

**PROJECT MANUAL**  
**FOR**  
**WASTEWATER TREATMENT PLANT**  
**IMPROVEMENTS**

**FUNDED BY**  
**ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT**  
**AMERICAN RECOVERY PLAN ACT (ARPA) DRINKING**  
**WATER/WASTEWATER PROJECT**  
**CS011038-01**

Prepared for:

**DEMOPOLIS WATER WORKS AND SEWER BOARD**  
**MARENGO COUNTY, ALABAMA**

Prepared by:



**October 2024**

PROJECT MANUAL

FOR

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**DEMOPOLIS WATER WORKS AND SEWER BOARD**

October 2024



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DEMOPOLIS WWTP IMPROVEMENTS (HW, RASWAS)  
CITY OF DEMOPOLIS  
MARENGO COUNTY, AL  
CLIENT JOB NO. R0011622272  
BASED ON CLIENT TEMPLATE: "CDG Engineers - No Proj Name.docx"

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10/15/2024

## DOCUMENT 00105

### INVITATION TO BID

Project: **Wastewater Treatment Plant Improvements  
ADEM ARPA Project No. CS011038-01**

Owner: Demopolis Water Works and Sewer Board

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 10:30 AM on the 13<sup>th</sup> day of November 2024. The bid opening will be held at the offices of the Demopolis Water Works and Sewer Board located at 103 E. Capitol Street, Demopolis, Alabama 36732.

A mandatory Pre-bid Meeting will be held at 10:30 AM on the 30<sup>th</sup> day of October 2024. Pre-bid Meeting will be held at the offices of the Demopolis Water Works and Sewer Board located at 103 E. Capitol Street, Demopolis, Alabama 36732.

The Project is generally described as follows: Construction of improvements to existing wastewater treatment plant including upgrades to existing screening equipment, upgrades to existing grit removal equipment, construction of a new clarifier, modifications to the existing leachate storage tank, site piping and valving modifications, upgrades to the facility's SCADA system, and general site improvements.

The Owner requires the Project to be completed in **330** 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 bidders must comply with the President's Executive Order Number 11246 which prohibits discrimination in employment regarding race, creed, color, sex or national origin. All bidders must comply with title VI of the Civil Rights Act of 1964, the Davis-Bacon Act, the Anti-Kickback Act and the Contract Workhours Act. The attention of bidders is particularly called to the requirements as to conditions of employment to be observed, minimum wage rates to be paid under the Contract, and compliance with Disadvantaged Business Enterprise (DBE) requirements.**

The Owner reserves the right to waive any informality or to reject any or all bids, and to award the contract to the lowest and most responsible bidder. All bidders must comply with the requirements of the Contractor's Licensing Law of the State of Alabama and be certified for the type of work on which the proposal is submitted. Each bidder must deposit with his bid, security in the amount, form, and subject to the conditions provided in the Information for Bidders.

**All Contractors preparing Bids for the referenced project shall submit a list of similar projects (successfully completed) in the last two years, having the same scope of work with construction cost similar to or greater than this project to be included with their bid. All nonresident contractors preparing bids shall submit with the bid documents evidence of a current Alabama General Contractor's License, evidence (with original seal of the State of Alabama) of proper registration with the Alabama Secretary of State as a foreign corporation, and a Certificate of Good Standing as a Foreign Corporation from the State of Alabama Department of Revenue. Bids submitted by a non-resident contractor without these documents included will be rejected.**

No bidder may withdraw his bid within sixty (60) days after the opening thereof. Bids may be held by the Owner for a period not to exceed sixty (60) days from the date of opening of bids for the purpose of reviewing the bids and investigating the qualifications of the bidders prior to awarding the contract. This project is being funded by local funds.

**All bids must be submitted in a separate sealed envelope bearing on the outside the name of the Bidder, Bidder's license number, address, and name of the project: "Wastewater Treatment Plant Improvements ADEM ARPA Project No. CS011038-01." Envelopes containing bids must be addressed as follows and delivered to: Chairman Jay Reynolds, Demopolis Water Works and Sewer Board, 103 E. Capitol Street, Demopolis, Alabama 36732**

**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.**

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

- 1. Demopolis Water Works and Sewer Board**
- 2. CDG, Inc.**

**See Section 00700 - General Conditions for full details.**

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

Demopolis Water Works and Sewer Board

per:

Jay Reynolds  
Chairman

enclosures

END OF DOCUMENT

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):

Demopolis Water Works and Sewer Board  
103 E. Capitol Street  
Demopolis, Alabama 36732

**BID**

BID DUE DATE: \_\_\_\_\_

PROJECT (Brief Description Including Location):

Wastewater Treatment Plant Improvements ADEM ARPA Project No. CS011038-01  
Demopolis, 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: Demopolis Water Works and Sewer Board

Project: Wastewater Treatment Plant Improvements ADEM ARPA Project No. CS011038-01

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 thirty (330)** 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**  
**Wastewater Treatment Plant Improvements ADEM ARPA CS011038-01**  
**Demopolis Water Works and Sewer Board**

**BASE BID**

NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	EXTENSION PRICE
1.	Mobilization	LS	1	\$	\$
2.	Erosion Control, Grassing and Restoration	LS	1	\$	\$
3.	Screening System Upgrades	LS	1	\$	\$
4.	Grit Removal System Upgrades	LS	1	\$	\$
5.	Clarifier Equipment	LS	1	\$	\$
6.	RAS and WAS Pumping Equipment	LS	1	\$	\$
7.	SCADA Upgrades and Integration by CSI	LS	1	\$ 71,522.39	\$ 71,522.39
8.	Potable Water Meter Installation	LS	1	\$	\$
<b>TOTAL BASE BID:</b>					\$

**ADDITIVE ALTERNATE**

NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL PRICE
1.	Leachate Tank Upgrades	LS	1	\$	\$
2.	Headworks Bypass to Lagoon Valve Automation	LS	1	\$	\$
3.	Existing Clarifier 1 and 2 WAS Valve Replacement	LS	1	\$	\$
4.	Influent Flow Meter Replacement	LS	1	\$	\$

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 **Demopolis Water Works and Sewer Board** (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: **WASTEWATER TREATMENT PLANT IMPROVEMENTS ADEM ARPA PROJECT NO. CS011038-01**

**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 thirty (330) 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 **three hundred and sixty (360) 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 10<sup>th</sup> 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:

**Demopolis Water Works and Sewer Board**

By: \_\_\_\_\_

By: \_\_\_\_\_

[CORPORATE SEAL]

[CORPORATE SEAL]

Attest \_\_\_\_\_

Attest \_\_\_\_\_

Address for giving notices:

Address for giving notices:

103 E. Capitol Street

\_\_\_\_\_

Demopolis, Alabama 36732

\_\_\_\_\_

(334) 289-3328

\_\_\_\_\_

END OF DOCUMENT

**DOCUMENT 00510**  
**NOTICE OF AWARD**

Dated \_\_\_\_\_

TO \_\_\_\_\_  
(BIDDER)

ADDRESS: \_\_\_\_\_

**PROJECT: WASTEWATER TREATMENT PLANT IMPROVEMENTS ADEM ARPA PROJECT**  
**NO. CS011308-04**

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.

Demopolis Water Works and Sewer Board

By: \_\_\_\_\_  
Jay Reynolds, Chairman

Accepted By:

\_\_\_\_\_  
(Contractor)

\_\_\_\_\_  
(Authorized Signature)

\_\_\_\_\_  
(Title)

END OF DOCUMENT

**DOCUMENT 00520**

**NOTICE TO PROCEED**

DATE: \_\_\_\_\_

TO: \_\_\_\_\_  
(CONTRACTOR)

ADDRESS: \_\_\_\_\_

\_\_\_\_\_

Project: **Wastewater Treatment Plant Improvements**

ADEM ARPA Project No. CS011038-01

Project No. R001622272

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)

\_\_\_\_\_

Demopolis Water Works and Sewer Board  
(OWNER)

By: \_\_\_\_\_  
Jay Reynolds

Chairman  
(TITLE)

Accepted By: \_\_\_\_\_  
(Contractor)

\_\_\_\_\_  
(Authorized Signature)

\_\_\_\_\_  
(Title)

END OF DOCUMENT

**DOCUMENT 00530**

**CERTIFICATION BY OWNER**

I, the undersigned, Jay Reynolds, the duly authorized and acting official representative Demopolis Water Works and Sewer Board 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

Chairman  
\_\_\_\_\_  
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):

Demopolis Water Works and Sewer Board  
103 E. Capitol Street  
Demopolis, Alabama 36732

**CONTRACT**

Date:

Amount: \$

Description (Name and Location): **Wastewater Treatment Plant Improvements ADEM ARPA Project No. CS011038-01  
Demopolis, 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 liability, 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 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):

Demopolis Water Works and Sewer Board  
103 E. Capitol Street  
Demopolis, Alabama 36732

**CONTRACT**

Date:

Amount:

Description (Name and Location): **Wastewater Treatment Plant Improvements ADEM ARPA CS011038-01  
Demopolis, 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 thereto.

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**

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# **GENERAL CONDITIONS**

## ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

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### 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 paragraph 11.01A

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

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### 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

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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

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### 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

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### 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 for 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

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#### 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

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#### 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

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#### 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

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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

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### 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

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### 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, expeditors, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the Site or in CONTRACTOR's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.01.A.1 or specifically covered by paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the CONTRACTOR's fee.

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

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

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

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

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

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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

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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

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### 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

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#### 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

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### 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

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### 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

**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

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## Supplemental General Conditions for SRF Assisted

Public Drinking Water and Wastewater  
Facilities Construction Contracts



SRF Project Number: CS011038-01

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## 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 30<sup>th</sup>, i.e. by November 30<sup>th</sup>**). 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 demonstrate compliance 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.

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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.

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## 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@birminghamal.gov](mailto:Monique.shorts@birminghamal.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 5<sup>th</sup> Street NW,  
Suite 300  
Atlanta, Georgia 30308  
Ph: (404) 894-2096  
<http://www.mbd.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 37<sup>th</sup> Street South  
Birmingham, Alabama  
35222  
Ph: (205) 324-6202  
[aorl@bcia1.org](mailto:aorl@bcia1.org)  
[kbaylorbivins@bcia1.org](mailto: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](mailto:laketa.ross@adem.alabama.gov) OR Diane Lockwood (DBE Coordinator) at (334) 271-7815 or [dpl@adem.alabama.gov](mailto: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: \_\_\_\_\_ SRF Loan (Project) Number: \_\_\_\_\_

### **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.*

\_\_\_\_\_  
(Proposed Prime Contractor Signature) Date \_\_\_\_\_

\_\_\_\_\_  
(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.)**

\_\_\_\_\_  
(Signature of Loan Recipient (Owner)) Date \_\_\_\_\_

**OR\*\***

\_\_\_\_\_  
(Loan Recipient's (Owner's) Representative's Signature, (P.E.)) Date \_\_\_\_\_

\_\_\_\_\_  
(Printed Name and Title)

### **GENERAL INFORMATION:**

Loan Recipient (Owner) Contact: \_\_\_\_\_

Loan Recipient (Owner) Phone Number/Email: \_\_\_\_\_

Consulting Engineer Contact: \_\_\_\_\_

Consulting Engineer Phone Number/Email: \_\_\_\_\_

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.



# VIII - EPA Form 6100-2 DBE Subcontractor Participation Form



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<sup>1</sup> subcontractor<sup>2</sup> 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	
Bid/ Proposal No.	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

<sup>1</sup> 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.

<sup>2</sup> 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)**

VIII - EPA Form 6100-2 DBE Subcontractor Participation Form



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:

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<b>Subcontractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

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.

# IX - EPA Form 6100-3 DBE Subcontractor Performance Form



OMB Control No: 2090-0030

## Disadvantaged Business Enterprise (DBE) Program DBE Subcontractor Performance Form

This form is intended to capture the DBE<sup>1</sup> subcontractor's<sup>2</sup> 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	
Bid/ Proposal No.	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: <input type="radio"/> DOT <input type="radio"/> SBA <input type="radio"/> Other: _____		Meets/ exceeds EPA certification standards? <input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> Unknown

<sup>1</sup> 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.

<sup>2</sup> 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.

# IX - EPA Form 6100-3 DBE Subcontractor Performance Form



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).

<b>Prime Contractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

<b>Subcontractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

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.

# X - EPA Form 6100-4 DBE Subcontractor Utilization Form



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<sup>1</sup> subcontractors<sup>2</sup> 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	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Issuing/Funding Entity:			

I have identified potential DBE certified subcontractors	<input type="radio"/> YES	<input checked="" type="radio"/> 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

<sup>1</sup> 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.

<sup>2</sup> 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)**

X - EPA Form 6100-4 DBE Subcontractor Utilization Form



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).

<b>Prime Contractor Signature</b>	<b>Print Name</b>
<b>Title</b>	<b>Date</b>

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.



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

<b>PART I OF II (PAGES SGC-16 &amp; SGC-17)</b>
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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) 20_____	1B. REPORT TYPE <input type="checkbox"/> Annual <input type="checkbox"/> Last Report (Project completed)																		
1C. REVISION OF A PRIOR YEAR REPORT? <input type="radio"/> No <input type="radio"/> 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: \$ _____ <input type="checkbox"/> 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), <b>CHECK and SKIP to Block No. 7.</b> (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.) <input type="checkbox"/>																		
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 <input type="radio"/> No <input type="radio"/> Were contracts issued under this assistance agreement?  Yes <input type="radio"/> No <input type="radio"/>																			
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.) <table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 15%;">Construction</th> <th style="width: 15%;">Equipment</th> <th style="width: 15%;">Services</th> <th style="width: 15%;">Supplies</th> <th style="width: 15%;">Total</th> </tr> </thead> <tbody> <tr> <td>\$MBE:</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> <td align="right">0.00</td> </tr> <tr> <td>\$WBE:</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> <td align="right">0.00</td> </tr> </tbody> </table>			Construction	Equipment	Services	Supplies	Total	\$MBE:	_____	_____	_____	_____	0.00	\$WBE:	_____	_____	_____	_____	0.00
	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](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 Recipient	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
	Sub-Recipient and/or SRF Loan Recipient	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 30<sup>th</sup> 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](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 1 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: \_\_\_\_\_ Loan (Project) Number: \_\_\_\_\_

### 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.*

\_\_\_\_\_  
(Prime Contractor Signature) Date \_\_\_\_\_

\_\_\_\_\_  
(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.)*

\_\_\_\_\_  
(Signature of Loan Recipient (Owner)) Date \_\_\_\_\_

**OR\***

\_\_\_\_\_  
(Loan Recipient's (Owner's) Representative's Signature, (P.E.)) Date \_\_\_\_\_

\_\_\_\_\_  
(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\*:

(\*not **Contract** Name)

\_\_\_\_\_

SRF Project No.:

\_\_\_\_\_

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](mailto: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](http://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](http://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](http://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](http://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 be 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 that 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: AL20240070 05/31/2024

Superseded General Decision Number: AL20230070

State: Alabama

Construction Type: Heavy  
Including Water and Sewer Line Construction

Counties: Choctaw, Clarke, Conecuh, Escambia, Marengo,  
Monroe, Perry, Sumter, Washington and Wilcox Counties in Alabama.

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:	<ul style="list-style-type: none"><li>. Executive Order 14026 generally applies to the contract.</li><li>. 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.</li></ul>
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:	<ul style="list-style-type: none"><li>. Executive Order 13658 generally applies to the contract.</li><li>. 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.</li></ul>

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
1	05/31/2024

\* ENGI0312-010 09/01/2023

PERRY and SUMTER COUNTY

	Rates	Fringes
Operating Engineers:		
Crane and Cherry Picker.....	\$ 31.52	13.98
Oiler.....	\$ 28.45	13.98

Cranes with 100 ft. or more boom receive \$0.25 extra per hour,  
 Cranes with 200 ft. or more boom receive \$0.50 extra per hour,  
 Cranes with 350 ft. or more boom receive \$1.10 extra per hour,  
 Cranes with 500 ft. or more boom receive \$1.45 extra per hour,  
 Tower Cranes, Derricks, Climbing Cranes, Ringer Cranes shall  
 receive \$0.35 in addition to A-rate and boom pay per hour

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\* ENGI0653-007 10/01/2023

CHOCTAW, CLARKE, CONECHU, ESCAMBIA, MARENGO, MONROE,  
WASHINGTON, and WILCOX COUNTIES

	Rates	Fringes
Operating Engineers:		
Crane (Conventional & Hydraulic 100 to 400 Tons), and Tower Cranes.....	\$ 32.75	20.55
Crane (Conventional & Hydraulic up to 100 Tons), and Derrick (Stationary Crane with 2 or more drums).\$	29.90	20.55
Cranes with 350 feet or more boom and/or 400 to 600 ton capacity.....	\$ 33.85	20.55
Cranes with 500 feet Boom and/or 600 ton capacity.....	\$ 34.20	20.55
Oiler.....	\$ 28.95	20.55

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\* SUAL2007-155 11/28/2007

	Rates	Fringes
BOILERMAKER.....	\$ 21.85	9.24
ELECTRICIAN.....	\$ 15.24 **	2.50
LABORER: Common or General.....	\$ 7.63 **	0.00
LABORER: Pipelayer.....	\$ 9.96 **	0.00
OPERATOR: Backhoe.....	\$ 12.00 **	0.00
OPERATOR: Bulldozer.....	\$ 18.89	0.00
OPERATOR: Drill.....	\$ 9.50 **	2.36
OPERATOR: Grader/Blade.....	\$ 12.59 **	1.33
OPERATOR: Loader (Front End)....	\$ 11.67 **	0.00
OPERATOR: Roller.....	\$ 9.45 **	0.00

OPERATOR: Scraper.....	\$ 9.78 **	0.18
OPERATOR: Trackhoe.....	\$ 12.00 **	0.00
TRUCK DRIVER.....	\$ 10.65 **	1.36

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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)).

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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.

#### State Adopted Rate Identifiers

Classifications listed under the "SA" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R. 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the SA identifier took effect under state law in the state from which the rates were adopted.

-----  
WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

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

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

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

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

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

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

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

=====  
END OF GENERAL DECISION"

## 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 \_\_\_\_\_, 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 – Build America, Buy America (BABA) Requirement

Comply with all federal requirements applicable to the assistance received (including those imposed by the Infrastructure Investment and Jobs Act (“IIJA”), Public Law No. 117-58) which the Participant understands includes, but is not limited to, the following requirements: that all of the iron and steel, manufactured products, and construction materials used in the Project are to be produced in the United States (“Build America, Buy America Requirements”) unless (i) the Participant has requested and obtained a waiver from the cognizant Agency[1] pertaining to the Project or the Project is otherwise covered by a general applicability waiver; or (ii) all of the contributing Agencies have otherwise advised the Participant in writing that the Build America, Buy America Requirements are not applicable to the Project. Comply with all record keeping and reporting requirements under all applicable legal authorities, including any reports required by the funding authority (such as EPA and/or a state), such as performance indicators of program deliverables, information on costs and project progress. The Participant 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 applicable legal requirements and this Agreement may result in a default hereunder that results in a repayment of the assistance agreement in advance of the maturity of the Bonds, termination and/or repayment of grants, cooperative agreements, direct assistance or other types of financial assistance, and/or other remedial actions.




ALL CONSTRUCTION CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE BABA REQUIREMENTS. 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 \_\_\_\_\_ (“Owner”) and the \_\_\_\_\_ (the “Funding Authority”) that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as “Build America, Buy America;” that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States (“Build America, Buy America Requirements”) including iron and steel, manufactured products, and construction materials provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements 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 Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Owner or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part,



from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding 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 Funding Authority.




XVII – Project Sign Detail - CWSRF

 <p><b>ADEM</b> Alabama Department of Environmental Management</p>	<p><b>STATE OF ALABAMA</b> Honorable (name), Governor</p>	
<p><b>ALABAMA WATER POLLUTION CONTROL AUTHORITY</b> <b>POLLUTION CONTROL PROJECT</b></p>		
<p>(NAME OF OWNER) <b>(NAME OF PROJECT)</b></p>		
<p>\$(Project/Contract Amount) STATE REVOLVING FUND LOAN</p>		
<p>(NAME OF CONTRACTOR) • CONTRACTOR (NAME OF ENGINEER) • CONSULTING ENGINEER</p>		
<p>ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT U.S. ENVIRONMENTAL PROTECTION AGENCY</p>		
		

[Two vertical rectangular posts are shown below the sign area, representing the support structure.]

