
1															
2															
3		-3.5													
4		3.5	...same		4-5-5	10								0.5	
5															
6		-6													
7		6	**(Residuum)** Medium, red, fine sandy CLAY		1-2-3	5								0.25	
8		-8.5													
9		8.5	...stiff		5-6-7	13								1.5	
10															
11															
12		-12.25													
13		12.25	...very stiff, tan												
14															
15					7-9-10	19								>4.0	
16															
17		-17.25													
18		17.25	Very stiff, tan, fat CLAY												
19															
20					4-5-8	13								>4.0	
21															
22		-22													
23		22	...stiff												
24														2.0	
25					2-4-6	10									
26															

Boring ID: B-10

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76207	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45602	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
26			*(continued)*												No groundwater encountered during drilling, Boring backfilled upon completion.
27		-27 / 27	...stiff Auger refusal encountered at 27 feet.												
28															
29															
30															
31															
32															
33															
34															
35															
36															
37															
38															
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46															
47															
48															
49															
50															
51															
52															

Boring ID: B-11

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76205	Logged By: Tyler Lawrence
Date Started: 01-15-2024	Longitude: -86.45624	Hammer Efficiency:
Date Completed: 01-15-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±1 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Stiff, black and brown, fine to medium sandy SILT with trace organics		3-5-5	10						19			
3		-3.5 / 3.5	...same with organics		4-4-4	8				49	20	21	69.7		USCS = ML AASHTO = A-6
6		-6 / 6	**(Residuum)** Stiff, red, fine sandy CLAY		2-4-5	9						20		2.0	
8		-8.5 / 8.5	...same		2-6-7	13				41	17	21	79.7		USCS = CL AASHTO = A-7-6
12		-12.25 / 12.25	...very stiff, tan and red		5-9-9	18						20		3.5	
17		-17 / 17	Stiff, brown, fat CLAY		3-5-8	13						39		2.0	
20		-20 / 20	Boring terminated at 20 feet.												No groundwater encountered during drilling, Boring backfilled upon completion.

Boring ID: B-12

Springville Sewer Plant Upgrade CWSRF

Project Number: R954719170	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Springville, AL	Latitude: 33.76199	Logged By: Tyler Lawrence
Date Started: 01-17-2024	Longitude: -86.45641	Hammer Efficiency:
Date Completed: 01-17-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer / Well	Elev. (ft) / Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec: RQD cr (%)	RQD / Rec: TCR (%)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
		0	±1 inches of topsoil encountered at ground surface.												
0	No Data	0	**(Fill)** Medium, black and brown, fine sandy SILT with organics		2-2-3	5									
3		-3.5 / 3.5	...stiff, with rock fragments		3-4-4	8									
6		-6 / 6	**(Residuum)** Stiff, red, fine sandy CLAY		2-5-5	10								1.5	
8		-8.5 / 8.5	...same		2-4-6	10								2.0	
12		-12.25 / 12.25	...very stiff, tan		3-5-9	14								4.0	
17		-17 / 17	Very stiff, brown, fat CLAY		3-6-8	14								3.0	
20		-20 / 20	Boring terminated at 20 feet.												No groundwater encountered during drilling, Boring backfilled upon completion.

APPENDIX D

Laboratory Test Results

cdge.com

Soil Classification Results

Dothan
1962 West Main Street
Dothan, AL 36301
Phone: 334-677-9431

Client:

City of Springville, AL
160 Walker Drive
Springville, AL 35146

Project:

R954719170
Springville- Sewer Plant Upg. CWSRF
Legacy Parkway
Springville, AL 35146

Sample and Test Information

Boring No. / Sample #: B-1 / 5583

Location Details: B-1 @ 9-10.5'

Sample Depth (ft.): 9-10.5'

Sample Description: Tan and brown, fine sandy SILT

Date Sampled: 01/22/2024 **Date Tested:** 01/26/2024

Completed By: John Rhodus

Date Issued: 01/26/2024

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 31

Plastic Limit (PL): 23

Plasticity Index (PI): 8

Classifications

AASHTO : A-4

USCS: ML

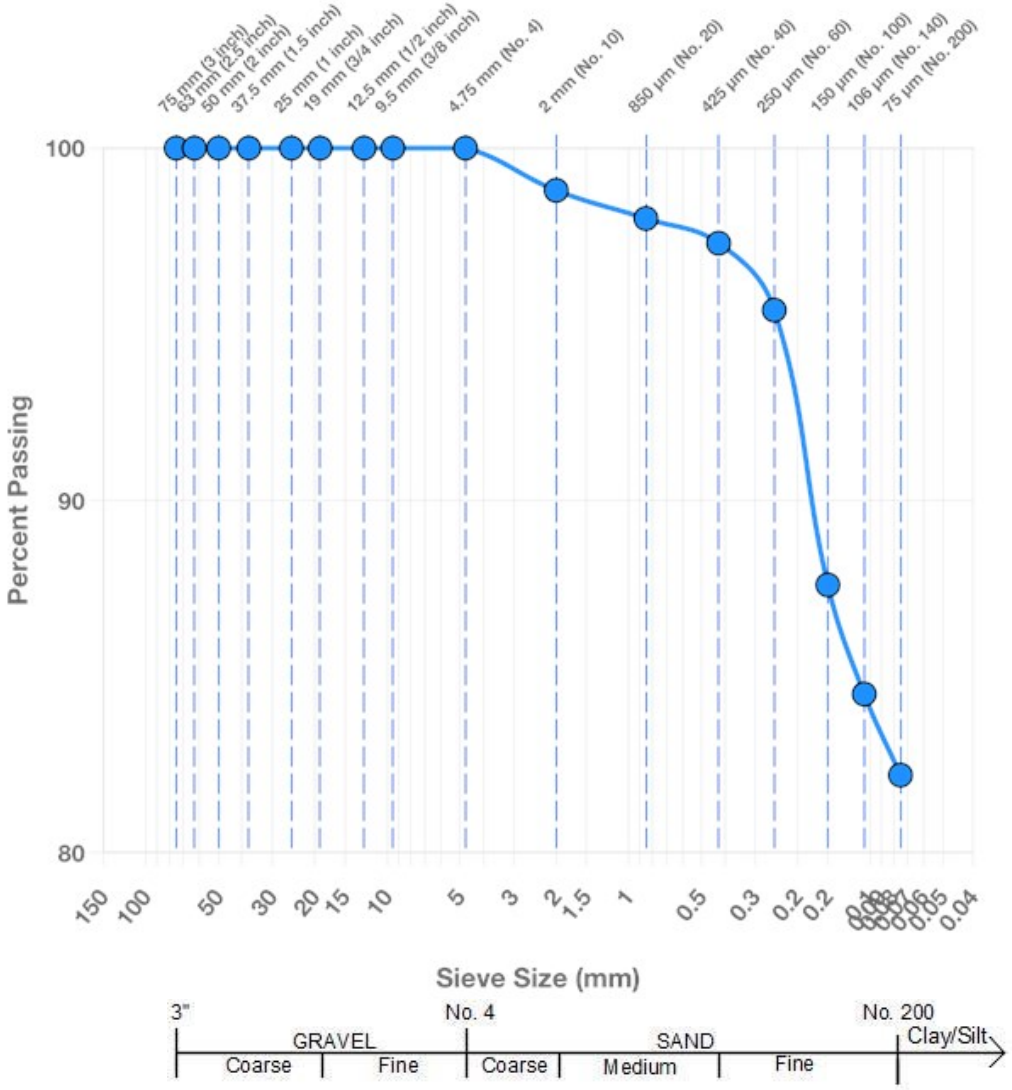
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 0.0