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

 <b>ADEM</b> Alabama Department of Environmental Management	<b>STATE OF ALABAMA</b> Honorable (Name), Governor	
<b>ALABAMA DRINKING WATER FINANCE AUTHORITY INFRASTRUCTURE PROJECT</b>		
(NAME OF OWNER) <b>(PROJECT OR CONTRACT NAME)</b>		
\$(Project/Contract Amount) STATE REVOLVING FUND LOAN		
(NAME OF CONTRACTOR) • CONTRACTOR (NAME OF ENGINEER) • CONSULTING ENGINEER		
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT U.S. ENVIRONMENTAL PROTECTION AGENCY		

| |

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

- K. The Recipient agrees to abide by the State of Alabama requirements for audits and access of records. The Recipient agrees that the Director of ADEM or any of his/her duly authorized representatives, and the Chief Examiner of the Department of Examiners of Public Accounts and any of his/her duly authorized representatives shall, until the expiration of five (5) years from the date of submission of the final report, have access to and the right to audit, examine, and make excerpts or transcripts from any directly pertinent books, documents, papers, and records of the Recipient involving this Agreement. The Recipient agrees to provide access to any or all documents, papers, records and directly pertinent books of the Recipient involving transaction related to this Agreement upon written request from ADEM.
- L. The Recipient is responsible for reporting and making payment of any applicable federal and state taxes which may be due as a result of payments received pursuant to this Agreement.
- M. Any publications produced with funds from this award must display the following language: "This project [is being] [was] supported, in whole or in part, by federal award number SLFRP2635 awarded to the State of Alabama by the U.S. Department of the Treasury."
- O. The recipient must construct a project sign that meets the following requirements:
- (a) Sign is to be constructed of ½" MDO plywood or similar material, 4' x 8'.
  - (b) Paint with two (2) coats of enamel paint (or equivalent) prior to lettering.
  - (c) Background color white, lettering black.
  - (d) Lettering may be painted or vinyl. All lettering sizes to be proportionate to sign layout.
  - (e) Sign shall be attached to 4" x 4" x 8' treated posts.
  - (f) Sign shall be placed in prominent location near the project area, easily readable from existing street or roadway.
  - (g) Sign shall be maintained in good condition until completion of project.
  - (h) Sign shall follow the format below and include the following information only:

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

<b>ADEM</b> Alabama Department of Environmental Management	SRF Project Review and Cost Summary	Form Revised 07-2021
<p>This form is to be completed and submitted (with supporting documentation) to the SRF Section <u>within 14 days after bid opening</u>. 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 (<b>with the SRF Project Manager in attendance</b>). <u>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.</u></p>		
Loan Recipient: _____ Project Number: _____		
Project Name: _____		
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. <b><u>DBE Documentation from the loan recipient (owner) and the prime contractor.</u></b> 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 <i>SRF Supplemental General Conditions</i> 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: _____ _____		

## Infrastructure Investment and Jobs Act (IIJA) “BIL” Signage Required Term and Condition

*This Term & Condition applies to construction projects funded in whole or in part by the Infrastructure Investment and Jobs Act (IIJA) for the following programs: Clean Water State Revolving Fund (CWSRF), Drinking Water State Revolving Fund (DWSRF).*

The recipient shall comply with the requirements for signage as outlined below and in the Infrastructure Investment and Jobs Act (IIJA) guidance. The IIJA sign should be constructed in addition to the State Revolving Fund sign outlined in the Supplemental General Conditions.

### 1. Signage Requirements

- a. Building A Better America Emblem: The recipient will ensure that a sign is placed at construction sites supported under this award displaying the official Building A Better America emblem and must identify the project as a “project funded by President Biden’s Bipartisan Infrastructure Law.” Construction is defined at 40 CFR 33.103 as “erection, alteration, or repair (including dredging, excavating, and painting) of buildings, structures, or other improvements to real property, and activities in response to a release or a threat of a release of a hazardous substance into the environment, or activities to prevent the introduction of a hazardous substance into a water supply.” The sign must be placed at construction sites in an easily visible location that can be directly linked to the work taking place and must be maintained in good condition throughout the construction period.

The recipient will ensure compliance with the guidelines and design specifications for using the official Building A Better America emblem and corresponding logomark available at: <https://www.whitehouse.gov/wp-content/uploads/2022/08/Building-A-Better-America-Brand-Guide.pdf>

- b. EPA Logo: The recipient will ensure that signage displays the EPA logo along with the official Building A Better America emblem. The EPA logo must not be displayed in a manner that implies that EPA itself is conducting the project. Instead, the EPA logo must be accompanied with a statement indicating that the recipient received financial assistance from EPA for the project.

The recipient will ensure compliance with the sign specifications provided by the EPA Office of Public Affairs (OPA) available at: <https://www.epa.gov/grants/epa-logo-seal-specifications-signage-produced-epa-assistance-agreement-recipients>. As provided in the sign specifications from OPA, the EPA logo is the preferred identifier for assistance agreement projects and use of the EPA seal requires prior approval from the EPA. To obtain the appropriate EPA logo or seal graphic file, the recipient should send a request directly to OPA and include the EPA Project Officer in the communication. Instructions for contacting OPA is available on the [Using the EPA Seal and Logo page](#).



- c. Procuring Signs: Consistent with section 6002 of RCRA, 42 U.S.C. 6962, and 2 CFR 200.323, recipients are encouraged to use recycled or recovered materials when procuring signs. Signage costs are considered an allowable cost under this assistance agreement provided that the costs associated with signage are reasonable. Additionally, to increase public awareness of projects serving communities where English is not the predominant language, recipients are encouraged to translate the language on signs (excluding the official Building A Better America emblem or EPA logo or seal) into the appropriate non-English language(s). The costs of such translation are allowable, provided the costs are reasonable.

## **2. Public or Media Events**

EPA encourages the recipient to notify the EPA Project Officer listed in this award document of public or media events publicizing the accomplishment of significant events related to construction projects as a result of this agreement and provide the opportunity for attendance and participation by federal representatives with at least ten (10) working days' notice.

## **Appendix A: Guidance Documentation**

===== PRESIDENT JOE BIDEN =====

# **BUILDING A BETTER AMERICA**

===== BUILD.GOV =====

**THE BIPARTISAN INFRASTRUCTURE LAW**

**Project Funding Source Sign Assembly**



# BUILDING A BETTER AMERICA SIGNAGE GUIDELINES

## Guidelines for Logo Applications

The purpose of this document is to provide general guidelines for signs displayed at project sites for projects funded under the Bipartisan Infrastructure Law, also known as the Infrastructure Investment and Jobs Act.

The first part of this document pertains to signs for projects funded under the Bipartisan Infrastructure Law that are not installed in the highway right-of-way. For highway signage guidance that is MUTCD compliant please see pages 10 and 11.

For all other signs please start here.

This document provides information about the Building A Better American logo mark as well as how logos, marks and seals of state, cities and counties can be incorporated into signage. Logos of contractors are not permitted on the signage. When logos are included in signage, the placement should conform to the brand guideline.




## Variations and Usage

There is one approved mark associated with the Building A Better America logo. To preserve the integrity of the Building A Better America logo mark, make sure to apply them correctly. Altering, distorting, or recreating the 'marks' in any way weakens the power of the image and what it represents.

Layout and design of signs and communication materials will vary, so care must be taken when applying the logo mark.



The colors, graphics and fonts used should conform to graphic standards.

COLOR	CMYK	RGB	HEX P	MS
 Blue	83,48,0,48	22 / 68 / 132	#164484	PMS7687C
 Red	0,100,81,0	255/0/49	#FF0031	PMS185C
 White	2,2,0, 3	242 /244/248	#F2F4F8	Bright White

# Logos

PROJECT FUNDED BY

# The Bipartisan Infrastructure Law

PROJECT FUNDED BY

# The Bipartisan Infrastructure Law



**U.S. Department  
of Transportation**

FTA

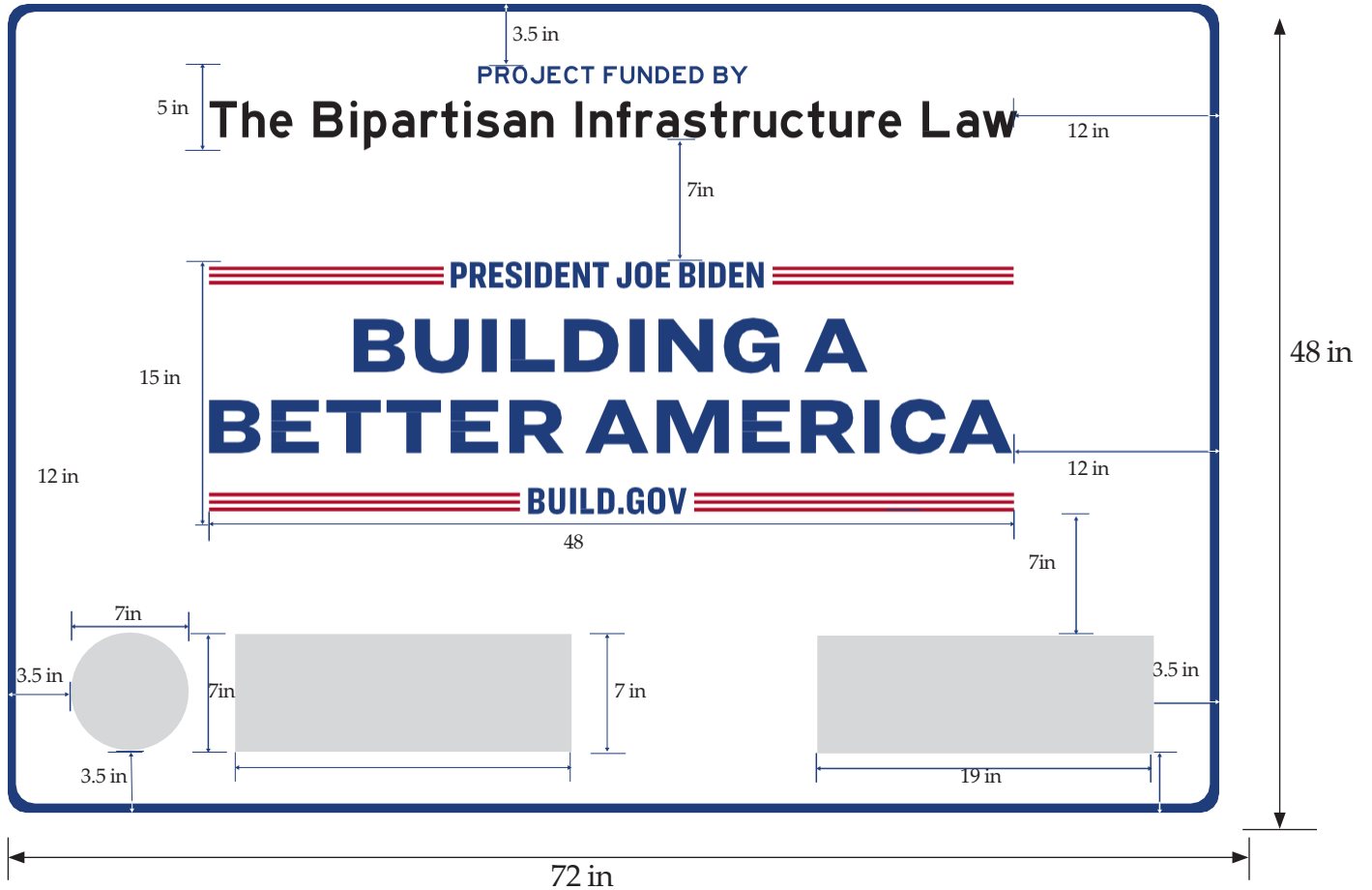


**U.S. Department  
of Transportation**

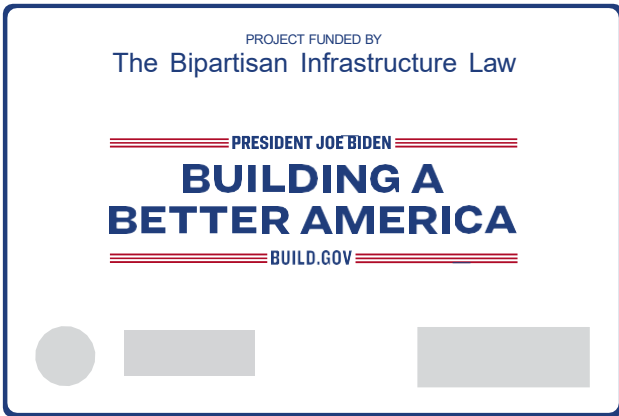
FTA



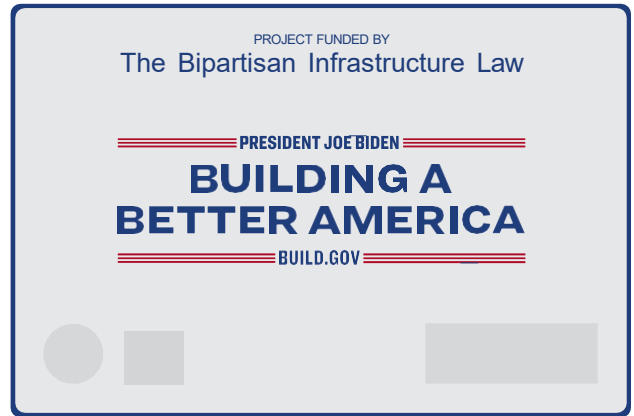
# Building A Better America General Guidelines for Logo Applications



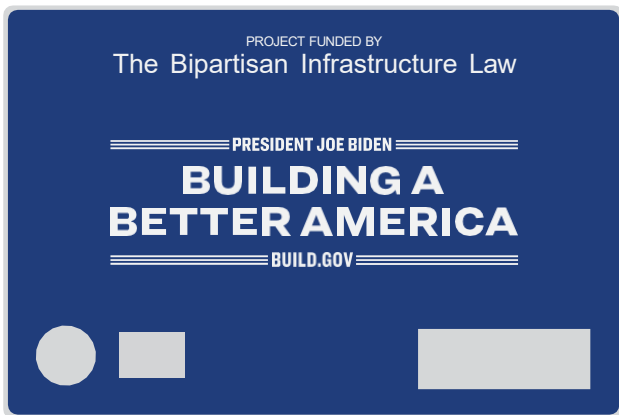
# Sign Colors \*



White \*

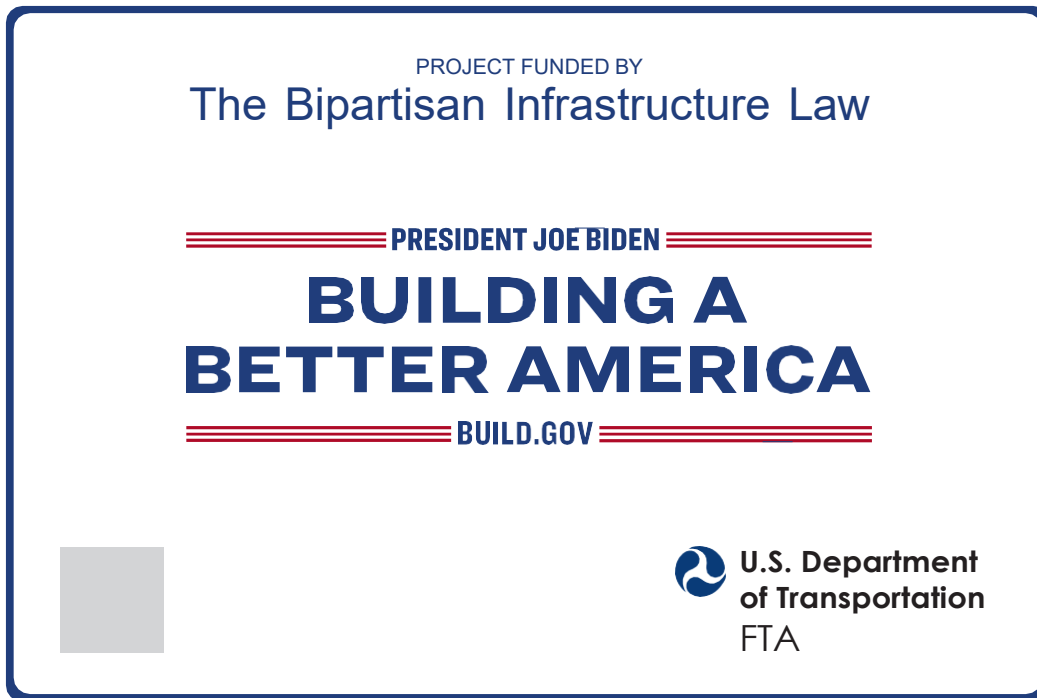


Gray

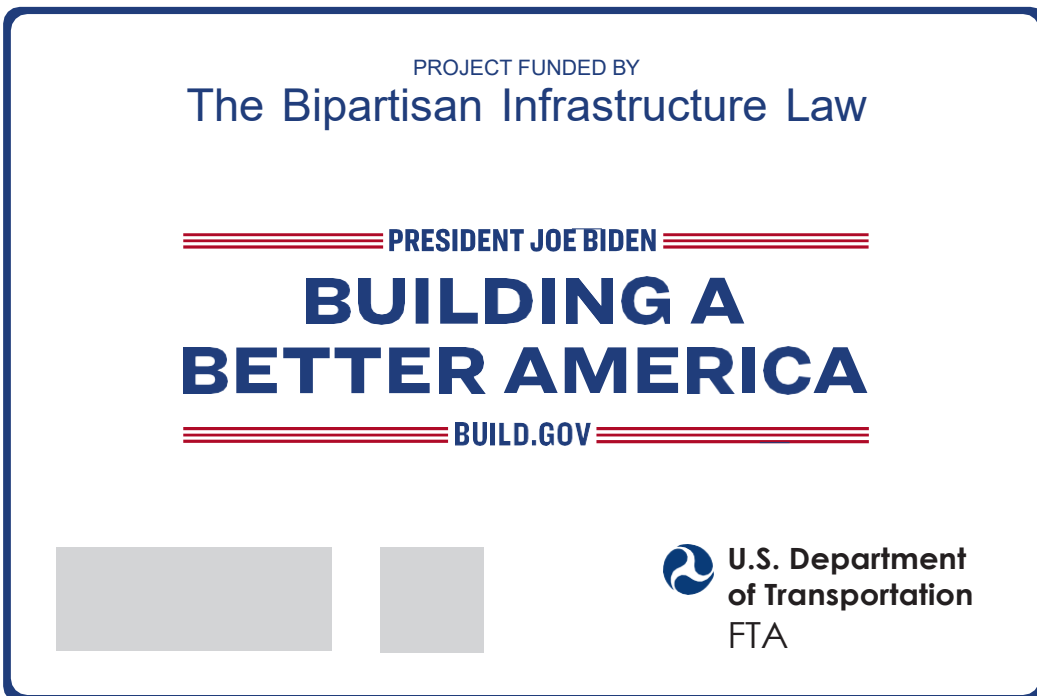


Blue

# State, City and County Logo Variations



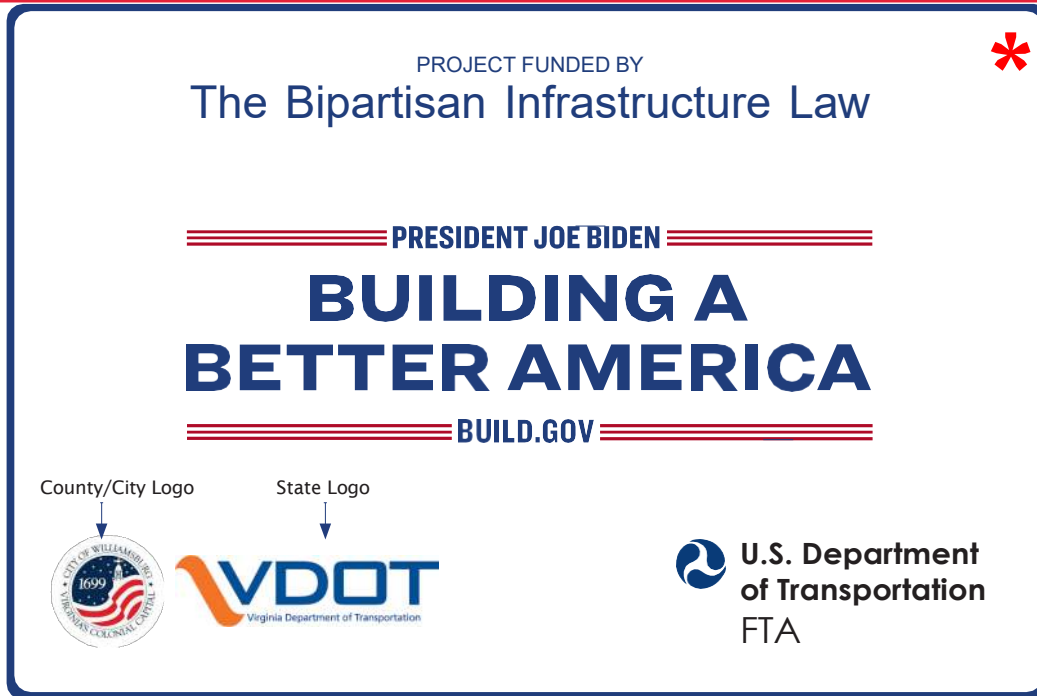
Square State Logo: 7X7 inches



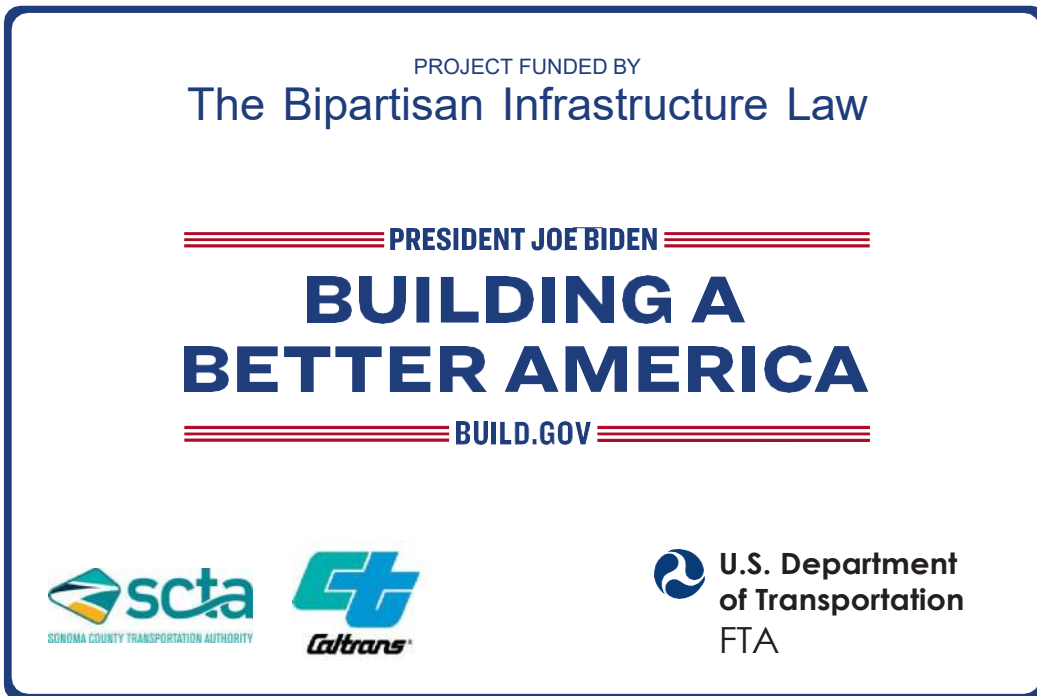
Rectangle State Logo: not to exceed 19 x 7 inches

# 3 Logos Samples \*

\* The 3-logo arrangement sign below is a general reference for all Alabama CWSRF and DWSRF (BIL Funded) Loan Projects. (Please see page 57 (last page) for an illustration of the selected Alabama BIL sign.)