Percent Sand: 17.8

Percent Clay/Silt: 82.2

Soak Duration: 24 hours



Soil Classification Results

Dothan
1962 West Main Street
Dothan, AL 36301
Phone: 334-677-9431

Client:

City of Springville, AL
160 Walker Drive
Springville, AL 35146

Project:

R954719170
Springville- Sewer Plant Upg. CWSRF
Legacy Parkway
Springville, AL 35146

Sample and Test Information

Boring No. / Sample #: B-9 / 5587

Location Details: B-9 @ 4-5.5'

Sample Depth (ft.): 4-5.5'

Sample Description: Black, fine sandy SILT with organics

Date Sampled: 01/22/2024 **Date Tested:** 01/26/2024

Completed By: John Rhodus

Date Issued: 01/26/2024

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 32

Plastic Limit (PL): 19

Plasticity Index (PI): 13

Classifications

AASHTO : A-4

USCS: ML

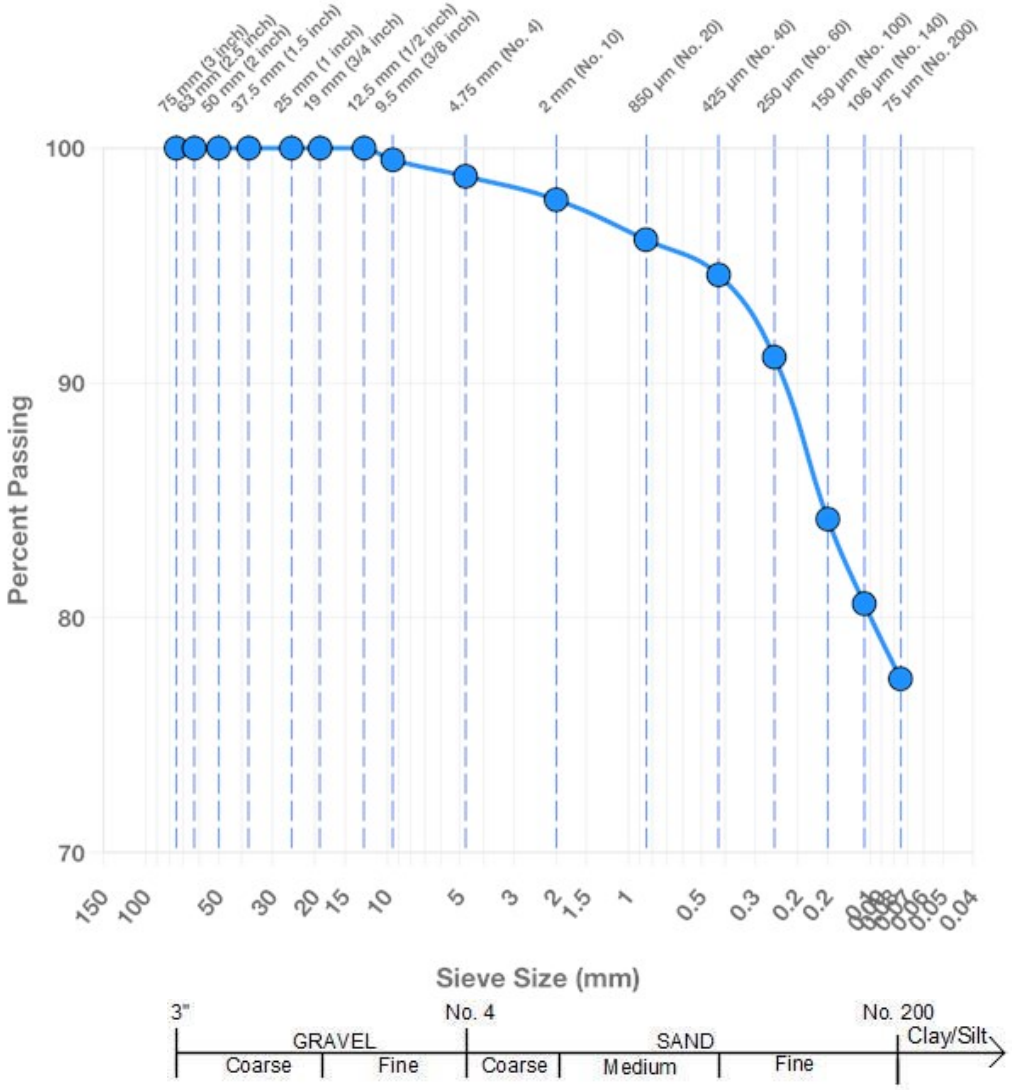
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 1.2

Percent Sand: 21.4

Percent Clay/Silt: 77.4

Soak Duration: 24 hours



Soil Classification Results

Dothan
1962 West Main Street
Dothan, AL 36301
Phone: 334-677-9431

Client:

City of Springville, AL
160 Walker Drive
Springville, AL 35146

Project:

R954719170
Springville- Sewer Plant Upg. CWSRF
Legacy Parkway
Springville, AL 35146

Sample and Test Information

Boring No. / Sample #: B-9 / 5588

Location Details: B-9 @ 6.5-8'

Sample Depth (ft.): 6.5-8'

Sample Description: Brown, fine sandy CLAY

Date Sampled: 01/22/2024 **Date Tested:** 01/26/2024

Completed By: John Rhodus

Date Issued: 01/26/2024

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 32

Plastic Limit (PL): 16

Plasticity Index (PI): 16

Classifications

AASHTO : A-6

USCS: CL

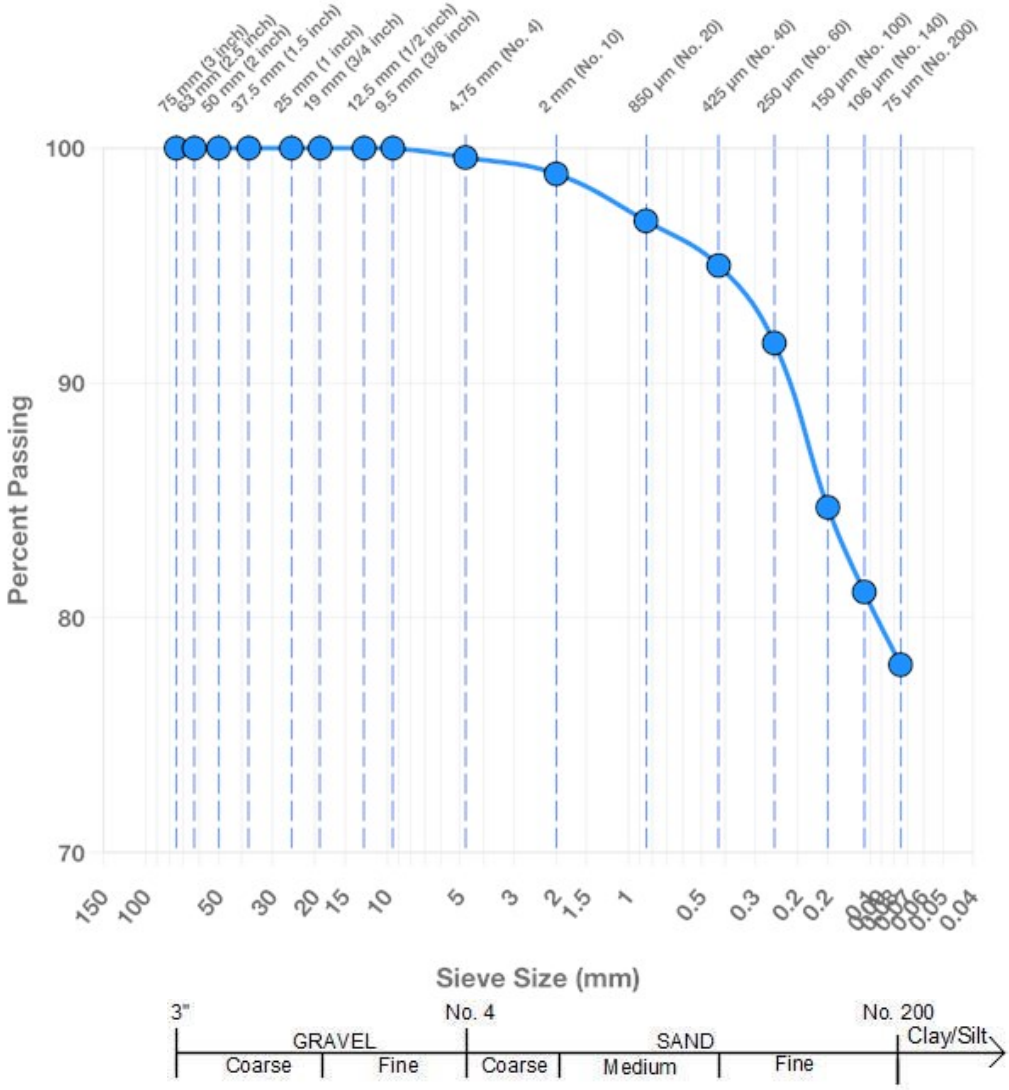
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 0.4

Percent Sand: 21.6

Percent Clay/Silt: 78.0

Soak Duration: 24 hours



Soil Classification Results

Dothan
1962 West Main Street
Dothan, AL 36301
Phone: 334-677-9431

Client:

City of Springville, AL
160 Walker Drive
Springville, AL 35146

Project:

R954719170
Springville- Sewer Plant Upg. CWSRF
Legacy Parkway
Springville, AL 35146

Sample and Test Information

Boring No. / Sample #: B-9 / 5590

Location Details: B-9 @14-15.5'

Sample Depth (ft.): 14-15.5'

Sample Description: Tan, fine sandy CLAY

Date Sampled: 01/22/2024 **Date Tested:** 01/26/2024

Completed By: John Rhodus

Date Issued: 01/26/2024

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 35

Plastic Limit (PL): 20

Plasticity Index (PI): 15

Classifications

AASHTO : A-6

USCS: CL

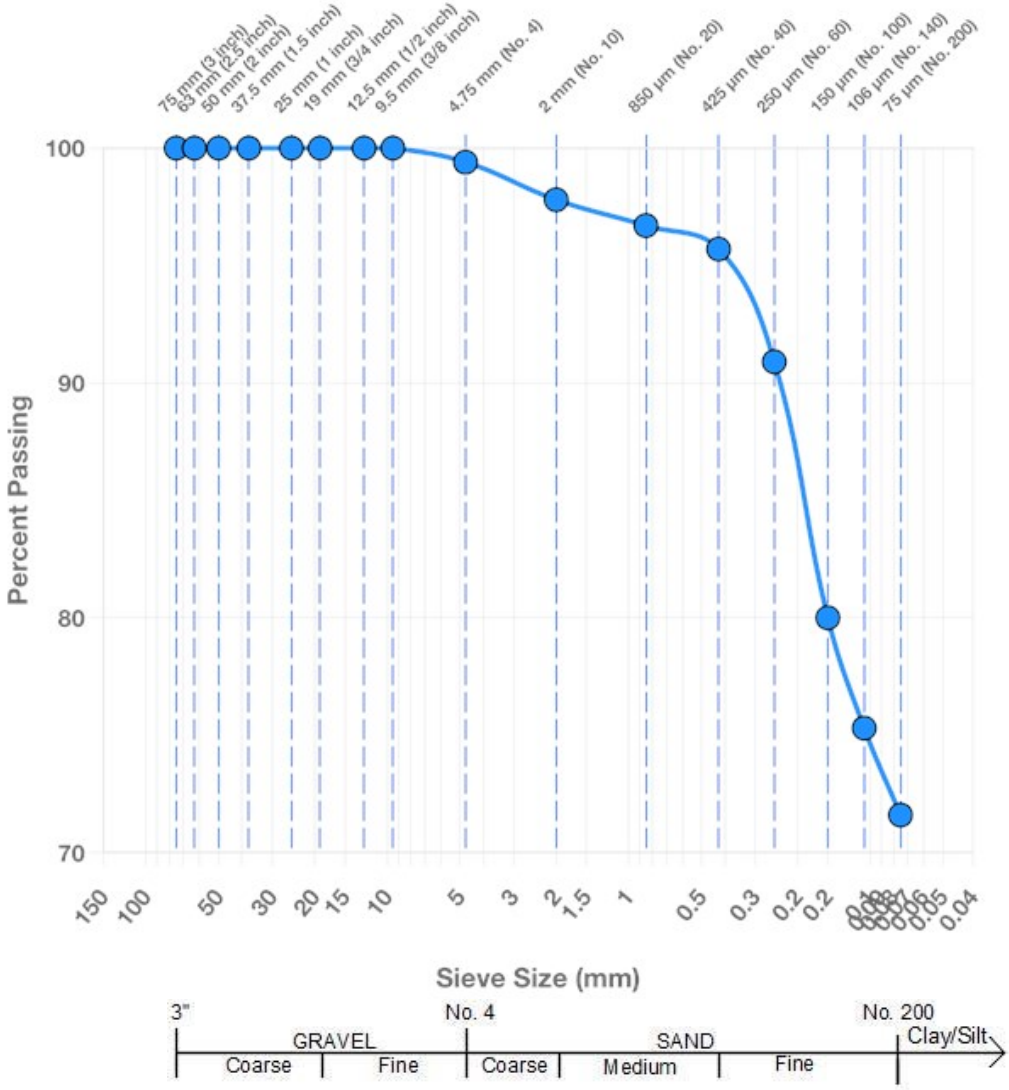
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 0.6

Percent Sand: 27.8

Percent Clay/Silt: 71.6

Soak Duration: 24 hours



Soil Classification Results

Dothan
1962 West Main Street
Dothan, AL 36301
Phone: 334-677-9431

Client:

City of Springville, AL
160 Walker Drive
Springville, AL 35146

Project:

R954719170
Springville- Sewer Plant Upg. CWSRF
Legacy Parkway
Springville, AL 35146

Sample and Test Information

Boring No. / Sample #: B-11 / 5595

Location Details: B-11 @ 4-5.5'

Sample Depth (ft.): 4-5.5'