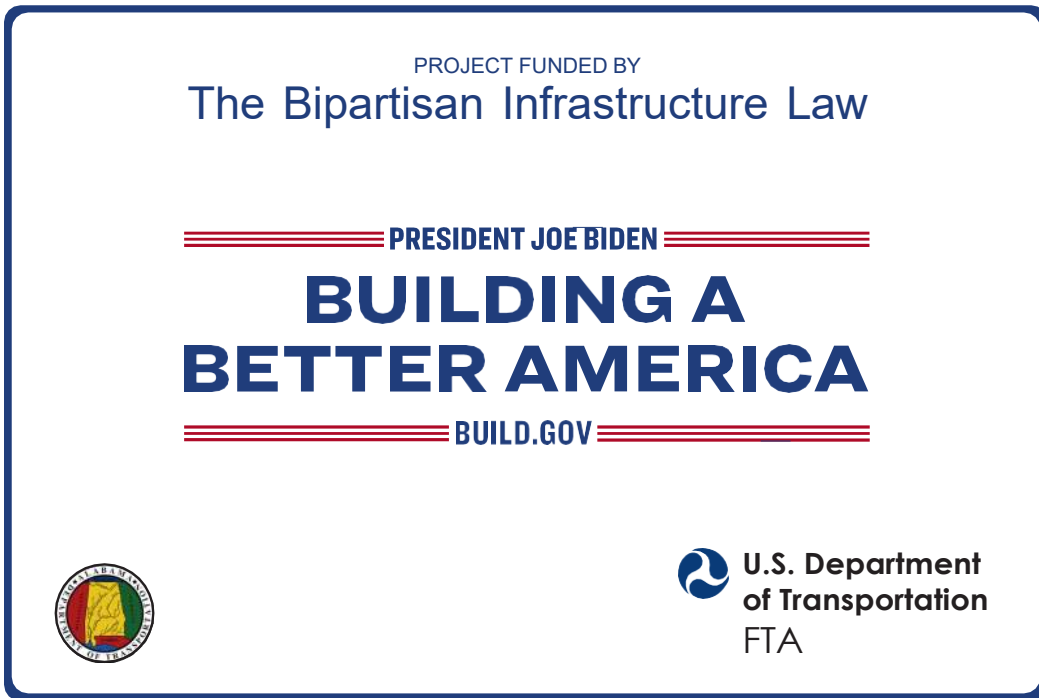


City Circle Logo 7 X 7 Inches. State Rectangle Logo should not exceed 19x7 inches

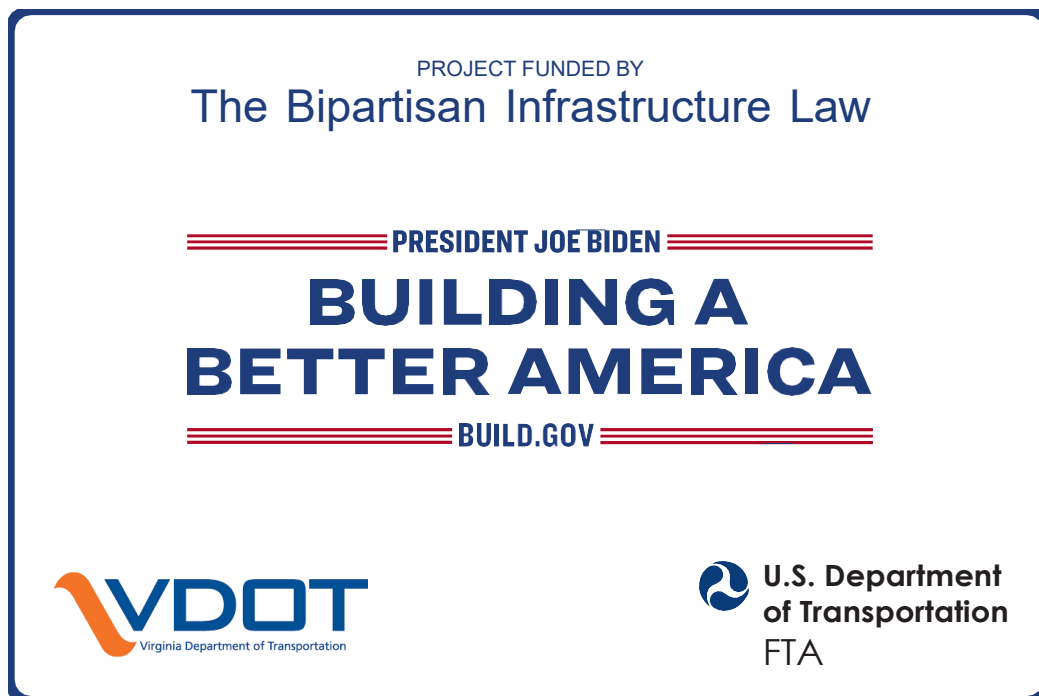


Rectangle State Logo: not to exceed 19 x 7 inches

## 2 Logos Samples



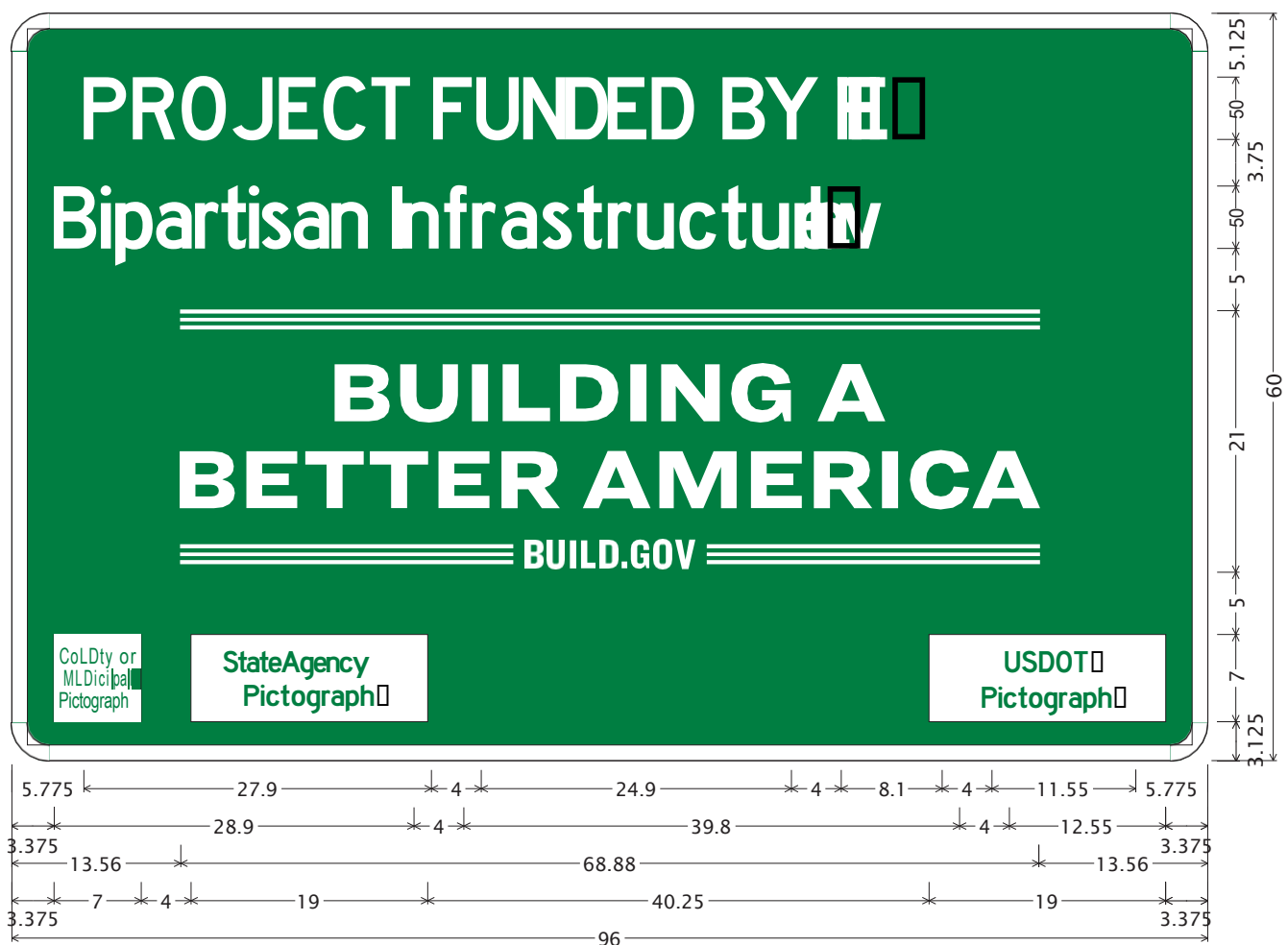
Circle State Logo: 7 x 7 inches



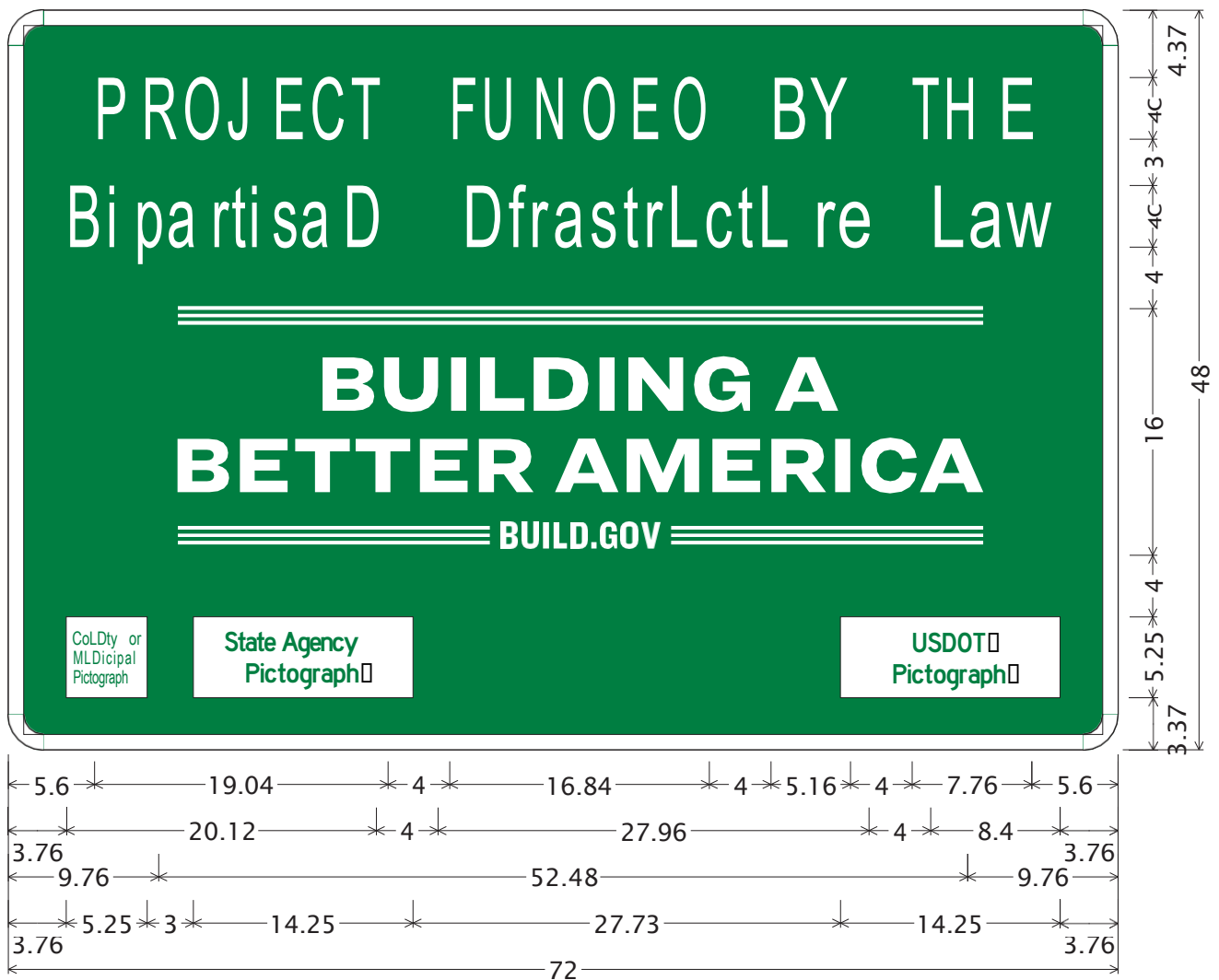
Circle State Logo: 7 x 7 inches

# RULES FOR HIGHWAY RIGHT OF WAY SIGNAGE

## Highway Right of Way Signage 8 Feet



# Highway Right of Way Signage 6 Feet



# EPA LOGO & SEAL SPECIFICATIONS FOR SIGNAGE PRODUCED BY EPA ASSISTANCE AGREEMENT RECIPIENTS

EPA's logo is a two-leaved flower, without stem, accompanied by the Agency's initials to the right. The EPA logo is the primary identifier for use on construction grant signage. Assistance agreement recipients are not required to receive EPA approval to use the EPA logo when used in accordance with the terms and conditions of their assistance agreement award.

The official seal of EPA is circular and is comprised of the two-leaved flower, with stem, encircled by the title UNITED STATES ENVIRONMENTAL PROTECTION AGENCY. The EPA seal may be used only when official comparable seals are used and the recipient has received prior written EPA approval.

It is important that the EPA logo and seal always be reproduced with consistent high quality. The seal and logo must remain intact and unchanged (for example, don't use the flower from the seal by itself). The logo and seal may only be displayed using either the standard color scheme or a single color that complements the background where it appears.

## COLOR AND SPACING

- The entire logo and seal must appear in black, gray, or any uniform color or knock out white on a dark background. The flower and text may not be different colors. The flower itself may not contain more than one color. The seal can be monotone or full color, based on the rest of the seals that it's placed with.
- The relationship between the flower portion of the logo and Helvetica type should never be shifted or adjusted.



## PREFERRED USE

Use the preferred presentation of the logo on products that do not have enough space for the full logo with text. It may also be used in the presence of other logos.



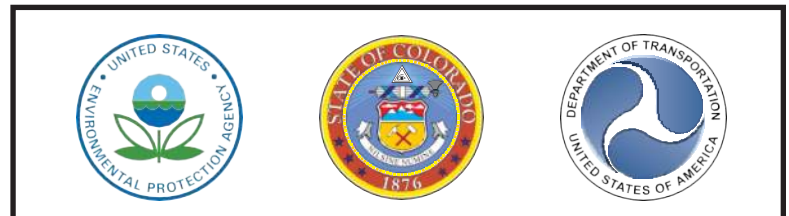
## SIZE AND LOGO WITH OTHER LOGOS

It's important that all parts of the EPA logo be readable. The EPA logo should not be reproduced at sizes any smaller than 1.0" height on a sign. There are no maximum size restrictions as long as the clear space requirements are met. The logo should be made the same relative size as the other logos on the signage.



## SIZE AND SEAL WITH OTHER SEALS

When there are multiple state or Federal seals/circular logos, the use of the EPA seal is appropriate with prior written EPA approval. The EPA seal should be the same size as the seals that accompany it and should be a minimum of 3 inches in height.



## IMPROPER LOGO USAGE





# AL BIL Sign Detail \*

\* This red, white and blue, 3-logo BIL sign (utilizing these required State of Alabama and Federal logos (as arranged and shown below)) should be erected on the project sites of all Alabama Clean Water and Drinking Water BIL Funded Projects alongside the SRF Project Sign.

PROJECT FUNDED BY  
The Bipartisan Infrastructure Law

==== PRESIDENT JOE BIDEN ====

**BUILDING A  
BETTER AMERICA**

==== BUILD.GOV ====



## 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 shall be Lump Sum.

- C. **Bid Item No. 3 – Screening System Upgrades:** Includes all labor, materials and equipment necessary to remove and properly dispose of existing climber screen, install new perforated plate screen with washer and compactor in accordance with Sections 11331 and 11332, and installation of slide gates as shown on the drawings and outlined in Section 11050. Work shall include cleaning of and modifications to the existing concrete channel and aluminum grating to support screen and washer/compactor installation and all ancillary piping and equipment required provide a complete and properly operating system. Payment shall be Lump Sum.
- D. **Bid Item No. 4 – Grit Removal System Upgrades:** Includes all labor, materials and equipment necessary to remove and properly dispose of existing travelling bridge grit removal equipment and install new grit removal and washing system in accordance with Section 11335 and packaged grit wash lift station in accordance with Section 11217. Work shall include cleaning of and modifications to the existing concrete structure and aluminum grating to support grit removal and washing system installation and all ancillary piping and equipment required provide a complete and properly operating grit removal system. Work shall also include precast concrete packaged lift station complete with two (2) submersible pumps, piping, valves, electrical and controls, concrete pad, excavation, dewatering, backfilling, final grading, cleanup, temporary utilities, testing and all appurtenances necessary to create a complete and properly operating system. Payment shall be Lump Sum.
- E. **Bid Item No. 5 – Clarifier Equipment:** Includes all labor, materials and equipment necessary to install clarifier equipment in accordance with Sections 11351 in concrete tankage with weirs and baffles in accordance with Section 11352. Also includes adding chlorine feed piping from existing chlorine building currently feeding Clarifiers 1 and 2, distribution piping in Clarifier 3 effluent weir to match existing setup in Clarifiers 1 and 2, and any required modifications to the existing chlorine feed system to facilitate the work. Work shall include site preparation including any fill material required to achieve specific grades and elevations shown in plans, grading, concrete tank, clarifier equipment, weirs and baffles and all ancillary piping and equipment required provide a complete and properly operating system. Payment shall be Lump Sum.
- F. **Bid Item No. 6 – RAS and WAS Pumping Equipment:** Includes all labor, materials and equipment necessary to install horizontal RAS and RAS pump equipment in accordance with Section 11215. Work shall include equipment pad, two (2) horizontal RAS pumps, two (2) horizontal WAS pumps, force main piping for recycle to the aeration basin, force main piping for wasting to the existing lagoon, duplex control panels, ancillary piping and equipment required provide complete and properly operating systems. Payment shall be Lump Sum.
- G. **Bid Item No. 7 – SCADA Upgrades and Integration by CSI:** The stated amount shall be included in the Base Bid and is associated with the cost that will be incurred by the Contractor for upgrading the HMI system at the WWTP and the main office as well as programming and control upgrades to monitor lagoon levels, correct effluent flow meter readings, integrate the controls associated with the proposed WAS/RAS pumps into the Owner’s existing SCADA system, and provide valving automation with actuators for RAS/WAS lines and the lagoon/headworks bypass lines by the Equipment Integrator.