Sample Description:
Black and brown, fine to medium sandy SILT with organics

Date Sampled: 01/22/2024 **Date Tested:** 01/26/2024

Completed By: John Rhodus

Date Issued: 01/26/2024

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 49

Plastic Limit (PL): 29

Plasticity Index (PI): 20

Classifications

AASHTO : A-6

USCS: ML

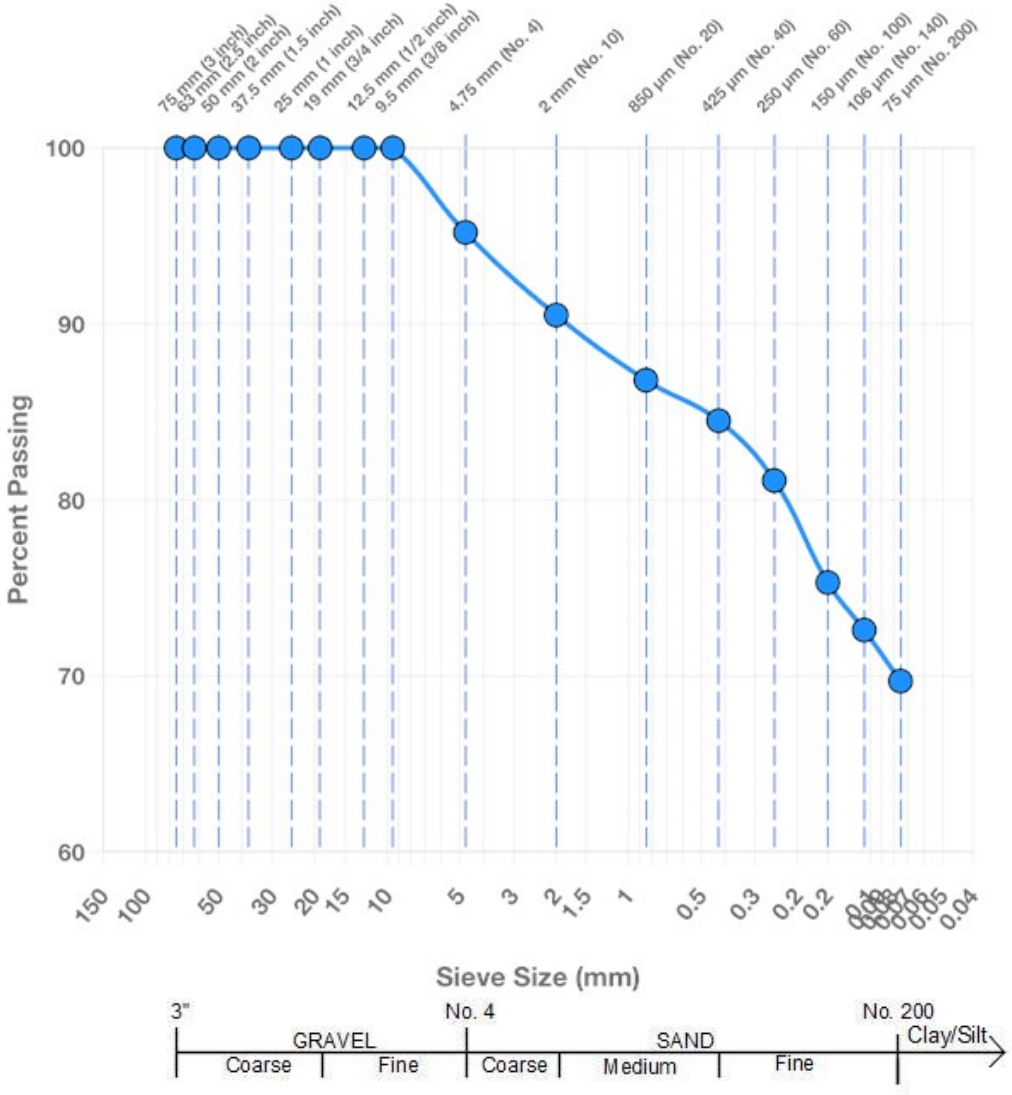
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 4.8

Percent Sand: 25.5

Percent Clay/Silt: 69.7

Soak Duration: 24 hours



Soil Classification Results

Dothan
1962 West Main Street
Dothan, AL 36301
Phone: 334-677-9431

Client:
City of Springville, AL
160 Walker Drive
Springville, AL 35146

Project:
R954719170
Springville- Sewer Plant Upg. CWSRF
Legacy Parkway
Springville, AL 35146

Sample and Test Information

Boring No. / Sample #: B-11 / 5597

Location Details: B-11 @ 9-10.5'

Sample Depth (ft.): 9-10.5'

Sample Description: Red, fine sandy CLAY

Date Sampled: 01/22/2024 **Date Tested:** 01/26/2024

Completed By: John Rhodus

Date Issued: 01/26/2024

Report of Atterberg Limits (ASTM D4318)

Liquid Limit (LL): 41

Plastic Limit (PL): 24

Plasticity Index (PI): 17

Classifications

AASHTO : A-7-6

USCS: CL

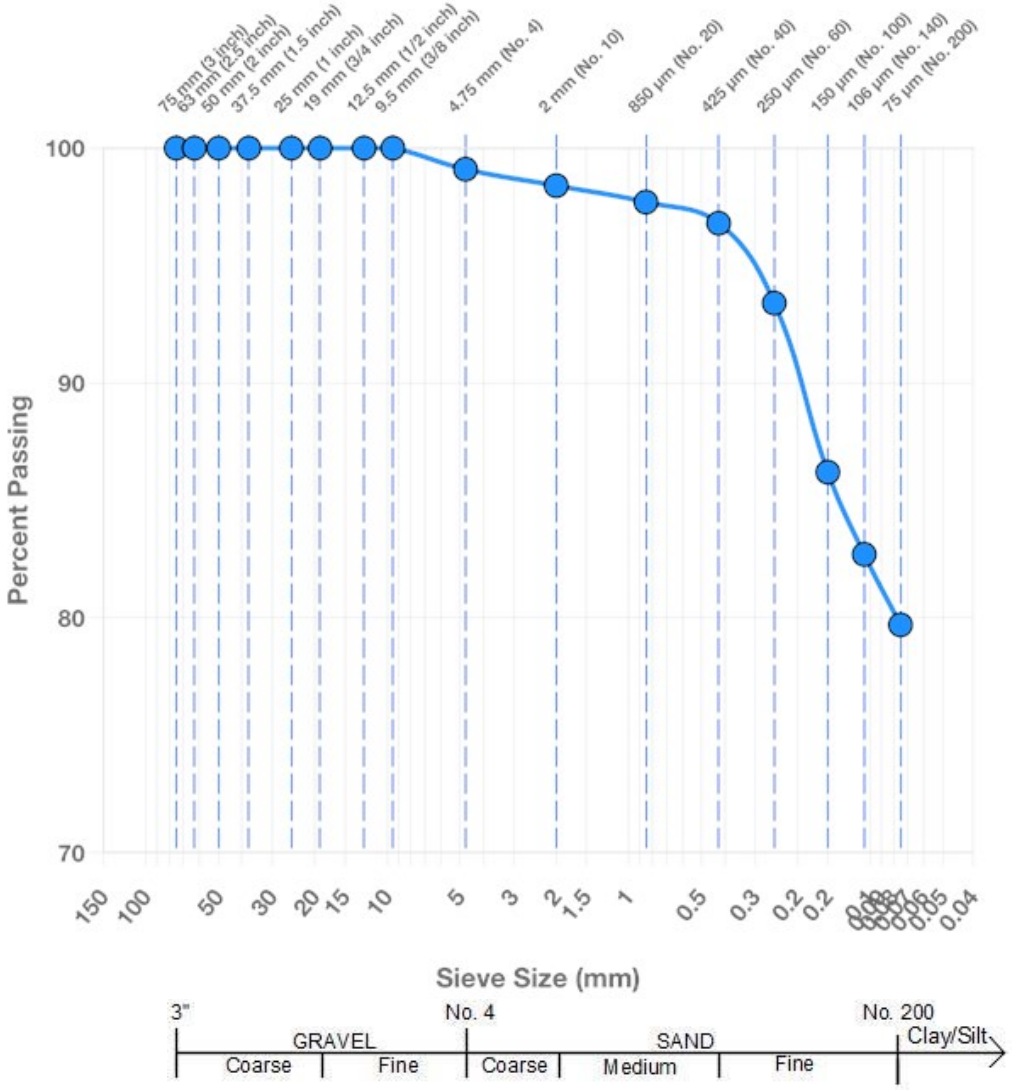
Report of Sieve Analysis (ASTM D6913)