Payment will be made at the contract lump sum price stated without markup. See Appendix B.

- H. **Bid Item No. 8 – Potable Water Meter Installation:** Includes all labor, materials, equipment, and incidentals necessary for the installation of one (1), 8-inch Neptune radio read potable water meter assembly. Work shall include new meter and properly sized meter box at the location shown on Sheet C-303. Payment shall be Lump Sum.
- I. 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.
- C. **Alternate No. 1 (Additive) – Leachate Tank Upgrades:** Includes all labor, materials and equipment necessary to core drill the inner wall in the leachate tank and provide spare transfer pump. Work shall include core drilling inner chamber wall of the leachate holding tank as shown on Sheet C-421 as well as providing one (1) Gorman Rupp T-Series self-priming centrifugal pump (Model T4A3-B, standard impeller) or compatible approved equal. Payment shall be Lump Sum.
- D. **Alternate No. 2 (Additive) – Headworks Bypass to Lagoon Valve Automation:** Includes all labor, materials and equipment necessary to provide two (2) automatic actuators in accordance with Section 11251 for existing 16-inch valves associated with the lagoon/headworks bypass lines as shown on Sheet C-422, ancillary piping and vaults, and all necessary equipment required provide a complete and properly operating system. Payment shall be Lump Sum.
- E. **Alternate No. 3 (Additive) – Existing Clarifier 1 and 2 WAS Valve Replacement:** Includes all labor, materials and equipment necessary to provide two (2) automatic actuators in accordance with Section 11251 and two (2) 12-inch valves associated with the existing WAS lines at existing Clarifiers 1 and 2 as shown on Sheet C-423, ancillary piping and doghouse access manholes, and all necessary equipment required provide a complete and properly operating system. Payment shall be Lump Sum.
- F. **Alternate No. 4 (Additive) – Influent Flow Meter Replacement:** Includes all labor, materials and equipment necessary to remove and properly dispose of the existing influent flow monitoring mag meter and install new mag meter in accordance with Section 11341 and shown on Sheet C-412. Work shall include all equipment required to provide a complete and properly operating system. Payment shall be Lump Sum.

Price and Payment Procedures  
01200 - 5

**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

**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.

### 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.

- 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.

- 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.

<b>SCHEDULE OF PARTIAL PAYMENTS FOR MOBILIZATION WHEN BID PRICE FOR MOBILIZATION IS 10% OR LESS OF ORIGINAL CONTRACT AMOUNT</b> (Partial Payments are a % of the Contract Amount for Mobilization)		
<b>TIME OF PAYMENT</b>	<b>AMOUNT OF PAYMENT</b>	<b>ACCUMULATED PAYMENT</b>
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

<b>SCHEDULE OF PARTIAL PAYMENTS FOR MOBILIZATION WHEN BID PRICE FOR MOBILIZATION IS GREATER THAN 10% OF ORIGINAL CONTRACT AMOUNT</b> (Partial Payments are a % of the Contract Amount, Except the Final Payment)		
<b>TIME OF PAYMENT</b>	<b>AMOUNT OF PAYMENT</b>	<b>ACCUMULATED PAYMENT</b>
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/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - 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:

<u>Sieve Size</u>	<u>Percent Passing</u>
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:

<u>Sieve Size</u>	<u>Percent Passing</u>
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:

<u>Sieve Size</u>	<u>Percent Passing</u>
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:

<u>Sieve Size</u>	<u>Percent Passing</u>
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:

<u>Sieve Size</u>	<u>Percent Passing</u>
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 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 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/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  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/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  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. ASTM 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 3/4" 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  $\pm 2\%$  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  $\pm 2\%$  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/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - 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/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - 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/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - 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 trenching 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 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/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - 2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - 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/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - 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/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - 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 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. Section 02951 – TV Inspection of Pipelines
  - 2. Section 02957 – Relining Sanitary Sewers
  - 3. Section 02959 – Rehabilitation of Sewers by CIPP Method
  - 4. Section 02957 – Rehabilitation of Manholes

##### 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 home owners 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. 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.

<b>Maximum Depth of Flow as Percentage of Pipe Diameter</b>					
<b>Television Inspection</b>		<b>Joint Testing and Sealing</b>		<b>Pipe Lining</b>	
<b>Pipe Diameter</b>	<b>Max. % Depth of Flow</b>	<b>Pipe Diameter</b>	<b>Max. % Depth of Flow</b>	<b>Pipe Diameter</b>	<b>Max. % Depth of Flow</b>
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. Implement by-pass pumping where in the opinion of the Engineer pumping is required to assure completion of downstream inspection, lining or replacement work.
- 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

<u>Pipe Dia.</u> <u>(inches)</u>	<u>T(time),</u> <u>min/ 100 feet</u>
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:

<u>Item</u>	<u>Coverage</u>
Concrete in contact with soil	3 inches
Exterior concrete	
Bars larger than No. 5	2 inches
No. 5 bars and smaller	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 noted on the Drawings:

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.

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### 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:

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- 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 “Cadmold 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 coarse 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 90°F or the ambient temperature is 40°F 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 cement 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. Begin 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

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- 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 40°F and below or 80°F 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 04065

### MASONRY MORTAR AND GROUT

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Section includes mortar and grout for masonry.
- 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 C91 - Standard Specification for Masonry Cement.
  - 2. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
  - 3. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
  - 4. ASTM C150 - Standard Specification for Portland Cement.
  - 5. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
  - 6. ASTM C476 - Standard Specification for Grout for Masonry.
  - 7. ASTM C1329 - Standard Specification for Mortar Cement.
- B. Masonry Codes and Specifications
- C. National Concrete Masonry Association (NCMA)
- D. International Building Code (IBC): Chapter 21 Masonry

##### 1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures.
- B. Samples: Submit one sample of mortar, illustrating mortar color and color range.
- C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
- D. Manufacturer's Certificate: Asbestos-free and lead free materials.

##### 1.4 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Hot and Cold Weather Requirements: Heat mixing water when air temperature is below 40 degrees F and heat aggregates when air temperature is below 32 degrees F, to assure mortar

and grout temperatures between 40 degrees F and 120 degrees F until installed. Do not heat water or aggregates above 120 degrees F.

## **PART 2 PRODUCTS**

### **2.1 MORTAR AND MASONRY GROUT**

- A. Manufacturers:
  - 1. Blue Circle Cement.
  - 2. Citadel Cement.
  - 3. The Quikrete Companies.
  - 4. Southern Grouts and Mortars.
  - 5. Substitutions: Section 01600 - Product Requirements.
- B. Furnish materials in accordance with local building code standards.

### **2.2 COMPONENTS**

- A. Mortar: Mortar mix shall comply with proportion specifications of ASTM C270 for job-mixed mortar. Masonry cement shall not be used for mortar.
  - 1. Aggregate ratio shall be not less than 2 ¼ and not more than 3 times the sum of the separate volumes of cementitious materials.
  - 2. Exterior Walls Above Grade: Type S, ¼ to ½ part hydrated lime to 1 part Portland cement by volume.
  - 3. Exterior Walls at or Below Grade: Type M, ¼ part hydrated lime to 1 part Portland cement by volume.
  - 4. Interior Walls: Type S, ¼ to ½ part hydrated lime to 1 part Portland cement by volume.
- B. Grout: Grout shall comply with proportion requirements of ASTM C476.
  - 1 part Portland cement
  - 1/10 part hydrated lime
  - 3 parts sand
  - 2 parts course aggregate (for course grout only, omit for fine grout)
- C. Slump: Unless otherwise indicated, mix grout to a consistency, which has a slump between 8 and 10 inches.
- D. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or grey cement as required to produce required mortar color.
- E. Hydrated Lime: ASTM C207, Type S.

- F. Fine Aggregate: ASTM C144, except for joints less than ¼ inch use aggregate graded with 100% passing the No. 16 sieve.
  - 1. Gray Mortar Aggregate: Grey sand or ground grey stone.
  - 2. Colored Mortar Aggregate: Ground marble, granite, or other sound stone, as indicated.
- G. Grout Aggregate: ASTM C404, maximum size 3/8" sieve.
- H. Water: Clean, potable and free of deleterious quantities of acids, alkalis, and organic materials.
- I. Admixtures: The use of admixtures including color pigments, accelerators, retarders, water repellent agents, or other admixtures shall not be permitted.
  - 1. No air-entraining admixtures or materials containing air-entraining admixtures may be used for mortar.
  - 2. No antifreeze compounds shall be added to mortar or grout.
  - 3. No admixtures containing chlorides shall be added to mortar or grout.
- J. Colored Mortar Pigments: Mortar pigments shall conform to ASTM C979.
  - 1. Natural and synthetic iron oxides, chromium oxides and carbon black, compound for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.
  - 2. Mineral oxide pigment shall not exceed 10% of the weight of Portland cement.
  - 3. Carbon black shall not exceed 2% of the weight of Portland cement.

## 2.3 MIXES

- A. Mortar Mixes:
  - 1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
  - 2. Mix mortar materials in a mechanical mixer with approximately one-half (1/2) of the water and fine aggregates placed into the mixer first. Cementitious materials, and remaining water and sand should then be added and mixed for not less than 5 minutes.
  - 3. Hand mixing shall not be used.
  - 4. Achieve uniformly damp sand immediately before mixing process.
  - 5. Add mortar color to achieve uniformity of mix and coloration.
  - 6. Re-temper only within two hours of mixing.



- B. Grout Mixes:
  - 1. Grout for Non-Structural Masonry: 2,000 psi strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476.
  - 2. Grout for Structural Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476.
  - 3. Application:
    - a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
    - b. Fine Grout: For grouting other spaces.
  - 4. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Section 01300 - Administrative Requirements.
- B. Request inspection of spaces to be grouted.

### **3.2 PREPARATION**

- A. Apply bonding agent to existing concrete surfaces.

### **3.3 INSTALLATION**

- A. Use mortar and grout within 1-hour of initial mixing. Discard mortar and grout that have begun to set.
- B. If mortar stiffens from evaporation or absorption of mixing water, temper by adding water and remixing. Mortar or grout mixture shall only be retempered once.

### **3.4 FIELD QUALITY CONTROL**

- A. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, consistency, and compressive strength.
- B. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength and in accordance with ASTM C143/C143M for slump.
- C. Test flexural bond strength of mortar and masonry units to ASTM C1357; test in conjunction with masonry unit sections specified.
- D. Test compressive strength of mortar and masonry to ASTM C1314; test in accordance with masonry unit sections specified.

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 fascia 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 1 1/4 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 capped 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 by 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 blast 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 Blast 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 H2O Hydro-Zinc at 2.5 – 3.5 mils DFT.  
Field Touch-Up: 91 H2O 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 H2O 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<sub>2</sub>O 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 – 3.0 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 I 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 contaminants.

Sealer Coat.: Apply TNEMEC Prima-Pell H<sub>2</sub>O 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
<b>WATER</b>		
Raw Water	olive green	110GN Clover
Settled or Clarified Water	aqua	GB36 Aqua Sky
Finished or Potable Water	Dark Blue	11SF Safety Blue
<b>WASTEWATER</b>		
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
<b>CHEMICAL</b>		
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

	<b>GENERIC COLOR</b>	<b>COLOR IDENTIFICATION</b>
<b>OTHER</b>		
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.

## SECTION 11216

### SELF-PRIMING CHOPPER PUMPS

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Description:
  - 1. The General Contractor shall furnish, install, test and place in satisfactory operation, as shown on the Plans and specified, self-priming return activated sludge (RAS) and waste active sludge (WAS) chopper pump(s) complete with 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 Bearing Manufacturers Association:
  - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. American Society of Mechanical Engineers:
  - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

##### 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 rebuilt kit for each pump.
- C. Furnish special tools required for equipment maintenance.

### **PART 2 PRODUCTS**

#### 2.1 SELF-PRIMING CHOPPER PUMPS

- A. Manufacturers:
  - 1. Vaughan
  - 2. Patterson
  - 3. KSB
  - 4. Hayward Gordon
  - 5. Substitutions: Section 01600 - Product Requirements
- B. Operating Characteristics:
  - 1. Pumping units as specified herein include units installed at the location(s) as shown on the Drawings. The design characteristics are summarized as follows:

##### **RAS Pumps**

Primary Design Condition:	1680 GPM @ 20' TDH @ 598 RPM
Minimum Hydraulic Efficiency:	66%
Minimum Shutoff Head:	30' @ 598 RPM
Motor HP:	15 HP

Electrical Service:	460 V/ 3Ø/ 60Hz
Impeller design:	Self-priming chopper design
Suction size:	12" Class 125 flanged
Discharge size:	10" Class 125 flanged

### **WAS Pumps**

Primary Design Condition:	450 GPM @ 35' TDH @ 931 RPM
Minimum Hydraulic Efficiency:	46%
Minimum Shutoff Head:	42' @ 931 RPM
Motor HP:	15 HP
Electrical Service:	460 V/ 3Ø/ 60Hz
Impeller design:	Self-priming chopper design
Suction size:	6" Class 125 flanged
Discharge size:	6" Class 125 flanged

#### **C. General:**

1. The RAS and WAS pumps furnished for this project shall be fully capable of successfully handling the anticipated service, i.e., transfer of return and waster activated sludge in a wastewater plant. The pumps provided shall also be capable of handling heavy concentrations of rags, debris, grit, plastic, hair, and other foreign material that can be expected to be present in typical RAS and WAS pumping applications.
2. The chopper pumps shall be specifically designed to pump return and waste sludge and solids at heavy consistencies. Materials shall be macerated and conditioned by the pump as an integral part of the pumping action. The pump must have demonstrated the ability to chop through and pump high concentrations of solids such as thick sludge, heavy rag loadings, plastics, grease and hair balls, wood, paper products, sanitary products, wipes, and stringy materials without plugging, both in tests and in field applications.
  - a. The pumps shall be a true self-priming design which retains adequate liquid in the pump casing to ensure re-priming without suction or discharge check valves, and with a dry suction pipe.

#### **D. Pump Construction:**

1. The RAS and WAS pump housing shall include ANSI Class 125 flanged inlet and discharge flanges, an oversized cleanout, and mounting feet. The pump housing shall be cast ductile cast iron with all water passages to be smooth, and free of blowholes and/or other imperfections that might hinder good flow characteristics.
  - a. The use of fabricated casing construction is not considered acceptable. All fasteners used for assembly of the pump liquid end shall be 316 stainless steel.
  - b. Pressure taps shall be provided on the suction adapter and on or near the discharge flange, to facilitate installation of suction and pressure gauges as outlined elsewhere herein.
2. The pump casing shall be of a volute design, spiraling outward to the 125# flanged centerline discharge. Back pull-out design shall incorporate adjusting sleeves for the accurate field adjustment of impeller-to-cutter bar clearance, and shall allow removal of pump components without requiring disconnection of casing from either the inlet or discharge piping. Casing and backplate shall be cast ductile cast

iron with all water passages to be smooth, and free of blowholes and imperfections for good flow characteristics.

- a. Backplate shall include a replaceable Rockwell C 60 steel cutter adjustable for 0.005-0.015" clearance to cut against the rotating impeller pump out vanes for removing fiber and debris. The casing shall be a separate parts component of the housing.
3. The pump impeller shall be the semi-open type with integral pump out vanes on the back of the shroud to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a maximum set clearance between the impeller and cutter bar of 0.015-0.025" cold.
  - a. The impeller shall be cast alloy steel heat treated to minimum Rockwell C 60 hardness, and be dynamically balanced. The impeller shall be threaded to the shaft and shall have no axial adjustments and no set screws. Pumps with open type impellers, or impellers without pump out vanes on the back plate shall not be allowed on this project.
  - b. Pump impellers shall have a maximum of three (3) vanes for the RAS pumps and four vanes (4) for the WAS pumps to ensure non-clog performance as specified. The use of fabricated or modified impellers is not considered acceptable.
  - c. A cutter nose shall be provided for the WAS pumps and shall be designed to cut stringy materials and prevent binding using two opposing cutter edges that cut against the inside of the cutter bar fingers. The cutter nose shall be cast steel heat treated to minimum Rockwell C 60.
4. A replaceable Rockwell C60 alloy steel wear plate with internal cutter groove, and adjustability to maintain 0.030-0.050" clearance to cut against the rotating impeller pump-out vanes for removing fiber and debris shall also be included.
5. A cutter bar shall be recessed into the pump bowl and shall extend diametrically across the entire pump suction opening. Cutter bar shall be alloy heat-treated steel hardened to minimum Rockwell C60. Chopper pump designs which utilize individually mounted shear bars shall not be acceptable.
6. An external cutter shall be used to eliminate binding and the build-up of stringy materials at the pump inlet on the RAS pumps. The external cutter shall consist of opposing cutter wings which shear against the outside surface of the shear bars and the anvil, an integral cast tooth which shears against the adjacent surface of the shear bars, and a hex head sufficiently sized for ease of removal. The external cutter shall be cast steel and heat treated to a minimum Rockwell C60. Chopper pumps which do not have a rotating external cutter extending through to the opposite side of the shear bar and lack the ability to cut debris from the pump suction shall not be acceptable.
7. An upper cutter shall be threaded into the backplate behind the impeller, and shall be specifically designed to cut against the pump-out vanes and the impeller hub, to reduce and remove stringy materials from the mechanical seal area. The upper cutter teeth shall be positioned as closely as possible to the center of shaft rotation to minimize cutting torque and nuisance motor tripping. Upper cutter shall be cast steel heat treated to minimum Rockwell C60. Upper cutter shall be a replaceable item, and shall be separate from the casing back plate.
8. Pump shafting shall be heat treated alloy steel, fully supported by rolling element bearings. Shaft thrust in both directions shall be taken up a pair of angular contact

ball bearings. A single deep groove spherical roller bearing shall also be provided for radial loads. Bearings shall be oil bath lubricated with ISO 46 hydraulic oil, and shall have a minimum 100,000-hour L10 bearing life. A sight glass shall be provided to allow visual confirmation of oil level.

9. The back pull-out bearing housing shall be cast ductile iron, machined with piloted bearing fits for concentricity of all components. The design shall incorporate the use of adjusting sleeves for accurate external adjustment of impeller/cutter bar and impeller/upper cutter clearances, as well as removal of the pump rotating assembly for service without requiring disconnection of housing from inlet or discharge piping. Viton double lip seals riding on a stainless-steel shaft sleeve shall provide sealing at the drive end of the bearing housing.
10. Mechanical seals shall be provided, and shall be a cartridge type with silicon carbide faces for both rotating and stationary elements. Mechanical seals shall be positively-driven by means of multiple set screws. All elastomers used in the seal construction shall be Viton. Cartridge seal shall be factory pre-assembled and pre-tested so that no seal settings or adjustments are required from the installer. Any springs that are used to compress the seal faces shall be shielded from the pumped fluid by means of a 17-4 pH heat-treated seal sleeve and a stainless-steel seal gland.
11. Each RAS and WAS pump, motor, and belt drive assembly shall be mounted on a separate fabricated steel base designed to withstand the forces expected to be developed during shipment and subsequent operation of the equipment specified. The base shall be constructed of commercially-available steel sections with a minimum nominal thickness of ¼". All structural connections in the base shall be fully welded and ground if required for mounting of equipment.
  - a. Bases shall be designed to allow removal of the pump rotating assembly for service without disconnection of the suction or discharge piping.
  - b. Bases shall be provided with suitably sized openings to allow the contractor to firmly anchor and grout them in the position as shown on the Plans. All necessary grout dams shall be constructed as a part of the steel support base, and anchor bolt holes shall be provided as an integral part of the base design.
  - c. Base design shall be such that the pump motors shall be located adjacent to the pump (side x side configuration) as shown on the Plans, so that a suitable V-belt drive assembly can be used as outlined herein. V-belt drives shall be completely enclosed in a 304 stainless steel belt guard to prevent accidental contact with moving parts by operating personnel. Guards shall comply with OSHA restrictions. Belt guards shall be bolted to the pump base, and shall be sized to allow the use of the largest sheave and motor size required at any point on the performance curve for the proposed pump.
12. Power from the driver shall be transmitted to the pump by an adjustable V-belt drive assembly. The pump base shall incorporate adjustable brackets as outlined above to support the horizontal electric motor specified below. Multiple-groove cast iron sheaves and composite V-belts shall be provided to transfer power from the motor to the pump, and shall be properly sized for the horsepower ratings shown herein.
  - a. A minimum safety factor of 1.5 shall be applied to the selection of all drive components, based on the calculated brake horsepower versus motor nameplate horsepower. Not less than two (2) V-belts shall be provided on the drive assembly, regardless of the number of belts calculated.



- b. Full drive calculations shall be included as a part of the submittal data. Belt guards shall be provided as outlined above, to prevent accidental contact with the V-belt drive system, and to comply with current OSHA standards. V-belt drive system shall be as manufactured by Dodge, Browning, Woods, or approved equal. The belt drive assembly shall be set for the operating speed as referenced above.
  - c. Tensioning of the V-belt drive assembly shall be facilitated by means of an adjustable motor base, which shall be mounted and adjusted at the pump manufacturer's facility during production of the RAS and WAS pumps. The base shall allow tensioning of the belts after the pump and motor are mounted.
13. The pumps shall be capable of the minimum reprime lift as referenced above, while operating at the stated speed. Reprime lift shall be defined as the vertical height from the centerline of the pump suction to the top of the liquid from which the pump will prime. Repriming of the pump shall be accomplished within 5 minutes.
14. Stainless steel nameplates shall be attached to the pump and drive motor giving the manufacturer's model and serial number, rated capacity, head, pump and motor speed, and motor horsepower.

E. Motor:

- 1. Each RAS and WAS pump shall be driven by a horizontal foot-mounted solid shaft electric motor of the size indicated above. Motor shall be an inverter-duty, premium efficient design, TEFC severe duty rated, and sized for non-overloading conditions over the entire pump performance curve as specified herein.
- 2. Motors shall be suitable for operation on 460/3/60VAC electrical service, shall be the horizontal solid shaft ball bearing type, provided with totally enclosed fan cooled enclosures. Motors shall be a premium efficiency design suitable for mounting in the space shown on the Plans. Motors shall be provided with three (3) winding thermostats (one per phase) in the windings of each phase to afford protection of the motor against excessive operating temperature. Thermostats shall be the Klixon type, suitable for use with 120VAC control power, with leads routed to the conduit box for connection to monitoring circuitry separate from the power wiring. Special purpose relays will not be required for the operation/monitoring of the thermostats provided.
  - a. The pump motors shall be manufactured in accordance with all applicable standards of NEMA, IEEE, AFBMA, NEC, and ANSI. The motors shall be a premium efficiency squirrel cage induction type, with normal starting torque and slip characteristics.
  - b. Winding insulation shall be non-hygroscopic, rated as Class H or better.
  - c. The motor shall be capable of carrying full load current continuously, without injurious temperature rise, in an ambient temperature of 40 degrees C.
  - d. All motors shall be provided with a minimum service factor of 1.0 when used with variable frequency drives.
  - e. Motors shall be provided with 20VAC silicon space heaters to prevent the formation of condensation. The space heaters shall be sized by the motor manufacturer for the specific frame size provided, and shall be installed prior to shipment. Location of the space heaters shall not interfere with operation of the winding thermostats specified above. Leads from the space heaters will be routed to the conduit box that is mounted on the side

of the motor frame. Wiring of the space heaters to 120VAC power shall be provide by the contractor, and shall be interlocked with auxiliary contacts from the pump control panel so that they are energized only when the pump is offline.

3. All motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of pump operation from zero head to shut-off.
4. Motors that are to be operated using variable frequency drives shall be specifically designed and labeled as “inverter duty”, shall be labeled as such, and shall include insulation upgrades and/or additional winding treatments as required to enhance the long-term operation of the motors. The use of “inverter capable” motors is not acceptable, and the use of standard motors “rated” by the manufacturer as capable of VFD operation will not be considered. Inverter duty motors shall bear a separate tag or name plate/label, separate from the data plate indicating that they are an inverter duty design.
  - a. Shaft grounding ring(s) shall be provided by the motor manufacturer for all inverter-duty motors to prevent damage to the motor bearings from induced shaft voltages and parasitic capacitance. Grounding rings shall be AEGIS bearing protection rings, which provides a conductive discharge path away from the motor bearings to ground. Shaft surfaces shall be conductive and free of any finish flaws that inhibit conductivity, and shall be provided with a manufacturer-approved silver-based colloidal coating during installation of the grounding rings to enhance conductivity.

F. Pump Warranty:

1. The pump manufacturer shall warrant the equipment provided to be of the highest quality and construction, free of defects in material and workmanship. A written warranty will be provided for all equipment, and shall indicate specific parts and labor covered.
2. New equipment will be generally warranted for a period not to exceed one year from date of initial startup and/or beneficial use, not to exceed eighteen (18) months after date of shipment.
3. The equipment warranty shall become effective upon acceptance by the Owner or the Owner's authorized agent, or upon beneficial use of equipment by plant operating staff, whichever occurs first.

G. Spare Parts and Accessories:

1. Each pump shall be equipped with a glycerin-filled suction and discharge pressure gauges, each provided with diaphragm isolator assemblies, to enable the operator to monitor pump operating pressures. Gauges shall be a minimum of 6 inches in diameter, and shall be scaled to read directly in feet of water column (discharge) or inches of mercury (suction). Rated accuracy shall be 1.5 percent of full scale. Pressure range of all gauges shall be adequate for the intended service, and shall be selected so that during equipment operation, the needle is at approximately 50% of full scale. Gauges shall be manufactured by PIC, or approved equal.
  - a. Gauges shall not be screwed directly into the pump discharge piping, but shall be provided with a diaphragm isolator to prevent contact of the gauge internals with the pumped media. Gauges and diaphragm isolators shall be pre-assembled prior to shipment to the job site, and both the gauge and interconnecting piping shall be filled with glycerin. Gauges shall be

- mounted with 304 stainless steel fittings and shall be provided with ball valves for both isolation and venting purposes.
- b. Pressure gauges shall be all-304 or 316 stainless steel construction. Cases shall be 304 or 316 stainless, and wetted parts shall be 316 stainless. Elastomers shall be neoprene. Diaphragm seals shall include 316 stainless steel diaphragms, as well as 316 top and bottom housings. Gaskets shall be Teflon or neoprene.
  - c. Connections and all interconnecting piping, including valves, shall be 304 stainless steel, ½" diameter. A separate vent and isolation valve shall be provided to allow the operator to remove system pressure from the gauge assembly after use.
2. After installation and startup of the new pump, the Owner shall provide the following spare parts and equipment to the Owner for use during normal operation and/or maintenance of the new equipment:
    - a. One (1) rotating assembly with all required gaskets and/or shims
    - b. One (1) set of any special pump maintenance tools
    - c. One (1) set of V-belts
    - d. Three (3) of all O-rings and/or gaskets utilized in the pumps. Twelve (12) oil plug inspection O-rings shall be provided.
    - e. Two (2) flapper valves for the pump suction, if provided.
  3. Only one set of parts need be provided for identical model pumps, but a complete set is required for each separate pump model furnished. All spare parts provided shall be new and unused, and shall be packed in sturdy containers with indelible identification markings as to their use. Spare parts shall be provided to the Owner after acceptance of the project by the Engineer. Storage of the parts prior to that time shall be the responsibility of the contractor. Any spare parts consumed during equipment startup shall be replaced by the manufacturer without cost to the Owner.
  4. Each pump shall be provided with a 2" air & vacuum valve, to be installed as shown on the Plans. Air and vacuum valves shall be Series 35-WW, as manufactured by Cla-Val, an equivalent by FloMatic, or approved equal. All required piping, valves, and other related equipment that may be necessary for installation or operation of the specified air valves will be included in the base bid.
    - a. Air and vacuum release valves shall be the float-operated, compound-lever design, capable of automatically releasing air, gas, or vapor from the piping system during operation, and allowing atmospheric air to re-enter the piping during draining or whenever a negative pressure occurs after a pump stops.
    - b. The inlet and outlet connections of the valve shall be the same size, 2" NPT. The valve float shall be guided by a synthetic rubber seal.
    - c. Upper and lower internal floats shall be constructed of ASTM-A276 T316 stainless steel, and shall be able to withstand maximum system surge pressure without failure. The body and cover shall be ASTM A126, Class B cast iron, and the internal valve parts shall be T316 stainless steel. An ASTM A536 ductile iron baffle shall be provided to break up water velocity prior to striking the upper float. Seat shall be Buna-N elastomer.
    - d. All discharge piping and fittings from the air and vacuum valve back to the wet well or plant drain shall be 2" diameter 304L stainless steel, and shall be installed by the contractor as directed by the Engineer or as shown on the Plans. All changes in direction shall be made with tee fittings and plugs, to facilitate future cleanout. Union connectors shall be installed

before and after air valves to allow removal of piping in the future, and a 2" diameter stainless steel ball valve shall be included to allow isolation of the valve for maintenance or repair.

- H. Painting:
1. All exposed metal surfaces of the pump exterior shall be prepared for finish painting by means of a solvent wash and commercial sandblast meeting the requirements of SSPC-SP6. Immediately after blast cleaning, the pump unit shall be provided with a single coat of Tnemec Perma-Shield PL Series 431 epoxy primer. After the primer has cured, finish coat(s) of Tnemec Perma-Shield PL Series 431 epoxy shall be applied by the pump manufacturer, for a total coating thickness of 30 MDFT. All coatings will be factory-applied in strict accordance with the coating manufacturer's instructions. Motors shall be provided with the manufacturer's standard machinery enamel paint finish, for field finish painting by others.
  2. Coatings shall be applied by the pump manufacturer prior to shipment of pumping equipment to the job site.

## 2.2 PUMP CONTROLS

- A. Manual control panels shall be provided for each RAS and WAS pump, in the locations as shown on the Plans.
- B. Refer to Specification Section 16480 ("Manufactured Control Panels") for additional control panel requirements.
- C. Control panels shall be provided in 304 S.S. enclosures, with all indicators and local operating controls to be mounted on the exterior of the door. If desired by the panel manufacturer, a hinged inner door may be provided and operating/indicating devices may be mounted on the same. Switches, indicators, elapsed time meters, and other operating devices shall be NEMA 4X rated, suitable for installation in the locations shown. Panel doors shall be provided with a three-point latch, and the use of multiple clamps and/or screws around the periphery of the door shall not be considered acceptable.
- D. Panels shall be provided with a suitable variable frequency drive for each pump, as noted elsewhere herein. Heat calculations shall be provided for all panels, and supplemental cooling shall be provided as may be appropriate.
- E. An H-O-A selector switch and manually-adjustable speed potentiometer shall be provided on the external door of the control panel enclosure. In the "hand" position, the drive shall be controlled solely by the potentiometer setting as adjusted by the operating personnel. In the "auto" position, the drive shall be controlled by a signal from the plant SCADA, and shall run the pump at the speed setting selected by the operator via the potentiometer.
- F. Panel Construction
1. The electrical control equipment shall be mounted within a NEMA 4X 304 stainless steel dead front type control enclosure fitted with a three-point latching mechanism, and operated by a single padlockable handle located on the front side of the panel exterior. The enclosure door shall be hinged and sealed with a neoprene gasket. No controls are to be accessible from the outside of the enclosure,

and the use of locking clamps, bolts, etc... to secure the outer door of the enclosure shall not be allowed. Enclosure shall be minimum 14-gauge 304 stainless steel minimum. Heavy-gauge continuous hinges shall support each exterior door, and the enclosure shall be provided with body stiffeners as may be required.

- a. All control components shall be securely fastened to a removable painted steel back panel with machine screws. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount any components. All connections from the back panel to door mounted or remote devices shall be made through terminal blocks. All control devices shall be clearly labeled to indicate function. Back panel shall be secured to the rear of the enclosure with collar studs.
  - b. The enclosure shall be the dead front type with aluminum hinged inner door. All devices routinely accessed by operation personnel shall be mounted on or through the inner door, including and not limited to pilot lights, selector switches, pushbuttons, single pole control circuit breakers, pump circuit breaker handles, motor overload reset pushbuttons, GFI receptacle, PLC operator interface, and VFD control stations. No control components shall be accessible from the front of the enclosure without opening the outer door. Twist locking hardware shall be provided to secure the door in its closed position in the panel.
  - c. Enclosure may have single or double doors, depending on the amount of equipment to be housed inside. The enclosure shall also be provided with 304 S.S. support legs, with height as required to position operating controls approximately 5'-0" off the mounting pad for the panel. Layout drawings provided in the submittal shall indicate the height of the support legs to be provided.
  - d. The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include an adjustable thermostat, and shall be Hoffman or approved equal.
  - e. LED work lights shall be provided within each section of the enclosure to aid operators in viewing internal components under dim conditions. Work lights shall be operated by means of door-mounted limit switches that energize the lights when the enclosure inner door(s) are opened.
2. A packaged air-conditioning system shall be provided on the exterior of the panel enclosure to regulate internal temperatures, and shall be provided with an automatic thermostat to control operation. Air-conditioning units shall be minimum NEMA Type 4 rated, with a BTU rating sufficient to cool the panel plus 20% additional BTU output. Unit exterior shall be stainless steel or painted galvanized steel, shall include a thermostat control, and shall be as manufactured by Ice Qube, Bard, or approved equal. The control panel manufacturer shall provide heat calculations to verify that the cooling system is properly sized, and shall include such calculations with the submittal data provided.
  3. A main terminal block and ground bar shall be furnished for field connection of the incoming electrical supply. The connecting lugs shall be designed to accept copper conductors of sufficient size to serve anticipated pump station loads. Main terminal block shall be mounted to allow incoming wire bending space in accordance with Article 373 of the National Electrical Code (NEC), but shall in no case be less than as outlined below.
  4. The control panel, as furnished by the manufacturer, shall be completely wired. The contractor shall field connect the power feeder lines to the main terminal

block, final connections to the remote alarm devices, wiring from the remote oil level sensors, and the connections between the pump and the pump motor control. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications set forth by the National Electric Code (NEC).

- a. All wiring shall have not less than 600 volts insulation. All job connections required to conveniently replace control components shall be made an approved type terminal blocks with engraved phenolic labels identifying each component. All wiring an components shall be marked as shown on the as-built drawings at both ends by means of self-adhering plastic wire markers and engraved nameplates.
  - b. All user serviceable wiring shall be type MTW or THW, 600 volts, and shall be generally color coded as follows:
    - 1) Line and load circuits, AC or DC power Black
    - 2) AC control circuit less than line voltage Red
    - 3) DC control circuit Blue
    - 4) Interlock control circuit, from external source Orange
    - 5) Equipment grounding conductor Green
    - 6) Current carrying ground White
    - 7) Hot with circuit breaker open Orange
  - c. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be 14 gauge minimum, type MTW or THW, 600 volts rated. Power wiring shall be #8AWG minimum for the 20HP motor, and #4AWG for the 50HP motors. Motor branch and power conductors shall not be loaded above the temperature rating of the connected termination. Wires shall be clearly numbered with suitable indelible marking tape at each end, in accordance with the electrical diagrams. All wires on the sub-plate shall be bundled and tied.
  - d. Wires connected to components mounted on the inner door shall be bundled and tied in accordance with good commercial practice. Bundles shall be flexible at the hinged side of the door. Adequate length and flex shall be provided to allow the door to swing to its full open position without undue stress or abrasion on the wire or insulation. Bundles shall be held in place on each side of the hinge by mechanical fastening devices.
  - e. Wiring between components mounted directly on the subpan shall be routed through properly-sized suitable PVC wiring troughs equipped with snap-on caps. Loose wiring in the control panel will not be permitted.
5. Wiring, cables, and other conductors shall individually enter the enclosure through the bottom, and terminal blocks shall be provided for all pump motor sensor wiring so that all individual pump cables can be easily disconnected and removed if required.
- a. All wiring to or from the control panel shall be made only by means of lugs or terminal blocks. Loose wiring connecting directly to panel components shall not be permitted. Adequate room shall be provided at the bottom of the panel enclosure to allow ease of wiring, but in no case shall less than 8" of room be provided between the lowest terminal lug/block and the bottom of the enclosure.
  - b. The control manufacturer shall provide a common ground bar mounted on the enclosure subpan. A separate ground lug shall be provided for each of the pump motors. The mounting surface of the sub pan where the ground

- bar and motor grounding lugs are located shall have paint removed before making final connections. The contractor shall make field connections to the main ground lug and each pump motor in accordance with the requirements of the National Electric Code.
6. The control panel shall be equipped with a transient voltage surge suppressor to minimize damage to the pump motors and controls from transient voltage surges. The suppressor shall utilize thermally protected silicon-oxide varistors encapsulated in a non-conductive housing. Mechanical indicators shall be provided on each phase to indicate protection has been lost. A surge arrestor shall be supplied and connected to the load side of the control transformer, to protect the PLC against damage due to voltage surges.
    - a. The control panel shall also be equipped to monitor the incoming power and shut down the pump when required to protect the motors from damage due to single phase conditions, or by voltage levels at less than 83% of nominal. Pump motors shall automatically restart when power conditions return to normal.
  7. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. The lowest rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 10 kA, RMS symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating.
  8. A properly sized heavy duty air primary/main circuit breaker shall be furnished to allow to completely disconnect power to the control panel. The main breaker shall be sized as required, and shall have a symmetrical RMS interrupting rating of 30,000 amperes at 460 volts. Circuit breaker shall be sealed by the manufacturer after calibration to prevent tampering.
    - a. A padlocking operating mechanism shall be installed on the main breaker. An operating handle for the breaker mechanism shall be located on the inner door of the enclosure, with an interlock which permits the door to be opened only when the main circuit breaker is in the "OFF" position. An additional mechanism shall be provided on the circuit breaker to permit the breaker to be operated and/or locked after the control panel inner door is opened.
  9. A properly sized heavy duty air circuit breaker shall be furnished for each pump motor, and shall have a symmetrical RMS interrupting rating of 30,000 amperes at 460 volts. Circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.
    - a. A padlocking operating mechanism shall be installed on each motor circuit breaker. Operating handles for the breaker mechanisms shall be located on the enclosure inner door, with interlocks which permit the door to be opened only when the circuit breakers are in the "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.
  10. RAS/WAS Pumps shall be provided with pulse width modulated (PWM) variable frequency drives, for system operation as specified above. For the purposes of

establishing a minimum level of quality and features, variable frequency drives shall be ABB Model ACS580 Series, each to be provided with integral chokes. Variable frequency drive specifications are listed below.

- a. VFDs provided for this project shall be the constant-torque type only. Under no circumstances shall variable-torque drives be utilized. The manufacturer of the control panel shall clearly state the type of drives utilized in the required submittal data.
11. A lightning arrestor shall be supplied and connected to each line of the incoming power. Lightning arrestor shall protect the control against damage due to lightning strikes on the incoming power line.
12. Dry (non-powered) contacts shall be provided to the terminal strip for connection to existing or future SCADA equipment that is not required under this contract. Contacts provided shall include for each pump to indicate “pump on”, “pump off”, “pump high temperature”, and “pump leakage alarm”. Dry contacts for “high wet well level”, RVSS or VFD “fault”, and “PLC failure” conditions shall also be provided. The Monitoring contacts shall be provided for each pump located in the wet well. All contacts shall be Form B design, capable of carrying a minimum of 10 amps at 120VAC. Contact closures shall be separately wired with two separate leads in the panel, and with no common wiring between functions.
  - a. Dry output contacts shall be provided for the conditions noted above, and shall be wired to a separate terminal strip located at the bottom of the enclosure, for future connection to SCADA or other monitoring equipment (not included in this contract).
13. Control relays shall be the plug-in enclosed polycarbonate type. Coil winding shall be polyurethane insulated with insulation resistance of 100 megohms minimum. Dielectric strength shall be 1500 volts R.M.S. and temperature range of -50 degrees C to 65 degrees C. Mechanical life expectancy shall be in excess of 20 million operations.
14. Single phase control voltage shall be provided by a dry type control transformer. Circuit breakers shall be provided for the primary circuit and all loads connected to the transformer. Minimum transformer rating shall be 3KVA.
15. Provide under current relays for each pump. A current transformer shall be provided for each pump to monitor motor amperage during operation.
16. Adjustable sequence timers shall be provided for each pump motor to prevent simultaneous starting of pumps after a power failure condition. Timers shall be solid state, plug-in type with an LED indicator. Timers shall be wired in “automatic” pump starter circuits.
17. Oil-tight pilot lights shall be provided as specified herein. Pilot lights shall be Hevy-Duty oil-tight UL type 4, transformer type, Square D 9001 type, or approved equal. Pilot lights furnished shall be in addition to any lights provided as a part of any automatic level controller that may be specified herein. All pilot lights shall be suitable for 120VAC, and shall be mounted in keyed openings on the inner door of the control panel. Pilot lights shall be push-to-test, shall utilize LED lamps and shall be provided with jeweled glass or plastic lenses a minimum of 1" in diameter. A common push-to-test button for verifying the condition of pilot light lamps shall also be acceptable.
  - a. Individual pilot lights will be provided on the door of the control panel to alert station maintenance personnel to a “normal power on”, “pump run”, or “VFD fault” condition for each pump. These pilot lights shall be red in color.