Percent Gravel: 0.9

Percent Sand: 19.4

Percent Clay/Silt: 79.7

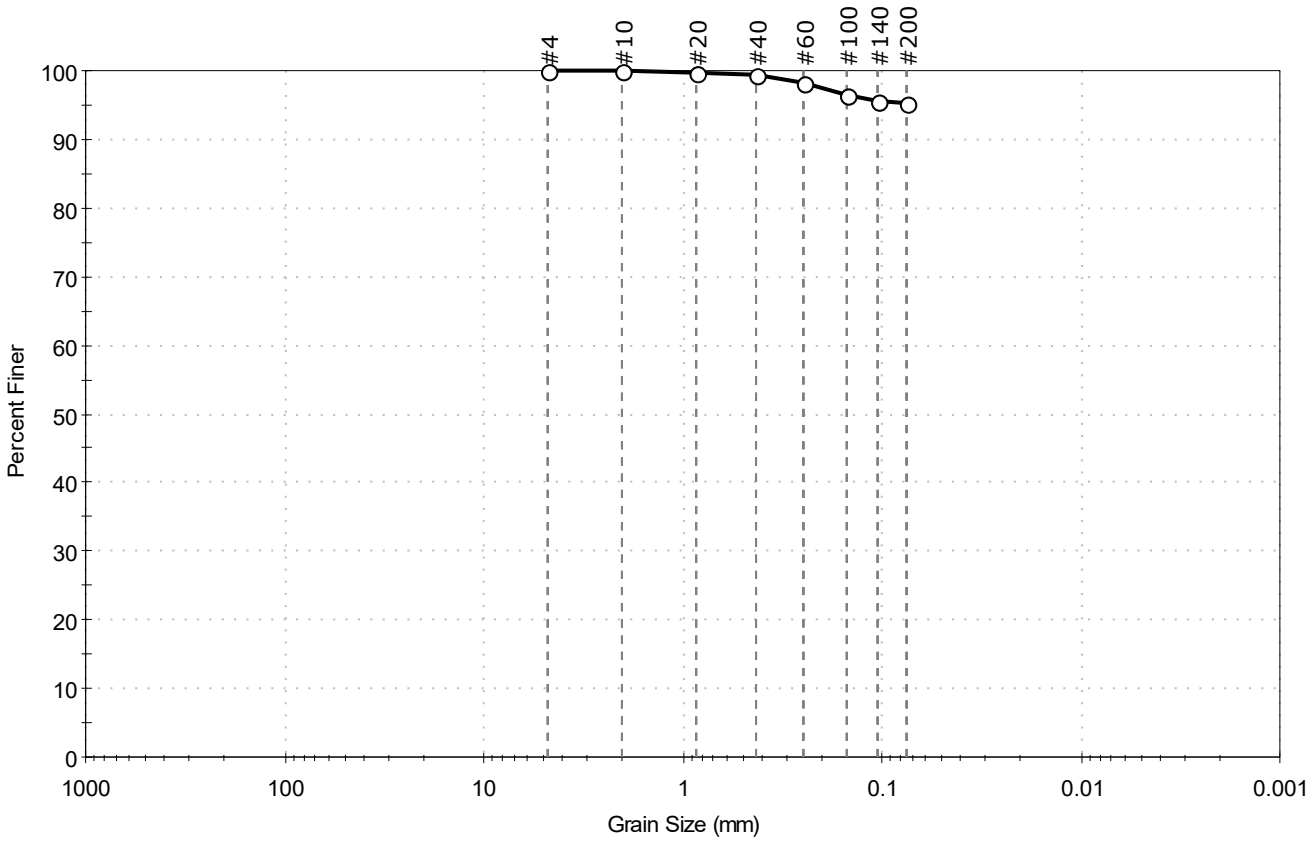
Soak Duration: 24 hours



GeoTesting EXPRESS

Client:	CDG Engineers				
Project:	Springville Sewer Plant Upgrade				
Location:	Springville, Alabama			Project No:	GTX-318529
Boring ID:	B-9	Sample Type:	Tube	Tested By:	bdh
Sample ID:	---	Test Date:	02/01/24	Checked By:	MCM
Depth :	24-26 ft	Test Id:	354771		
Test Comment:	---				
Visual Description:	Moist, reddish yellow clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	4.8	95.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	98		
#100	0.15	97		
#140	0.11	96		
#200	0.075	95		

Coefficients

D_{85} = N/A	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Fat CLAY (CH)

AASHTO Clayey Soils (A-7-5 (71))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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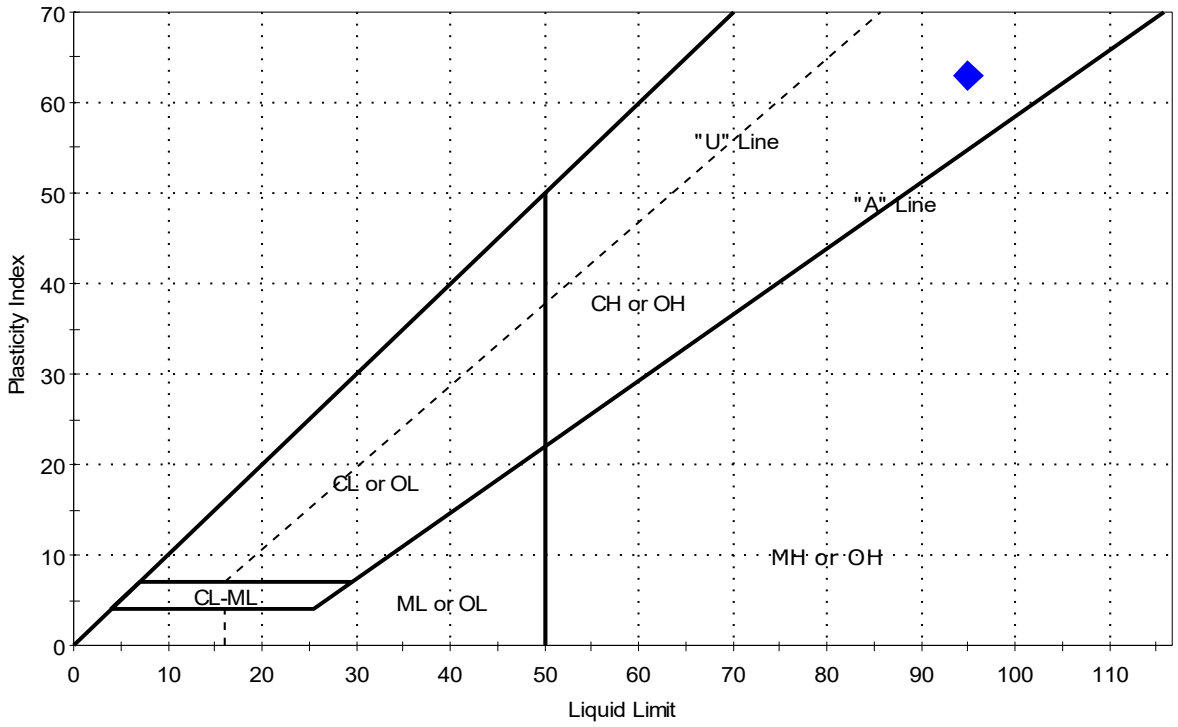
GeoTesting EXPRESS