- b. Each “pump run” light shall be wired in parallel with the related pump motor starter to indicate that the motor is (or should be) running. Running lights shall be green in color.
  - c. The pump control panel shall be equipped to terminate pump operation due to high motor winding temperature or moisture in the motor housing, utilizing contacts in the pump motor housing. If either event should occur, the motor starter will drop out and a “high stator temperature” or “seal fail” pilot light on the panel door shall indicate that the pump motor has been shut down. The associated circuitry for either condition shall require manual reset. High temperature and seal leak lights shall be red in color.
18. Pump mode selector switches shall be connected to permit manual start and manual stop for each pump individually, and to select automatic operation of each pump under control of the liquid level control system. Manual operation shall override the liquid level control system. Selector switches shall be heavy duty, oil-tight design, with contacts rated NEMA A300 minimum. Selector switches and push button operators (where provided) shall be Hevi-Duty oil tight UL type 4, Square D 9001 type.
19. Six digit elapsed time indicators (non-reset type) shall be connected to each motor starter to indicate the total running time of each pump in "hours" and "tenth of hours".
20. The alarm system shall provide a visual means of warning the operating personnel of a system emergency. The common alarm light shall be red and mounted on side of enclosure for easy viewing. The panel manufacturer will supply a 115VAC alarm light fixture with a vapor-tight red globe, cast aluminum guard, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe. The alarm light will be mounted to the top of the control panel, but may be shipped loose for field installation by the contractor in the location as directed by the Engineer if desired. Alarm light shall be as manufactured by Crouse Hinds, Stonco, or approved equal.
- a. The external alarm light circuit shall be equipped with a timer circuit to cause the alarm light to flash. Flash rate shall be approximately 1 second (one half second on and off intervals).
21. A duplex ground fault indicating utility receptacle providing 115VAC, 60 Hertz, single phase current, shall be mounted on the inner door of the control enclosure to allow operation of the hoist drill driver. The receptacle circuit shall be protected by 15 ampere thermal-magnetic circuit breaker.
22. If referenced in the pump specifications, the pump manufacturer shall provide a monitor relay for each pump, for installation in the pump control panel. The relay shall continuously monitor the status of both the motor thermostats and the internal leakage sensor as noted below, and shall be designed to provide alarm indication contacts for integration with the panel’s indicating pilot lights and alarm indication.
- a. If the motor thermal sensor contacts open (i.e., overtemperature condition), the overtemperature indication is turned on, and the alarm relay is de-energized, opening the contacts between the designated connections.
  - b. When the high motor temperature condition has cleared, the unit will reset based on the position of alarm reset mode select switch (auto or manual). When in the auto position, the overtemperature alarm resets automatically. If the switch is in the manual position, the overtemperature reset

pushbutton must be pushed for approximately 1.5 seconds to clear the alarm.

- c. If the leakage sensor contacts open (i.e., seal leakage condition), the seal leakage indication is turned on and the leakage alarm relay is de-energized, opening/closing the contacts between the designated terminal connections.
  - d. Output contacts from the monitor relays shall be incorporated into the wiring as noted herein, for operation as specified. Over-temperature protection shall be provided in the control system to shut off the pump upon occurrence of high temperature. The high temperature alarm pilot light shall be illuminated under this condition. Reset shall be manual only, located on front panel.
23. A permanent corrosion resistant name plate(s) shall be attached to the control and include the following information:
- a. Equipment serial number
  - b. Control panel short circuit rating
  - c. Supply voltage, phase and frequency
  - d. Current rating of the minimum main conductor
  - e. Electrical wiring diagram number
  - f. Motor horsepower and full load current
  - g. Motor overload heater element
  - h. Motor circuit breaker trip current rating
  - i. Name and location of equipment manufacturer
24. Control components mounted on the subpan shall be permanently marked using the same identification shown on the electrical diagram. Identification labels shall be mounted adjacent to the device. Switches, indicators, and instruments shall be plainly marked to indicate function, position, etc... using engraved phenolic plates with black backgrounds and white lettering. All marking plates shall be mounted adjacent to and/or above the device.

#### G. Variable Frequency Drives

1. VFDs provided shall be a solid-state design, with pulse width modulated (PWM) output, and shall be a sensor-less vector AC to AC converter utilizing the latest Insulated gate bipolar transistor (IGBT) technology. VFDs shall employ a sensor-less vector inner loop torque control strategy that mathematically determines motor torque and flux, and shall provide an optional operational mode for V/Hz Operation.
  - a. As noted above, drives provided for this application shall be constant-torque design. Variable-torque drives are not acceptable.
2. Each VFD shall be provided with an EXTERNAL 3% line reactor (in addition to the internal VFD choke) to help reduce harmonic distortion and to help protect the drive from line side voltage surges.
3. Each VFD shall be rated to operate from 3-phase power at 380-480VAC +10/-15%, 48-63 hertz. VFDs shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.98 at all speeds and nominal load. The ACQ580 standard VFD efficiency shall be 98% or better at full speed and load.
4. VFDs for 1-350HP motors at 460/3/60VAC shall have internal chokes (reactors) to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions.

5. VFDs shall be rated to operate at an ambient environmental temperature 0 to 40°C continuous. VFDs that can operate at 40° C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude of 0-3300 feet above sea level without de-rating, less than 95% humidity, non-condensing.
6. Output voltage and current ratings shall match the adjustable frequency operating requirements of standard NEMA design A or NEMA design B motors. The normal duty overload current capacity shall be 110% of rated current for one minute out of ten minutes. The heavy-duty overload current capacity shall be 150% of rated current for one minute out of ten minutes.
7. The latest, most efficient IGBT power technology shall be used for all power and voltage ranges offered by the manufacturer. The VFDs shall offer microprocessor based control logic that is isolated from power circuitry. Drives shall be provided in UL Type 1 open chassis configuration, and shall include a remote-mounted control module to allow operator programming as required. Circuit boards shall be coated as standard, and internal chokes (reactors) shall be included to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions
8. The VFDs shall be equipped with an operator control panel consisting of a four-line back-lit alphanumeric LCD display that is 240x160 pixels. Configurable displays shall show bar graph and meter orientations. The keypad shall include keys for run/stop, local/remote, increase/decrease, reset, menu navigation and parameter select/edit. The control panel shall allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
9. The display of the control panel shall include all parameter names, fault messages, warnings and other information, and shall display the same in complete American English words or standard American English abbreviations, to allow the user to understand what is being displayed without the use of a manual or cross-reference table.
  - a. During normal operation, one (1) line of the control panel shall display the speed reference, and run/stop forward/reverse and local/remote status. The remaining three (3) lines of the display shall be programmable to display the values of any three (3) operating parameters. The selection shall include at least the following values:
    - 1) Speed/torque in percent (%), RPM or user-scaled units
    - 2) Output frequency, voltage, current and torque
    - 3) Power and kilowatt hours
    - 4) Heat sink temperature and DC bus voltage
    - 5) Status of discrete inputs and outputs
    - 6) Values of analog input and output signals
    - 7) Values of PID controller reference, feedback and error signals
  - b. The control panel shall be used for local control, setting all parameters, and for stepping through the displays and menus. A copy function to upload and store parameter settings from another VFD and download stored parameter settings to the same VFD or to another VFD shall be provided.
  - c. An intelligent start-up assistant shall be provided as standard. The start-up routine shall guide the user through all necessary adjustments to optimize operation. The start-up routine shall include “plug and produce” operation, which automatically recognizes the addition of options and

- fieldbus adapters and provides the necessary adjustment assistance. The start-up routine will prompt the user for motor nameplate data including power, speed, voltage, frequency and current.
10. An auto-tune function shall identify the optimal motor tuning parameters for typical applications, and shall also be available to tune the PID speed regulator loop. Manual adjustments shall also be allowed.
  11. A selection of at least ten (10) preprogrammed application macro parameter sets shall be provided to minimize the number of parameter adjustments required during start-up. Macros offered shall include factory default, hand/auto, PID control, torque control, and pump/fan control.
    - a. Selection shall be offered for both 2-wire and 3-wire start/stop control.
  12. For each programmed warning and fault protection function, the VFD shall display a message in complete English words or standard English abbreviations. The eight (8) active and most recent fault messages and times shall be stored in the VFD's fault history.
  13. The VFD shall include internal MOV's for phase-to-phase and phase-to-ground line voltage transient protection. Output short circuit and ground fault protection rated for 100,000 amps without relying on line fuses shall be provided per UL508C. Motor phase loss protection shall be provided. The VFD shall also provide electronic motor overload protection as qualified per UL61800-5-1.
  14. Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated voltage or undervoltage at 65% of minimum rated voltage. The VFD shall protect itself against input phase loss. A power loss ride through feature shall allow the VFD to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
    - a. Stall protection shall be programmable to provide a warning or stop the VFD after the motor has operated above a programmed torque level for a programmed time limit. Underload protection shall be programmable to provide a warning or stop the VFD after the motor has operated below a selected underload curve for a programmed time limit.
    - b. Over-temperature protection shall provide a warning if power module temperature is less than 5°C below the over-temperature trip level.
  15. Input terminals shall be provided for connecting a motor thermistor (PTC type) to the VFD protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact.
  16. Digital and analog inputs shall be provided as outlined below:
    - a. Not less than six (6) digital inputs shall be provided, each of which can be independently programmed with function selections (run/stop, hand-off-auto, etc...). Inputs shall be designed for use with either the VFD's internal 24VDC supply or a customer-supplied external 24VDC supply.
      - 1) A minimum of three (3) form C relay contact outputs shall be provided. Outputs shall be independently programmable to activate with at least 30 function selections including operating conditions such as drive ready, drive running, reversed and at set speed, general warning and fault conditions, and adjustable supervision limit indications based on programmed values of operating speed, speed reference, current, torque, and PID feedback. Relay contacts shall be rated to switch 2 amps at 24VDC or 115VAC.

- b. A minimum of two (2) analog inputs shall be provided, selectable for either current or voltage input. Analog inputs shall have an inaccuracy of  $\leq 1\%$  of full scale in both current and voltage modes, and shall be independently programmable to provide signals including speed/frequency reference, torque reference or set point, PID set point and PID feedback/actual. Analog input signal processing functions shall include scaling adjustments, adjustable filtering and signal inversion.
- 17. If the input reference is lost, the VFD shall give the user the option of the following. The VFD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus:
  - a. Stopping and displaying a fault
  - b. Running at a programmable preset speed
  - c. Hold the VFD speed based on the last good reference received
  - d. Cause a warning to be issued, as selected by the user.
- 18. A minimum of two (2) 0/4-20 mA analog outputs shall be provided. The analog outputs shall be programmable to give an output signal proportional to frequency, motor speed, output voltage, output current, motor torque, motor power, DC bus voltage, active reference or other defined data
- 19. The VFD shall have at least six (6) programmable digital inputs (24VAC and 12-24VDC, PNP, or 5 pcs NPN) to connect to external devices, as follows:
  - a. All inputs can be configurable for PTC sensors
  - b. There shall be a programmable run permissive circuit.
  - c. Up to four (4) programmable free text interlock inputs shall be available
  - d. The VFD shall have at least one digital input configurable to receive a pulse signal up to 16 kHz
- 20. The VFDs shall have a safe torque off (STO) terminal integrated in the drive as a standard. The STO function will meet a safety integrity level (SIL) 3 and a performance level (PL) e. This function will be certified by a third party approval agency, e.g. TUV Nord.
- 21. The VFDs shall be capable of communicating with other VFDs or controllers via a serial communications link. A variety of communications interface modules for the typical overriding control systems shall be available. Interface modules shall be available for a wide selection of protocols.
  - a. If provided, interface modules shall mount directly to the VFD control board or be connected via fiber optic cables to minimize interference and provide maximum throughput. I/O shall be readily accessible through the serial communications adapter. Serial communication capabilities shall include, but not be limited to:
    - 1) Run-Stop control
    - 2) Hand-Off-Auto Control
    - 3) Speed Adjustment
    - 4) PID (proportional/integral/derivative) control adjustments
    - 5) Current Limit
    - 6) Accel/decel time adjustments
  - b. A connection shall also be provided for personal computer interface. Software shall be available for VFD setup, diagnostic analysis, monitoring and control. The software shall provide real time graphical displays of VFD performance.
- 22. Operating and control functions shall be provided as outlined herein. The output frequency shall be adjustable between 0- 500Hz. Operation above motor

nameplate speed shall require deliberate programming changes to prevent inadvertent high-speed operation. Stop mode selections shall include coast to stop and ramp to stop.

- a. The VFD shall be capable of controlling deceleration of a load without generating an overvoltage fault caused by excessive regenerated energy. Overvoltage control on deceleration shall extend the ramp time beyond the programmed value to keep the amount of regenerated energy below the point that causes overvoltage trip.
  - b. The VFD shall be capable of starting a rotating motor with or without existing magnetic flux on the motor regardless of the motor direction. The time the start signal is given to the VFD to the time the VFD has control of the motor shall not exceed two (2) seconds. Once the VFD has control of the motor it will then accelerate or decelerate the motor to the active reference speed without tripping or faulting or causing component damage to the VFD. The VFD shall also be capable of flux braking at start to stop a reverse spinning motor prior to ramp.
  - c. The VFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
  - d. Control functions shall include two (2) sets of acceleration and deceleration ramp time adjustments with linear and an S-curve ramp time selection. The speed control functions shall include:
    - 1) Adjustable min/max speed limits
    - 2) Selection of up to 7 preset speed settings for external speed control
    - 3) Three sets of critical speed lockout adjustments
    - 4) A built-in PID controller to control a process variable such as pressure, flow or fluid level.
  - e. Functions shall include energy optimization for optimizing efficiency and limit the audible noise produced by the motor by providing the optimum magnetic flux for any given speed / load operating point.
  - f. VFDs will be capable of sensing a loss of load and signal the loss of load condition. The VFDs shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for VFD acceleration from zero speed without signaling a false underload condition.
  - g. Three (3) programmable critical frequency lockout ranges shall be provided to prevent the VFD from operating the load continuously at an unstable speed.
  - h. The VFD shall offer software to select the VFDs action in the event of a loss of the primary speed reference.
23. Authorized factory start-up shall be provided for each VFD by a factory authorized service center. A certified start-up form shall be filled out for each VFD with a copy provided to the owner, and a copy kept on file at the manufacturer. The factory will extend the normal warranty for the VFD with a certified factory start-up.
- a. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally

available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free-line.

- b. With a authorized start-up, warranty shall be 24 months from the date of start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time, and expenses.

## **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 11217

### PACKAGED LIFT STATION

#### PART 1 GENERAL

##### 1.1 SUMMARY

###### A. Description:

1. The Contractor shall furnish, install, test and place in satisfactory operation, as shown on the Plans and specified, two (2) 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 for the Grit Wash Lift Station. The existing Drain Lift Station will be retrofit with two (2) wet-pit, chopper pump(s) and related accessories in the existing concrete wet well, 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. Some 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 or 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 or 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. Wetwell 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. A full-diameter wet well cover with integral access cover shall be provided. The cover shall be fabricated of aluminum, rated for a minimum of 300 PSF live load, and shall bolt to the top of the fiberglass wet well 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 a stainless steel 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. Vaughan
  2. Pentair
  3. Ebara
  4. Barnes
  5. KSB
  6. 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.
  4. The pump manufacturer must be certified to ISO 9001:2015 and ISO 14001:2015 by an accredited certification agency
- 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 304 stainless-steel cable capable of lifting loads 5 times greater than actual pumping unit weight. In lieu of lifting cable, 304 stainless steel lifting chain may be provided, if intermediate lifting links are provided every 24-36" along the length of the chain, to facilitate ease of pump removal from the wet well.
  2. Intermediate lifting links shall be round, with a 2-1/4" inside diameter every two feet. The link will allow for sliding a pinch bar through the link to pick up the chain, more than once if necessary, at multiple intervals during pump removal and installation.
- 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. Units shall be furnished with a discharge elbow and a 125# flat face ANSI flange.
  2. Exposed nuts or bolts of 304 stainless steel construction.

3. Internal and external surfaces are prepared to SPPC-VISI-SP-3-63 then coated with a zinc-chromate primer. External surfaces are coated with Hi-Build TNEMEC series 46H-413 Coal Tar paint.
4. Metal to metal contact sealing design on machined surfaces between pump volute and the base elbow system.
5. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Machining and fitting shall be such that sealing is accomplished by automatic compression of O-rings in two planes and O-ring contact is made on four surfaces.
6. A hoisting bail of AISI 304 stainless steel 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.
7. The combined pump rotor and shaft assembly shall be dynamically balanced for vibration-free operation.

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.
4. Cooling fluid shall be propylene glycol, circulating inside the cooling jacket. Cooling systems utilizing sewage as a cooling fluid shall not be allowed.

H. Cable Entry Seal:

1. The cable entry system shall comprise of primary, secondary, and tertiary sealing methods.
2. The primary seal shall be achieved by an NBR tapered elastomeric grommet compressed between the cable gland, cable housing, and 304SS washers.
3. Secondary sealing is accomplished with a compressed O-ring made of NBR material. Compression and subsequent sealing shall preclude specific torque requirements.
4. Tertiary sealing shall be provided to prevent leakage into the motor housing due to capillary action through the insulation if the cable is damaged or cut. Cable wires shall be cut, stripped, re-connected with a copper butt end connector, and embedded in epoxy within the cable gland, providing a dead end for leakage through the cable insulation into the motor junction area.
5. Cable entry junction chamber and motor sealed from each other.
6. Motor cable shall be a single eight core cable containing both power and sensor conductors. The cable jacket shall be manufactured of an oil resistant chlorinated polyethylene (CPE) rubber material, designed for submerged applications. Cable shall be Type RHW-2 / RW90, 90°C, 600V, UL/CSA Listed, & NEC/CEC approved for wet locations. Cable shall be watertight to a depth of at least 65’.

I. Motor:

1. NEMA B, induction type with squirrel cage rotor, shell type design, housed in air-filled watertight chamber and built to NEMA MG-1, Design B specifications. Oil filled motor designs are not considered acceptable.

2. Stator windings shall be copper, insulated with moisture resistant Class H 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. Other means of securing the stator requiring the use of keys, pins, bolts, or any other penetration of the motor housing shall not be considered acceptable.
6. Motor designed for continuous duty while handling pumped media up to 104°F.
7. Motor designed to withstand no less than 20 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. Provide pump monitor relays as outlined herein.
10. Junction chamber sealed from stator housing containing a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The junction chamber shall be sealed off from the stator housing with O-rings and packing and contain a terminal board mounted on a DIN rail for simple connection of the cable conductors to the motor stator and sensor leads. The use of wire nuts or crimp-type connectors is not acceptable.
11. Motor service factor of 1.15.
12. Motor voltage and frequency tolerance of +/- 10% and 5%, respectively.
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, and able to operate at full load for up to 30 minutes while unsubmerged without damage to the unit.
15. Motor and cable capable of continuous submergence underwater without loss of watertight integrity up to and including to a depth of 65 feet.
16. Motors shall meet efficiency standards in accordance with IEC 60034-30, level IE3. Motor rating tests shall be conducted in accordance with IEC 60034-2-1.

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 silicon-carbide ring.
3. Upper secondary seal, located between seal chamber and seal inspection chamber, containing one stationary ceramic and one positively driven carbon rotating 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. Lubricant shall be polypropylene glycol or oil bath design.
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. Mechanical float 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 body and float shall be a polypropylene material with a 316SS stopper.
6. The seal system shall not rely on a pumping medium for lubrication.
7. Pump manufacturer shall provide a monitor relay for each pump, for installation in the pump control panel. Relays shall continuously monitor the status of the motor thermostats and the internal leakage sensor described herein, and shall be designed to provide dry contacts for integration with the control panel's indicating pilot lights and alarm indication.
8. Monitor relays shall continuously apply a low voltage DC signal to the motor thermal sensor to check status. If the unit detects that the thermal sensor contacts are closed (i.e., normal condition), the overtemperature indication remains off, and the overtemperature relay is energized, closing the contacts between the designated terminal connections.
9. If the motor thermal sensor contacts open (i.e., overtemperature condition), the overtemperature indication is turned on, and the alarm relay is de-energized, opening the contacts between the designated connections.
10. When the high motor temperature condition has cleared, the unit will reset based on the position of alarm reset mode select switch (auto or manual). When in the auto position, the overtemperature alarm resets automatically. If the switch is in the manual position, the overtemperature reset pushbutton must be pushed for approximately 1.5 seconds to clear the alarm.
11. The unit shall also continuously apply a low voltage DC signal to the leakage sensor to check its status. If the unit detects that the leakage sensor contacts are closed (i.e., normal condition), the seal leakage indication remains off, and the leakage relay is energized, closing the contacts between the designated connections.
12. If the leakage sensor contacts open (i.e., seal leakage condition), the seal leakage indication is turned on and the leakage alarm relay is de-energized, opening/closing the contacts between the designated terminal connections.
13. Monitor relays shall be installed in the pump station control panel specified herein, and wired for operation as specified.