Client:	CDG Engineers				
Project:	Springville Sewer Plant Upgrade				
Location:	Springville, Alabama			Project No:	GTX-318529
Boring ID:	B-9	Sample Type:	Tube	Tested By:	jbh
Sample ID:	---	Test Date:	01/31/24	Checked By:	MCM
Depth :	24-26 ft	Test Id:	354770		
Test Comment:	---				
Visual Description:	Moist, reddish yellow clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

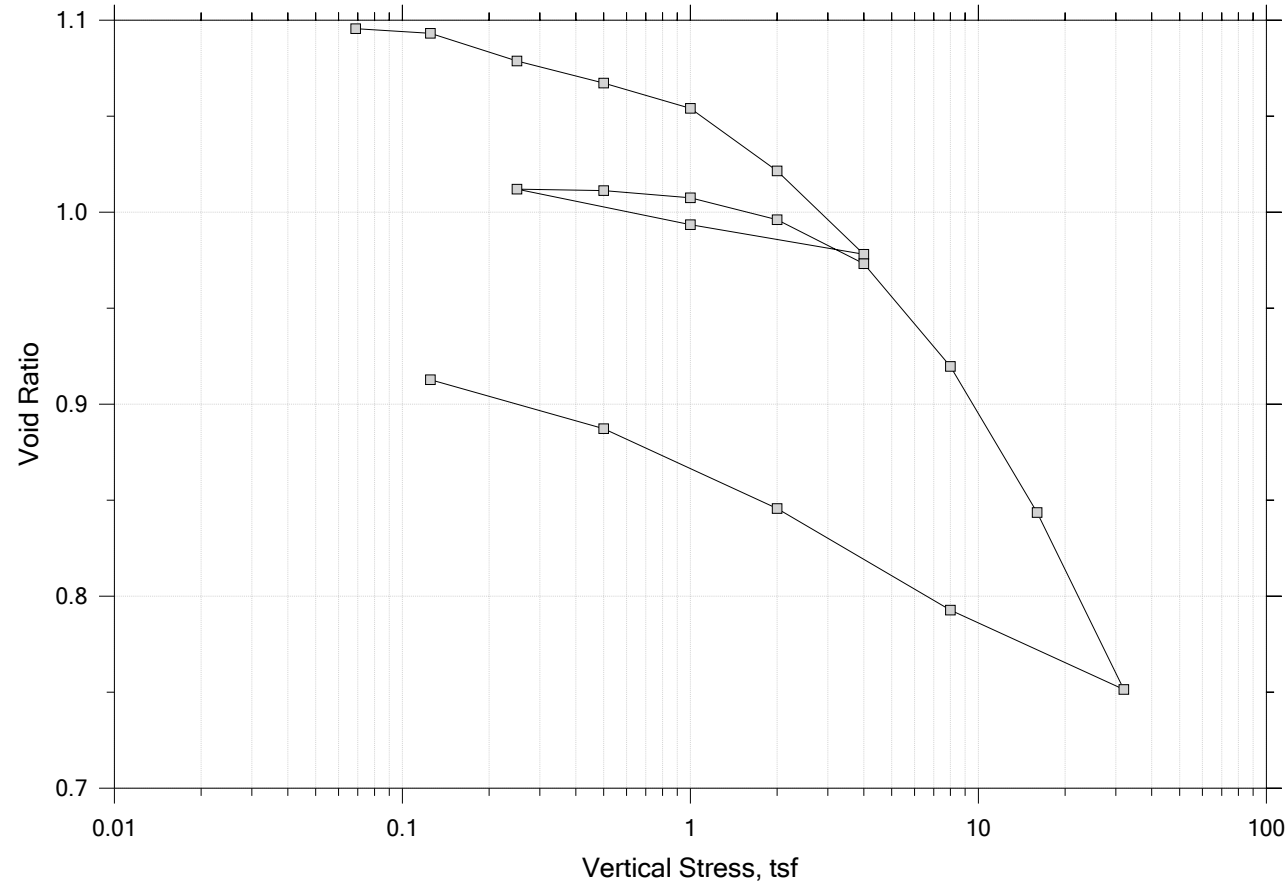


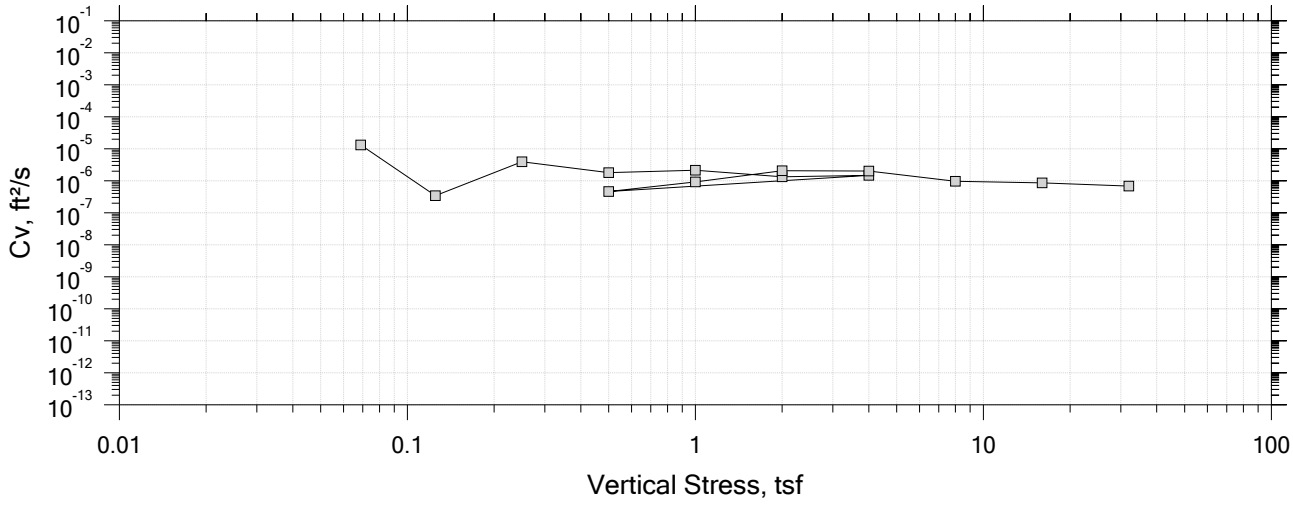
Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	---	B-9	24-26 ft	38	95	32	63	0.1	Fat CLAY (CH)