L. Pump/Motor Shaft:

1. Single piece unit, ASTM A479 S43100-T or AISI 403 stainless steel.

M. Impeller:

1. ASTM A-48 Class 35 grey cast iron, dynamically balanced, non-clog swept-open back-swept design.

2. Mechanically self-cleaned automatically upon each rotation as passing across spiral groove located on volute suction.
3. The impeller shall be dynamically balanced and shall be designed for solids handling with a long thru let 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 otherwise clog the pump.
4. Impeller capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. Impeller design shall include back pump out vanes to reduce the pressure and entry of foreign materials into the mechanical seal area. In addition, a lip seal shall be located behind the impeller hub to further reduce the entry of foreign materials into the seal area.
5. Impellers shall be slip fit, 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.
7. Pump design shall include a replaceable cast iron suction cover. The impeller and suction cover shall be designed such that it may be adjusted to maintain working clearances and hydraulic efficiencies. The combination of a guide pin at the suction cover and the slot on the surface of the suction cover lead foreign material out to the discharge side of the casing to avoid clogging.

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 30 grey cast iron, ANSI class 125-pound flange, coated with coal tar epoxy.
2. Each pump shall be furnished with a submersible discharge connection system to permit 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 lowered into place. The connection shall be metal-to-metal without the use of gaskets, O-rings, or grommets. The base elbows shall be mounted in the sump as shown on the Plans.
3. Design shall include two (2) 304SS 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 below the hatch opening, (refer to project drawings). Intermediate guide brackets are recommended for guide rail lengths greater than 20 feet.

4. The QDC shall be designed to adequately support the guide rails, discharge piping, and pumping unit under both static and dynamic loading 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.
5. The pump design shall include an integral self-aligning sliding bracket. Sealing of the pumping unit to the QDC shall be accomplished by the single linear downward motion of the pump. The entire weight of the pump unit shall be guided to and wedged tightly against the inlet flange of the QDC, making metal to metal contact with the pump discharge forming a seal without the use of bolts, gaskets or O-rings. Systems that require the use of gaskets, O-rings, or grommets shall not be acceptable.
6. The contractor shall provide two lengths of Schedule 40 304L stainless steel guide rail pipes for each pump. Guide rails shall be unspliced (unless the wet well depth exceeds twenty feet), and rail size shall be specified by the pump manufacturer.
7. All bolts, machine screws, nuts, washers, and lock washers for complete assembly of guide rail assembly, discharge elbow (QDC), and discharge piping located within the wet well shall be 304 stainless steel or better.

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 recommended by the pump manufacturer. 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. All submersible pumps provided for this project shall be the size/type as described herein. 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: The design characteristics are summarized as follows:

**Grit Wash Lift Station**

Design Conditions:	180 GPM @ 21' TDH
Minimum Hydraulic Efficiency at Design Point:	54%
Electrical Service:	460 V/ 3Ø/ 60Hz
Motor HP:	3 HP
Maximum Operating Speed:	1800 RPM
Discharge Elbow Size:	3-inch
Impeller Design:	Non-clog centrifugal

### Existing Drain Lift Station

Design Conditions:	400 GPM @ 30' TDH
Minimum Hydraulic Efficiency at Design Point:	55%
Electrical Service:	460 V/ 3Ø/ 60Hz
Motor HP:	10 HP
Maximum Operating Speed:	1160 RPM
Discharge Elbow Size:	6-inch
Impeller Design:	3-blade chopper

- 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/contactors 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, overtemp) 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 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:

<b>Controls:</b>	<b>Status:</b>	<b>Alarms:</b>
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 +/- 1/2% 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  $\pm 7$  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:

<b>Actuator Identification</b>	Existing Clarifier 1 WAS Valve (Alternate)	Existing Clarifier 2 WAS Valve (Alternate)	Headworks Bypass Valve 1 (Alternate)	Headworks Bypass Valve 2 (Alternate)
<b>Service Condition</b>	On-Off Service	On-Off Service	On-Off Service	On-Off Service
<b>Electric Service</b>	480 V – 3 Phase – 60 Hz	480 V – 3 Phase – 60 Hz	480 V – 3 Phase – 60 Hz	480 V – 3 Phase – 60 Hz
<b>Actuated Valve Size and Configuration</b>	12-inch Plug Valve	12-inch Plug Valve	16-inch Plug Valve	16-inch Plug Valve
<b>Installation Max Differential Pressure</b>	20 psi	20 psi	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

### MECHANICALLY CLEANED FILTER SCREEN

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Contractor shall furnish all labor, equipment, materials, tools, and incidental items required to install and place into proper operation one (1) mechanically cleaned filter screen(s) and one (1) screenings washer/compactor(s) specified in Section 11332. All equipment shall be installed as shown on the plans, as recommended by the supplier, and in compliance with all local, state, and federal codes and regulations.
- B. Each screen shall be furnished complete with filter panels, discharge chute, side frames, covers, drive chains, sprockets and bearings, drive motor, gear reducer, anchor bolts, controls for operation of the screen and associated screenings washer/compactor and all accessories and appurtenances specified or otherwise required for a complete and properly operating installation.
- C. Screen(s), Washer/compactor(s) and Controls shall be supplied by a single manufacturer to ensure compatibility and proper operation of the system.
- D. Contractor shall be responsible for coordination of all related parts of the work. The contractor shall verify all structures, piping, wiring, and components are compatible. Contractor shall be responsible for all structural and other alterations required to accommodate equipment differing in dimensions or other characteristics from these specifications and drawings.

##### 1.2 RELATED SECTIONS

- A. General Conditions, Supplementary Conditions, and General Requirements sections apply to work of this Section.
- B. Section 01300 – Submittals
- C. Section 03300 – Concrete
- D. Section 05500 – Miscellaneous Metals
- E. Section 09900 – Special Coatings and Painting
- F. Section 11332 – Screenings Washer/Compactor
- G. Division 16 – Electrical

### 1.3 SUBMITTALS

- A. Provide shop drawings and product data in accordance with section 01300 for the equipment being furnished, to include at minimum the following:
  - 1. Certified shop drawings showing the details of construction, dimensions and anchor bolt requirements.
  - 2. Complete wiring diagrams detailing all required field connections.
  - 3. Descriptive literature, brochures, and/or catalogs of submitted equipment.
  - 4. Headloss calculations showing the ability of the screen to meet the flow and headloss requirements as specified in Table 2.2.B.
  - 5. Complete bill of materials for the equipment.
  - 6. List of Manufacturer's supplied spare parts.
  - 7. Manufacturer's ISO 9001:2015 certificate of registration
  - 8. Equipment weights.
  - 9. A copy of Manufacturer's 3-year factory warranty.
  
- B. The manufacturer shall furnish operation and maintenance manuals in accordance with the requirements of section 01430 – Operation and Maintenance Manuals, to include at minimum the following:
  - 1. Short and long term storage requirements.
  - 2. Manufacturers unloading instructions.
  - 3. Manufacturer's installation instructions
  - 4. Equipment weights and lifting points.
  - 5. Complete wiring diagrams detailing all required field connections.
  - 6. Assembly drawings
  - 7. Maintenance schedule
  - 8. Maintenance instructions

### 1.4 REFERENCE STANDARDS

- A. American Iron and Steel Institute (AISI).
- B. American National Standards Institute (ANSI).
- C. American Society for Testing Materials (ASTM).
- D. American Bearing Manufacturers Association (ABMA).
- E. American Gear Manufacturers Association (AGMA).
- F. National Electrical Manufacturers Association (NEMA).
- G. Underwriters Laboratory (UL).

### 1.5 QUALITY ASSURANCE

- A. Qualifications: Qualified Manufacturers shall have a minimum 15 years' experience manufacturing screens, with no fewer than 20 operating installations of the type specified herein located in the USA. Manufacturer shall provide a list of 20 names and dates of installations for verification by the Engineer or Owner's Representative.

- B. A single manufacturer shall provide all components including but not limited to the screen, motors, gear reducers and control panels as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.
- C. Screen shall be Manufacturer's standard product and only modified as necessary to comply with the drawings, specifications, and specified service conditions. Equipment manufactured outside the United States, or by third parties, shall not be permitted for this project. The equipment manufacturer shall supply a certificate of origin and letter of compliance confirming both requirements.
- D. All welding shall be performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code.
- E. Screen shall undergo a passivation process to ensure maximum resistance to corrosion. All stainless steel surfaces shall be thoroughly cleaned and glass bead-blasted to a minimum SSPC-SP-6 finish. The use of nitric and hydrofluoric acid passivation is not acceptable due to the negative impact these chemicals have on the environment.
- F. Manufacturer shall warranty all equipment against faulty or inadequate design, improper assembly, defective workmanship or materials. Materials shall be suitable for the service conditions.
- G. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practices. The fabrication shall be performed by the equipment manufacturer at the manufacturer's facility located within the continental USA; all welding and assembly shall be performed by direct employees of the manufacturer; each welder shall be certified in accordance with AWS or ASME. Welder certificates shall be provided to the Engineer upon request.
- H. All structural members of the equipment shall be designed for shock and vibratory loads. Additionally, the screen shall be designed to withstand the forces generated by maximum operating head without damage to the screen or its components.
- I. Each screen shall have the Manufacturer's name, address, and product identification information on a corrosion resistant nameplate securely affixed to the equipment.
- J. Screen manufacturer shall be ISO 9001:2015 certified and provide the Engineer with a copy of a valid certificate of registration. Equipment suppliers not utilizing ISO 9001 manufacturing facilities shall not be considered or approved for this project.
- K. All control panels shall be fabricated and tested in the manufacturer's UL Authorized control panel shop. The equipment manufacturer shall supply a certificate of conformance confirming this requirement.

## 1.6 WARRANTY

- A. The equipment shall be warranted by the manufacturer for a period of three (3) years from the date of shipment. Additionally, the lower sprocket bearings shall include a (5) year warranty period from the date of shipment.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Shipping:
  - 1. Ship equipment, material, and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
  - 2. Pack spare parts in containers bearing labels clearly designating contents and equipment for which they are intended.
- B. Receiving and Storage:
  - 1. Store and safeguard equipment, material, and spare parts. All spare parts must be stored in accordance with manufacturer's recommendations.

## 1.8 OPERATION AND MAINTENANCE MANUALS

- A. The manufacturer shall furnish operation and maintenance manuals in accordance with the requirements of section 01430 – Operation and Maintenance Manuals.

## **PART 2 PRODUCTS**

### 2.1 MECHANICALLY CLEANED FILTER SCREEN EQUIPMENT

- A. Manufacturers:
  - 1. Kusters
  - 2. Parkson
  - 3. Andritz
  - 4. Substitutions: Section 01600 - Product Requirements.
- B. GENERAL DESIGN REQUIREMENTS
  - 1. The mechanically cleaned filter screen shall be a self-contained screening system designed to positively clean and remove debris from the influent flow stream and transport the retained debris to the discharge point. The screen system shall be fully automated and controlled by the manufacturer supplied control system.
  - 2. The screen shall be mounted by fastening to the top of the channel. Routine service, repair or replacement of damaged parts, shall be possible with the screen in the channel. The screen shall be designed so that maintenance of the drive mechanism can be accomplished at operating floor level. Screen elements shall be capable of removal at the operating level without taking the screens out of the channel or affecting the continuous or intermittent rotation of the screen.
  - 3. The screen shall be designed to provide maximum solids filtration, and thus maximize capture of debris, while minimizing the rate of head loss increase through the screen. This shall be achieved by means of one piece perforated curved filter elements arranged to form a continuous filter belt. The one piece curved screening elements shall be minimum 1/8" thick and fixed by four fasteners to a heavy duty box link drive chain. The use of roller chain or filter shafts and rollers will not be acceptable.
  - 4. The chains shall be driven by sprockets mounted to a solid drive shaft which shall be mounted in externally mounted bearings and driven by a shaft mounted motor-driven gear unit.

5. The screen shall be automatically self-cleaning through the interaction of the one piece filter elements with a rotating cleaner brush and the use of spray water for supplementary cleaning. Screens which use a spray water cleaning system only will not be accepted due to the high volume of water required for proper cleaning.
6. A rotating deflector consisting of a tube roller and wiper supported by externally mounted bearings shall be provided at the discharge point of the screen. The roller shall function to direct all solids removed from the screen by the revolving brush cleaner to the screenings discharge chute and shall prevent bypassing of solids into the downstream channel. Screens which do not incorporate a rotating deflector shall not be acceptable.
7. Stainless steel channel seals shall be provided and mounted to the channel walls to seal the vertical gaps between the channel wall and the screen side frames. The channel seals shall not require the use of rubber, plastic, or other non-metallic materials to form a positive seal
8. The Contractor shall be required to make any necessary modifications to the existing concrete channel walls and floor, and to the operating floor curb, to accommodate the equipment furnished. The manufacturer shall ensure the manufacturer furnished seals at the channel walls and floor are properly mounted to redirect influent flow into the screen and prevent screenings from passing between the concrete walls and screen side frames.

#### C. DESIGN CRITERIA

Maximum Flow:	6.0 MGD
Channel Width:	3.0 ft.
Channel Depth:	3.67 ft.
Channel Floor Pocket Depth:	6.0 in.
Filter Panel Perforation:	6.0 mm
Downstream Water Level at Maximum Flow:	1.14 ft.
Headloss at Maximum Flow:	10.84 in.
Headloss at Maximum Flow and 30% Blinding:	15.57 in.
Maximum Upstream Water Level:	2.44 ft.
Channel Invert to Operating Floor Depth:	3.67 ft.
Screen Discharge Height:	4.00 ft.
Screen Incline from Horizontal:	75 degrees
Screen Motor Horsepower:	Minimum 3 HP
Brush Motor Horsepower:	Minimum 2 HP
Deflector Motor Horsepower:	Minimum 1/2 HP
Side Frame Material / Thickness:	304L Stainless Steel / 3/16 in.
Guide Track Material:	304L Stainless Steel
Filter Panel Material:	304L Stainless Steel
Sprocket/Guide Material:	304L Stainless Steel
Chain material:	316 Stainless Steel
Fastener Material:	316 Stainless Steel
Wash Water Flow Rate:	7 gpm @ 40 psig
Ball Valve Material:	Bronze Body, Stainless Steel Ball
Solenoid Valve Material:	Bronze
Strainer Material:	316 Stainless Steel Body & Screen
Operational Environment:	Class I, Div. I
Operational Voltage:	460V/3ph/60Hz

Control Panel NEMA Rating:  
Local Station NEMA Rating:

NEMA 4X, Stainless Steel  
NEMA 4X, Stainless Steel

D. PERFORMANCE AND DESIGN REQUIREMENTS

1. Each screen shall be capable of processing the specified peak flow of municipal wastewater with the specified amount of freeboard when installed in the channel at a screen inclination as noted in paragraph 2.1C. The screen shall lift and discharge screenings at an elevation as specified in paragraph 2.1C into the discharge chute.
2. The maximum upstream water level shall not exceed that specified in paragraph 2.1C. The screen shall be capable of processing the peak flow without exceeding the maximum upstream water level based on a 30% reduction (blinding) of the screens free open area.
3. All parts shall be designed and manufactured so the screen structure can withstand the hydraulic force exerted by the maximum water depth. All structural and functional parts shall be adequately sized to prevent deflection and vibration which could impair screen operation.
4. All components shall be so designed that jamming at any point will not result in structural failure but will cause the drive motor to stall. All components, including the gear reducer, shall be designed to withstand, without damage or permanent distortion, the full stalling torque of the drive motor and/or the maximum differential head at any water depth.
5. The screen shall include a pivoting support arrangement to pivot the screen from the channel. The pivot will be attached to the screen frame and top of the channel to allow the screen to be pivoted following the removal of the inlet hopper of the downstream screenings receiving device. It will not be necessary to disassemble or move the downstream screenings receiving device from its fixed position to allow pivoting of the screen.

E. SCREEN COMPONENTS

1. Screen Frame Assembly
  - a. The screen frame shall be provided and designed to support all required static and dynamic loads.
  - b. Screen frame shall be made of the material and thickness specified in paragraph 2.1C.
  - c. The side frames shall be connected with each other through engineered structural support members and shall be of welded construction. Screen frames utilizing bolted construction of the frame assembly shall not be acceptable.
  - d. Each side frame shall include a separate chain guide track to guide and support the drive chains. The tracks must support both the upstream and downstream chain lengths and be welded to the side frames. The guide tracks shall be made of material as specified in paragraph 2.1C.
  - e. The side frames shall incorporate adjustable UHMW-PE side seals to provide a sliding seal between the filter panel side plates and the screen frame. The side seals shall be adjustable to compensate for any wear that may occur over the life of the screen.
  - f. A curved stainless steel deflector plate shall be provided at the foot of the screen to prevent ingress of stones and grit that create wear on the filter panels. A lateral seal element consisting of a full width brush and neoprene

flap shall be attached to the curved deflector plate to seal the gap between the screen frame and the channel floor as well as the gap between the deflector plate and the filter panels.

2. Filter Belt

- a. The screen filtration belt shall be comprised of one piece perforated plate filter panels. The panels shall be curved to prevent deflection. Panel design shall limit the maximum opening as specified in paragraph 2.1C in any direction.
- b. The one piece curved screening elements shall be minimum 1/8" thick and fixed by four fasteners to the heavy duty drive links. The panels shall incorporate integral stainless steel side plates which are welded to the panel for durability and to prevent material from bypassing the panel. Screen panels which are not curved, that incorporate removable side plates, or are manufactured with slots or a bar type grid shall not be acceptable.
- c. On every fifth screen panel a set of static 'finger' type lifters shall be attached to the lower edge of the panel, designed specifically to lift spherical and large size solids (stones, cans, bottles, rag clumps, etc.) from the bottom of the channel. Screen panels formed with ledges, lifters located on the panel other than the lower edge, or hook type lifters shall not be acceptable.
- d. The horizontal space between adjoining screen panels will not exceed 1.0 mm at any point between adjacent panels. If more than 10% are greater than this dimension the screen will not be accepted until the manufacturer has corrected the problem.
- e. The screen elements shall be cleaned by a motorized polypropylene bristle brush. The brush shall be adjustable such that as the brush wears during use, it can be manually adjusted to increase cleaning efficiency. The brush shall be driven independently with a single speed motor coupled to a shaft-mounted gear reducer.

3. Wash Water System

- a. To control the buildup of biological slimes behind the screen panels, an internal spray water wash bar will be provided, manufactured from material as specified in paragraph 2.1C.
- b. The spray bar will be attached in the internal space between the moving screen panels, and the spray water will be directed to wash each screen panel as the panel moves past the spray nozzles.
- c. The spray bar will supply approximately 3 gpm per ft. of screen panel width at a pressure as specified in paragraph 2.1C.
- d. The spray nozzles will be non-plugging and suitable for use with treated effluent water.
- e. A minimum 1" NPT connection will be located on one side of the screen frame above the operating floor level.
- f. A control solenoid valve, flow adjustment ball valve and incoming plant water strainer shall be supplied for installation by the Contractor.
- g. The wash water flow and minimum pressure requirements shall be as noted in paragraph 2.1C.
- h. Solenoid valves shall be 1-inch, minimum, suitable for 120 VAC operation and shall be UL rated for the operational environment as specified in

- paragraph 2.1C. Solenoid valves shall be normally closed and rated for up to 100 psig.
- i. Ball valves shall be 1-inch, minimum, with stainless steel ball, stem and Teflon seats.
  - j. A Y-strainer with replaceable stainless-steel internals shall be provided for the incoming plant water supply. Y-strainer shall be 1-inch, minimum.
4. Chains
- a. Drive chains for the screen panels shall be box link type chains manufactured using the material specified in paragraph 2.1C. Each chain shall have a minimum breaking load of 20,000 lbf.
  - b. Chain with non-stainless steel components will not be accepted.
  - c. The chain shall be guided by the guide tracks mounted on each side frame.
  - d. Each guide track shall incorporate a replaceable 2" wide x 1.5" thick UHMW-PE chain support to prevent metal on metal wear.
5. Upper Bearings and Drive Sprockets
- a. The screen shall be provided with upper drive sprockets with 5 teeth and a nominal pitch diameter of 13". The sprockets shall have a minimum plate thickness of 1".
  - b. The sprockets shall be two piece design and be bolted to the drive hubs allowing the sprockets to be changed without removal of the drive hubs or drive shaft bearings. Designs that do not incorporate a split sprocket design will not be acceptable.
  - c. Sprockets shall be fabricated from material as specified in paragraph 2.1C.
  - d. The drive shaft shall be a solid shaft which shall be manufactured using the material specified in paragraph 2.1C.
  - e. The drive shaft shall be supported on each side by an externally mounted, grease lubricated bearings.
  - f. Upper bearings shall be ball bearings, greased, and protected by double seals. The bearing diameter shall be a minimum of 2-3/8" and mounted in oil-resistant, enamel coated casings supported by a stainless-steel take-up frame.
6. Lower Chain Guides
- a. The screen shall be provided with lower revolving sprocket/guides with 5 teeth and a nominal pitch diameter of 13". The sprocket/guides shall have a minimum plate thickness of 1". The sprocket/guides shall maintain accurate alignment of the screen chain and elements.
  - b. The lower guides will be mounted on two stub shafts bolted to the screen side frames and shall incorporate high performance metallic bushings that can be lubricated from the operating floor.
  - c. Non-Metallic lower bushings shall not be accepted.
7. Discharge Chute
- a. A discharge chute shall be provided that fully encloses the discharge section of the screen. The discharge chute shall be made of minimum 14 ga. stainless steel.
  - b. The height of the discharge chute shall be as specified in paragraph 2.1C and shall allow proper discharge into the screenings receptacle.
  - c. The discharge chute shall contain inspection ports on each side and shall pivot away from the screen frame for access to the cleaning brush.
8. Guards and Covers



- a. The portion of the screen above the operating floor level shall be provided with easily removable, properly stiffened stainless-steel covers.
  - b. The covers shall fully enclose the screen to provide safety and to contain odors. The covers will allow ready access for maintenance to the equipment.
  - c. The covers shall be removable to facilitate visual observation by maintenance personnel when required.
9. Screen Drive Assembly
- a. The screen shall be driven by a heavy-duty, shaft-mounted helical worm gear reducer. The gear reducer shall be sized to provide the proper input power and torque to operate the screen and be rated for greater than the nominal horsepower of the drive motor.
  - b. The gear reducer shall be driven by an inverter duty electric motor. The motor shall be UL rated for the operational environment as specified in paragraph 2.1C. The motor shall be rated for a minimum horsepower and voltage as specified in paragraph 2.1C, with a minimum service factor of 1.0.
10. Brush Drive Assembly
- a. The screen cleaner brush shall be driven by a heavy-duty, shaft-mounted helical worm gear reducer. The gear reducer shall be sized to provide the proper input power and torque to operate the screen and be rated for greater than the nominal horsepower of the drive motor.
  - b. The gear reducer shall be driven by an inverter duty electric motor. The motor shall be UL rated for the operational environment as specified in paragraph 2.1C. The motor shall be rated for a minimum horsepower and voltage as specified in paragraph 2.1C, with a minimum service factor of 1.0.
11. Rotating Deflector Drive Assembly
- a. The rotating deflector shall be driven by a heavy-duty, shaft-mounted helical worm gear reducer. The gear reducer shall be sized to provide the proper input power and torque to operate the screen and be rated for greater than the nominal horsepower of the drive motor.
  - b. The gear reducer shall be driven by an inverter duty electric motor. The motor shall be UL rated for the operational environment as specified in paragraph 2.1C. The motor shall be rated for a minimum horsepower and voltage as specified in paragraph 2.1C, with a minimum service factor of 1.0.