Sample Prepared using the WET method
1% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilatancy: NONE
Toughness: MEDIUM

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report

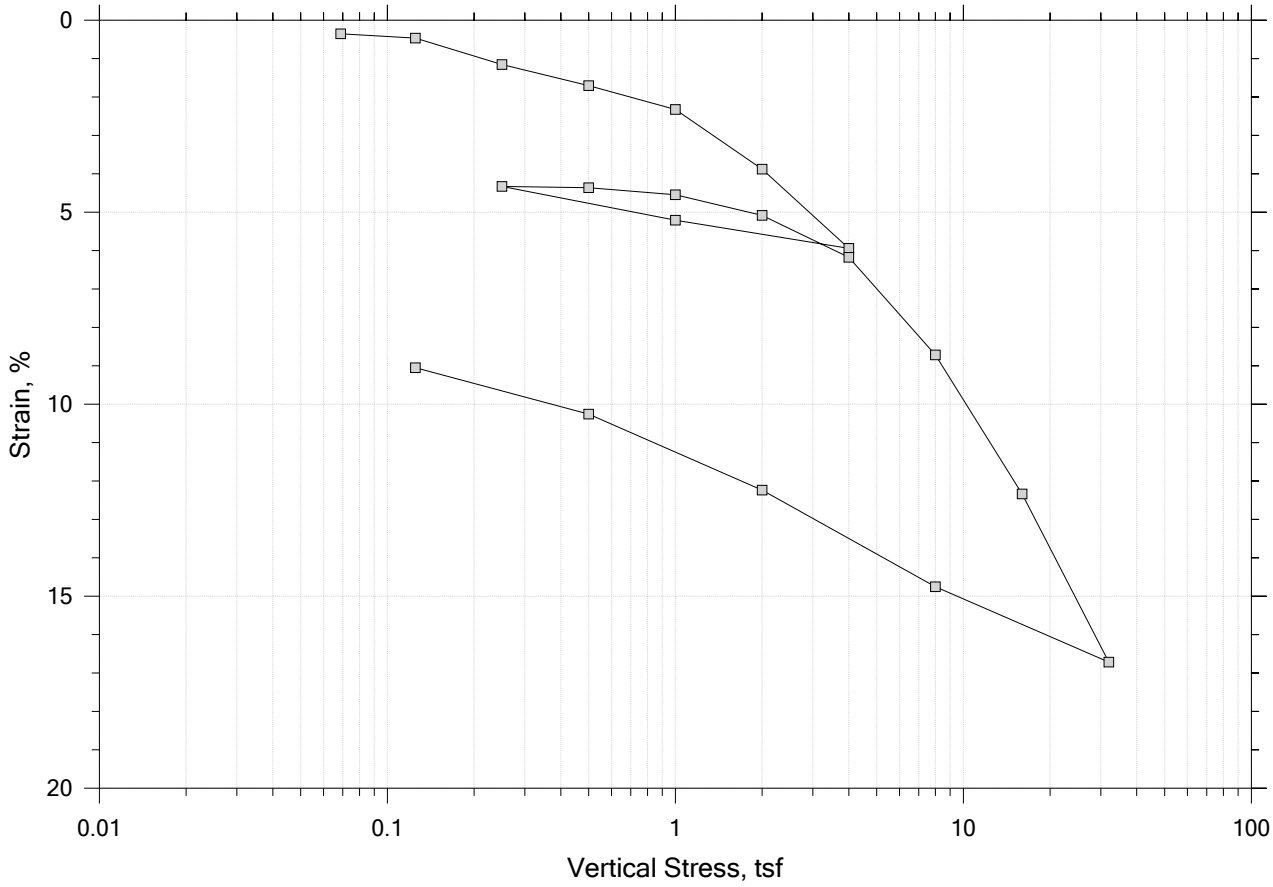


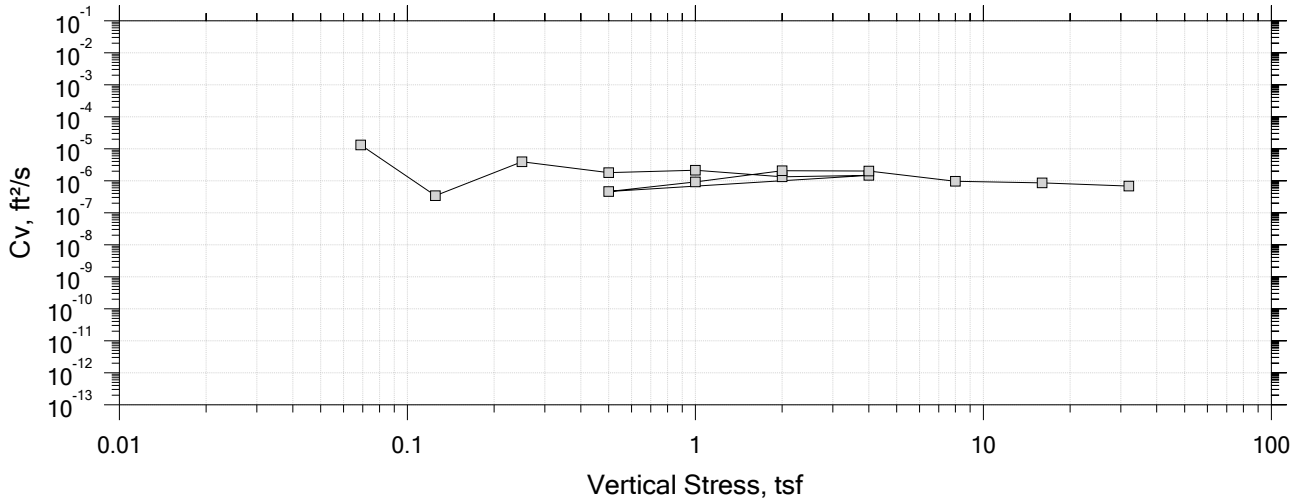


GeoTesting EXPRESS	Project: Sringville Sewer Plant Upgrade	Location: Springville, Alabama	Project No.: GTX-318529
	Boring No.: B-9	Tested By: cag	Checked By: mcm
	Sample No.: ---	Test Date: 1/31/24	Depth: 24-26 ft
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, reddish yellow clay		
	Remarks: System G, Swell Pressure = 0.0689 tsf		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report





GeoTesting EXPRESS	Project: Sringville Sewer Plant Upgrade	Location: Springville, Alabama	Project No.: GTX-318529
	Boring No.: B-9	Tested By: cag	Checked By: mcm
	Sample No.: ---	Test Date: 1/31/24	Depth: 24-26 ft
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, reddish yellow clay		
	Remarks: System G, Swell Pressure = 0.0689 tsf		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter: 2.50 in	Estimated Specific Gravity: 2.78	Liquid Limit: 95
Initial Height: 1.00 in	Initial Void Ratio: 1.1	Plastic Limit: 32
Final Height: 0.94 in	Final Void Ratio: 0.987	Plasticity Index: 63

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	GA0178	RING	Sys G	GA0195
Mass Container, gm	8.37	108.03	108.03	8.35
Mass Container + Wet Soil, gm	174.74	254.81	252.03	152.25
Mass Container + Dry Soil, gm	129.08	214.26	214.26	114.51
Mass Dry Soil, gm	120.71	106.23	106.23	106.16
Water Content, %	37.83	38.17	35.55	35.55
Void Ratio	---	1.10	0.99	---
Degree of Saturation, %	---	96.10	100.00	---
Dry Unit Weight, pcf	---	82.446	87.245	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

GeoTesting EXPRESS	Project: Sringville Sewer Plant Upgrade	Location: Springville, Alabama	Project No.: GTX-318529
	Boring No.: B-9	Tested By: cag	Checked By: mcm
	Sample No.: ---	Test Date: 1/31/24	Depth: 24-26 ft
	Test No.: IP-1	Sample Type: intact	Elevation: ---
	Description: Moist, reddish yellow clay		
	Remarks: System G, Swell Pressure = 0.0689 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method B

Square Root of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/s	Mv 1/tsf	k cm/s
1	0.0689	0.003512	1.10	0.351	1.865	1.31e-05	5.10e-02	6.36e-07
2	0.125	0.004670	1.09	0.467	71.219	3.42e-07	2.06e-02	6.71e-09
3	0.250	0.01153	1.08	1.15	6.179	3.91e-06	5.49e-02	2.04e-07
4	0.500	0.01702	1.07	1.70	13.260	1.80e-06	2.20e-02	3.76e-08
5	1.00	0.02325	1.05	2.32	11.028	2.14e-06	1.25e-02	2.53e-08
6	2.00	0.03877	1.02	3.88	17.361	1.33e-06	1.55e-02	1.96e-08
7	4.00	0.05939	0.978	5.94	15.100	1.47e-06	1.03e-02	1.44e-08
8	1.00	0.05209	0.993	5.21	15.627	1.40e-06	2.43e-03	3.24e-09
9	0.250	0.04328	1.01	4.33	39.369	5.65e-07	1.17e-02	6.32e-09
10	0.500	0.04364	1.01	4.36	48.911	4.59e-07	1.40e-03	6.12e-10
11	1.00	0.04543	1.01	4.54	24.217	9.25e-07	3.59e-03	3.16e-09
12	2.00	0.05083	0.996	5.08	10.841	2.05e-06	5.40e-03	1.05e-08
13	4.00	0.06173	0.973	6.17	10.841	2.02e-06	5.45e-03	1.04e-08
14	8.00	0.08717	0.920	8.72	21.842	9.62e-07	6.36e-03	5.82e-09
15	16.0	0.1234	0.844	12.3	22.810	8.61e-07	4.52e-03	3.71e-09
16	32.0	0.1672	0.751	16.7	26.249	6.83e-07	2.74e-03	1.78e-09
17	8.00	0.1475	0.793	14.8	14.570	1.20e-06	8.19e-04	9.32e-10
18	2.00	0.1224	0.846	12.2	46.550	3.94e-07	4.19e-03	1.57e-09
19	0.500	0.1026	0.887	10.3	100.806	1.92e-07	1.32e-02	2.41e-09
20	0.125	0.09047	0.913	9.05	203.998	9.82e-08	3.23e-02	3.02e-09

GeoTesting EXPRESS

Project: Sringville Sewer Plant Upgrade	Location: Springville, Alabama	Project No.: GTX-318529
Boring No.: B-9	Tested By: cag	Checked By: mcm
Sample No.: ---	Test Date: 1/31/24	Depth: 24-26 ft
Test No.: IP-1	Sample Type: intact	Elevation: ---
Description: Moist, reddish yellow clay		
Remarks: System G, Swell Pressure = 0.0689 tsf		
Displacement at End of Increment		

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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November 7, 2024

City of Springville
P.O. Box 919
Springville, Alabama 35146

Attention: Mayor Dave Thomas

Reference: **Report of Subsurface Exploration and**
Geotechnical Engineering Evaluation – Addendum #1
Springville Sewer Plant Upgrade - CWSRF
Springville, Alabama
CDG Reference Number: R954719170

Dear Mayor Thomas:

CDG, Inc. (CDG) has completed an addendum to the geotechnical engineering evaluation for the proposed Sewer Plant Upgrade project in Springville, Alabama. The addendum was requested by Mr. Tripp Lindsey, PE (MBA Engineers, Inc.) to assist in structural design for the project. Specifically, the addendum addresses lateral earth pressures associated with cast-in-place retaining and basin walls.

Reinforced Concrete Retaining Walls

We understand that the proposed SBR basins will bear ±5 to ±14 feet below finished grades. Additionally, the headworks and associated lift station structure will bear 8+ feet below finished grades. Below-grade walls are assumed to be constructed of cast-in-place, reinforced concrete. Retaining walls that are restrained from moving should be designed for at-rest earth pressures. Walls that are free to rotate may be designed for active earth pressures.

The soil test boring and laboratory testing information indicates that the on-site materials contain between 69.7% and 95.2% fine grained particles (silt and clay). Fine grained soils are susceptible to frost action, hinder drainage, may create swell pressures, and generally exhibit relatively low strength parameters. Therefore, the on-site soils are generally not suitable for use as retaining wall backfill. We recommend walls be backfilled with off-site borrow consisting of open-graded, high-strength, granular material with less than 10% passing the #200 sieve (such as ASTM C-33 #57 coarse aggregate). Wall backfill should be placed and compacted in a wedge extending out from the base of the wall at a minimum 30° angle from vertical.

The wall backfill should be placed in a controlled manner and compacted in thin (8") lifts. Additionally, it is important that all debris and loose soil/rock be removed from behind the walls prior to backfilling. Good construction practice is essential when backfilling retaining walls. Inappropriate backfilling procedures can lead to excessive pressures against the wall and subsequent movements and/or settlement of the backfill material. Engineering verification and testing during backfilling of the wall will be important to ensure the backfill materials are suitable and properly compacted.

Retaining walls should be designed with a foundation drain and weep holes, as appropriate, to remove water from behind the walls. The following recommendations are based on the assumption that no hydrostatic pressure will act on the wall. Springs are common in the geologic formation present at the site. Additionally, groundwater was encountered in a piezometer at a depth of 27 feet below the existing ground surface. Therefore, the use of drains and free-draining backfill will be important to ensure no hydrostatic pressure is applied to the walls.

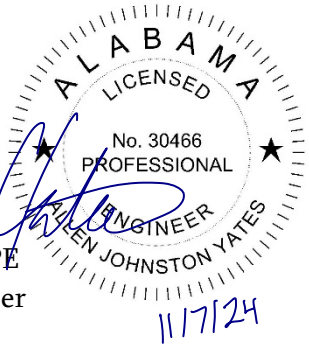
Provided the backfill is properly placed and compacted ASTM C-33 #57 coarse aggregate, the walls may be designed using an assumed internal angle of friction of 37°, cohesion of 0 psf, and a total unit weight of 105 pcf. The equivalent fluid pressures indicated in the following table are based on the values noted above, horizontal backfill, no hydrostatic pressure, and no surcharge load acting on the retained soils. **If hydrostatic pressures are expected to be encountered, the following values should be increased by 62.4 psf / foot wall height.**

Table 1 – Equivalent Fluid Pressures for CIP Retaining Walls

Earth Pressure Condition	Equivalent Fluid Pressure
At-Rest	42 psf / foot wall height
Active	27 psf / foot wall height

Respectfully Submitted,
CDG, Inc.

Tyler Lawrence, EI
Project Professional



Allen Yates, PE
Senior Engineer