## 2.2 CONTROLS AND INSTRUMENTATION

### A. GENERAL

- 1. Refer to Specification Section 16480 (“Manufactured Control Panels”) for additional control panel requirements.
- 2. Each control panel shall be the supplier’s standard UL listed enclosure and wired for the voltage as specified in paragraph 2.1C. The enclosure shall be furnished completely pre-wired and tested, requiring only mounting and connection to field mounted electrical devices. The control panel shall include all equipment required to control the equipment specified herein and the washer/compactor specified in Section 11332.

3. The control panel enclosure shall be as specified in paragraph 2.1C and suitable for wall mounting. The enclosure shall house all control devices required for a complete and operable system. All hinges and latches shall be corrosion resistant.
4. A separate local control station in an enclosure as specified in paragraph 2.1C shall be provided. The local control station shall include an emergency stop, red, mushroom head pushbutton.
5. Provide a single control panel for the operation of the Mechanically Cleaned Filter Screen (Section 11331) and the Screenings Washer and Compactor (Section 11332).
6. Panel shall be rated for 480V, 3Phase.
7. Panel shall be NEMA 4X stainless steel and UL508A listed and labeled.

**B. CONTROL DEVICES**

1. Main Breaker
2. Door mounted through the door disconnect switch with lockable handle
3. Pilot devices shall be mounted on the front of the enclosure door.
4. Indicator lights shall be LED type.
5. Selector switches shall be heavy duty NEMA type.
6. Control transformer shall be protected by two (2) primary fuses and one (1) secondary circuit breaker. The 120-volt secondary shall have one leg grounded.
7. Auxiliary relay contacts shall be included for signal outputs. The contacts shall be rated 10 amp, 240 VAC, resistive load.

**C. SAFETY FEATURES**

1. If a power failure occurs while the equipment is running, operation shall resume when power is restored.
2. If a power failure occurs while the equipment is in a fault condition, the fault indicator shall reactivate when power is restored.
3. Short-circuit protection requires that a properly sized circuit breaker be provided by the Electrical Contractor.
4. Control reset shall be from the main control panel only.

**D. COMPONENTS**

1. Controller
  - a. Allen Bradley MicroLogix 1400 PLC.
  - b. Allen-Bradley PanelView 800, 7" color flat panel touch screen.
2. Over Torque Protection
  - a. Tsubaki Shock Relay Model TSBSS (Screen drive and Brush drive).
3. Operation Controls
  - a. Control Power: OFF/ON switch
  - b. Alarm reset: Pushbutton
  - c. Emergency Stop: Push to stop, pull to run pushbutton
  - d. Compactor: HAND/OFF/AUTO selector switch
  - e. Compactor: REVERSE/OFF/FORWARD selector switch
  - f. Compactor Wash Zone Water: OPEN/CLOSED/AUTO selector switch
  - g. Screen Wash Water: OPEN/CLOSED/AUTO selector switch
  - h. Screen: HAND/OFF/AUTO selector switch
  - i. Screen: SLOW/FAST selector switch
  - j. Brush: HAND/OFF/AUTO selector switch
  - k. Deflector: HAND/OFF/AUTO selector switch

4. Indicator Lights
  - a. Control power on: White pilot light
  - b. Screen Running
  - c. Screen Fault
  - d. Brush Running
  - e. Brush Fault
  - f. Deflector Running
  - g. Deflector Fault
  - h. Compactor Running
  - i. Compactor Fault
  - j. Screen Wash Water Active
  - k. Compactor Wash Water Active
5. Dry Contacts
  - a. System (all selector switches) In-Auto
  - b. Wash Zone Active
  - c. Spray Wash Active
  - d. Screen Running
  - e. Screen Fault
  - f. Brush Running
  - g. Brush Fault
  - h. Deflector Running
  - i. Deflector Fault
  - j. Compactor Running
  - k. Compactor Fault
  - l. High Level
  - m. E-Stop at Screen
  - n. E-Stop at Washer/compactor

E. LOCAL STATION

1. Screen
  - a. Emergency Stop: Push to stop, pull to run pushbutton

F. FIELD MOUNTED DEVICES

1. Level Control
  - a. Three (3) level alarm float switches

G. OPERATION

1. When in Automatic mode, the screen shall be started by the level float switches or a screen idle timer.
2. When a level float switch starts the screen, the screen will start, and an alarm signal will be sent by the control system. The screen will continue to run until the float switch no longer detects a level. Once below this level the screen will continue to run for the duration set in its off-delay timer and then stop.
3. If the screen has not been started by float signal and the screen idle timer elapses, the screen will start and run for the duration set in its off-delay timer and then stop.
4. If the over-torque sensor for the screen is activated during screen operation, indicating a jam, the screen will stop, and an alarm signal will be sent by the control system.
5. See Screenings Washer/Compactor (Section 11332-2.2) for additional requirements.

## 2.3 SOURCE QUALITY CONTROL

- A. Screen system and control panel shall be factory assembled and tested to ensure proper design and satisfactory operation. Equipment shall be shipped in the minimal practical number of pieces for minimal field assembly by the Contractor.
- B. 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.
- C. 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
- D. A certified shop test report shall be submitted to the Engineer.

## 2.4 SHOP PAINTING

- A. Stainless steel and other corrosion-resistant surfaces shall not be painted. Gearboxes, Motors, and other manufactured components will receive the manufacturer's standard weather and corrosion-resistant coating.

## 2.5 SPARE PARTS

- A. The following spare parts shall be provided:
  - 1. One (1) Replacement screen panel without lifter
  - 2. One (1) Replacement screen panel with lifter
  - 3. One (1) Set of rotating brushes
  - 4. One (1) Lower seal assembly
  - 5. Three (3) Fuses of each size and type used in the control panel

## **PART 3 EXECUTION**

### 3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify anchors are correctly positioned.

### 3.2 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.

### 3.3 INSTALLATION AND TESTING

- E. 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.
- F. 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.
- G. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.
- H. 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.
- I. 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.

### 3.4 OPERATOR TRAINING

- J. 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 11332

### SCREENINGS WASHER/COMPACTOR

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Contractor shall furnish all labor, equipment, materials, tools, and incidental items required to install and place into proper operation one (1) screenings washer/compactor(s) and one (1) mechanically cleaned filter screen(s) specified in Section 11331. All equipment shall be installed as shown on the plans, as recommended by the supplier, and in compliance with all OSHA, local, state, and federal codes and regulations.
- B. Each washer/compactor shall be furnished complete with inlet hopper, discharge pipe, shafted screw, drive motor, gear reducer, anchor bolts, supports, controls for operation of the washer/compactor and all accessories and appurtenances specified or otherwise required for a complete and properly operating installation.
- C. Washer/compactor(s), Screen(s) and Controls shall be supplied by a single manufacturer to ensure compatibility and proper operation of the system.
- D. Contractor shall be responsible for coordination of all related parts of the work. Contractor shall verify all structures, piping, wiring, and components are compatible. Contractor shall be responsible for all structural and other alterations required to accommodate equipment differing in dimensions or other characteristics from these specifications and drawings.

##### 1.2 RELATED SECTIONS

- A. General Conditions, Supplementary Conditions, and General Requirements sections apply to work of this Section.
- B. Section 01300 – Submittals
- C. Section 03300 – Concrete
- D. Section 05500 – Miscellaneous Metals
- E. Section 09900 – Special Coatings and Painting
- F. Section 11331 – Mechanically Cleaned Filter Screen
- G. Division 16 – Electrical

##### 1.3 SUBMITTALS

- A. Provide shop drawings and product data in accordance with section 01300 for the equipment being furnished, to include at minimum the following:

1. Certified shop drawings showing the details of construction, dimensions and anchor bolt requirements.
  2. Complete wiring diagrams detailing all required field connections.
  3. Descriptive literature, brochures, and/or catalogs of submitted equipment.
  4. Complete bill of materials for the equipment.
  5. List of Manufacturer's supplied spare parts.
  6. Manufacturer's ISO 9001:2015 certificate of registration
  7. Equipment weights.
  8. A copy of Manufacturer's 3-year factory warranty.
- B. The manufacturer shall furnish operation and maintenance manuals in accordance with the requirements of section 01430 – Operation and Maintenance Manuals, to include at minimum the following:
1. Short- and long-term storage requirements.
  2. Manufacturers unloading instructions.
  3. Manufacturer's installation instructions
  4. Equipment weights and lifting points.
  5. Complete wiring diagrams detailing all required field connections.
  6. Assembly drawings
  7. Maintenance schedule
  8. Maintenance instructions

#### 1.4 REFERENCE STANDARDS

- A. American Iron and Steel Institute (AISI).
- B. American National Standards Institute (ANSI).
- C. American Society for Testing Materials (ASTM).
- D. American Bearing Manufacturers Association (ABMA).
- E. American Gear Manufacturers Association (AGMA).
- F. National Electrical Manufacturers Association (NEMA).
- G. Underwriters Laboratory (UL).

#### 1.5 QUALITY ASSURANCE

- A. Qualifications: Qualified Manufacturers shall have a minimum 15 years' experience manufacturing screenings washer/compactors, with no fewer than 100 operating installations of the type specified herein located in the USA. Manufacturer shall provide a list of 25 names and dates of installations for verification by the Engineer or Owner's Representative.
- B. A single manufacturer shall provide all components including but not limited to the motors, gear reducers, inlet hopper and control panels as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.

- C. Washer/compactor shall be Manufacturer's standard product and only modified as necessary to comply with the drawings, specifications, and specified service conditions. Equipment manufactured outside the United States, or by third parties, shall not be permitted for this project. The equipment manufacturer shall supply a certificate of origin and letter of compliance confirming both requirements.
- D. All welding shall be performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code.
- E. Washer/compactor shall undergo a passivation process to ensure maximum resistance to corrosion. All stainless-steel surfaces shall be thoroughly cleaned and glass bead-blasted to a minimum SSPC-SP-6 finish. The use of nitric and hydrofluoric acid passivation is not acceptable due to the negative impact these chemicals have on the environment.
- F. Manufacturer shall warranty all equipment against faulty or inadequate design, improper assembly, defective workmanship or materials. Materials shall be suitable for the service conditions.
- G. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practices. The fabrication shall be performed by the equipment manufacturer at the manufacturer's facility located within the continental USA; all welding and assembly shall be performed by direct employees of the manufacturer; each welder shall be certified in accordance with AWS or ASME. Welder certificates shall be provided to the Engineer upon request.
- H. All structural members of the equipment shall be designed for shock and vibratory loads.
- I. Each washer/compactor shall have the Manufacturer's name, address, and product identification information on a corrosion resistant nameplate securely affixed to the equipment.
- J. Washer/compactor manufacturer shall be ISO 9001:2015 certified and provide the Engineer with a copy of a valid certificate of registration. Equipment suppliers not utilizing ISO 9001 manufacturing facilities shall not be considered or approved for this project.
- K. All control panels shall be fabricated and tested in the manufacturer's UL Authorized control panel shop. The equipment manufacturer shall supply a certificate of conformance confirming this requirement.

## 1.6 WARRANTY

- A. The equipment shall be warranted by the manufacturer for a period of three (3) years from the date of shipment.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Shipping:



1. Ship equipment, material, and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
  2. Pack spare parts in containers bearing labels clearly designating contents and equipment for which they are intended.
- B. Receiving and Storage:
1. Store and safeguard equipment, material, and spare parts. All spare parts must be stored in accordance with manufacturer's recommendations.

## 1.8 OPERATION AND MAINTENANCE MANUALS

- A. The manufacturer shall furnish operation and maintenance manuals in accordance with the requirements of section 01430 – Operation and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.1 SCREENINGS WASHER/COMPACTOR EQUIPMENT

- A. Manufacturers:
1. Kusters
  2. Parkson
  3. Lakeside
  4. Substitutions: Section 01600 - Product Requirements.
- B. GENERAL DESIGN REQUIREMENTS
1. The screenings washer/compactor system shall be designed to wash, compress and transport screenings to the screenings receptacle. The equipment shall be of the latest design and shall be fabricated of materials and in a fashion that will fully perform the functions described below.
  2. Wet screening shall enter the screenings washer inlet hopper through an enclosed connecting chute. The solids shall be washed and agitated to liquefy fecal matter and to facilitate its return to the influent channel. The connecting chute shall provide a completely closed system to protect operating personnel from exposure to wastes.
  3. Wet screenings with a minimum dry solids content of 5–10 percent shall enter the washer/compactor through the inlet hopper. Excess liquid shall exit through the perforated drainage holes in the bottom of the trough. Drainage of free flowing liquid shall be provided through the integral overflow outlet located beneath the trough. The rolling action provided by the Archimedean screw and the wash water system shall provide additional cleaning of the screenings before the compaction stage and an integral brush attached to the screw shall continuously clean the trough perforations. The screw shall transport all collected, washed and compacted screenings into the discharge pipe for conveyance to the drop off point.
  4. The Contractor shall be required to make any necessary modifications to the existing concrete channel walls, operating floor, operating floor curb and building walls to accommodate the equipment furnished as shown on the Contract Drawings.

### C. DESIGN CRITERIA

Peak Throughput Volume:	70 ft <sup>3</sup> /hr.
Fecal Matter Reduction:	>95%
Weight Reduction:	60 – 70%
Volume Reduction:	60 – 70%
Dryness After Compaction:	40 - 50%
Screw Diameter:	200 mm
Screw Material:	Hardox 400, 400 BHN
Anti-Rotation/Wear Bar Material:	Alloy steel, 340 BHN
Inlet Hopper Material:	14 ga., 304L Stainless Steel
Housing Material:	304L Stainless Steel
Discharge Pipe:	8 in. expanding to 12 in.
Discharge Pipe Material:	11 ga., 304L Stainless Steel
Screenings Discharge Height:	4.5 ft.
Trough Perforation Size:	5 mm
Drain Connection Size:	6" plain ended pipe
Drain Location:	Bottom
Motor Horsepower:	3 HP
Wash Water Connection Size:	1" NPT
Wash Water Flow Rate:	10 – 20 gpm @ 40 psig
Ball Valve Material:	Bronze Body, Stainless Steel Ball
Solenoid Valve Material:	Bronze
Strainer Material:	316 Stainless Steel Body & Screen
Operational Environment:	Class I, Div. I
Operational Voltage:	460V/3ph/60Hz
Control Panel NEMA Rating:	NEMA 4X, Stainless Steel
Local Station NEMA Rating:	NEMA 4X, Stainless Steel

### D. PERFORMANCE AND DESIGN REQUIREMENTS

1. Each washer/compactor shall be capable of processing the peak throughput volume of screenings as noted in paragraph 2.1C. The washer/compactor shall lift and discharge the washed and compacted screenings to the elevation as specified in paragraph 2.1C.
2. All parts shall be designed and manufactured so the washer/compactor structure can withstand the forces exerted compacting and transporting the screenings volume specified. All structural and functional parts shall be adequately sized to prevent deflection and vibration which could impair operation.
3. All components shall be designed so that jamming at any point will not result in structural failure but will cause the drive motor to stall. All components, including the gear reducer, shall be designed to withstand, without damage or permanent distortion, the full stalling torque of the drive motor.

### E. WASHER/COMPACTOR COMPONENTS

1. Inlet Hopper
  - a. Each washer/compactor shall be equipped with an inlet hopper to receive screenings as shown on the Drawings.
  - b. The hopper shall be flanged, gasketed, and bolted to the washer/compactor housing to provide a watertight connection.

- c. The hopper shall be equipped with a stainless-steel spray bar with nozzles to provide wash water to the walls of the inlet hopper and trough. The spray bar shall include a ball valve to regulate the spray water flow supplied from the wash zone solenoid valve.
2. Screw Housing
  - a. The screw housing and associated components shall be constructed from material as specified in paragraph 2.1C. The outlet flange shall incorporate an ANSI 150 lb. bolt pattern for connection to the discharge pipe. DIN pattern flanges shall not be acceptable.
  - b. The compaction/washing section shall incorporate dewatering zones to allow the removal of the filtrate during compaction. Dual wash water inlets shall be provided in the washing zone.
  - c. To prevent screenings rotation and housing wear, the washing zone and compaction zone shall be fitted with a minimum of six (6) anti-rotation/wear bars to provide the washboard/friction contact points for the screenings and to prevent screw contact with the cylindrical wall.
  - d. Each anti-rotation/wear bar shall be secured to the cylindrical housing with M10 stainless steel hex head cap screws and shall be replaceable without removing the screw from the compactor. Each anti-rotation/wear bar shall be made from material as specified in paragraph 2.1C.
  - e. The bottom of the housing below the inlet hopper shall contain a replaceable perforated section for drainage. The perforated section shall have round openings as specified in paragraph 2.1C on staggered centers. Slotted holes or wedge wire sections in the drainage area are not acceptable as an alternate.
  - f. A drain pan shall be mounted to the bottom of the screw housing and shall be easily removeable. The drain pan shall incorporate a drain as specified in paragraph 2.1C. to return the wash water and liquefied fecal matter to the screening channel as shown on the Contract Drawings.
3. Drain Pan Flush System
  - a. The drain pan of the washer/compactor shall be supplied with a flush water system to periodically flush any accumulated organic debris from the pan.
  - b. The flush connection shall be a minimum 1/4" NPT.
  - c. A control solenoid valve, flow adjustment ball valve and incoming plant water strainer shall be supplied for installation by the Contractor.
  - d. Solenoid valves shall be 1/2-inch, minimum, suitable for 120 VAC operation and shall be UL rated for the operational environment as specified in paragraph 2.1C. Solenoid valves shall be normally closed and rated for up to 100 psig.
  - e. Ball valves shall be 1/2-inch, minimum, with stainless steel ball, stem and Teflon seats.
  - f. A Y-strainer with replaceable stainless steel internals shall be provided for the incoming plant water supply. Y-strainer shall be 1/2-inch, minimum.
4. Wash Water System
  - a. A screenings wash water system shall be provided to continuously clean the screenings during operation. Wash water will be introduced into the washing zone in two places to dissolve and remove organic material.
  - b. The wash water system shall be furnished with two stainless steel nozzles piped together to a single inlet connection point. Nozzle orifice diameter shall be 5/8" minimum to prevent plugging of the nozzles.

- c. A control solenoid valve, flow adjustment ball valve and incoming plant water strainer shall be supplied for installation by the Contractor.
  - d. Piping, fittings and valves shall be 1-inch diameter, minimum.
  - e. The wash water flow and minimum pressure requirements shall be as noted in paragraph 2.1C.
  - f. Solenoid valves shall be 1-inch, minimum, suitable for 120 VAC operation and shall be UL rated for the operational environment as specified in paragraph 2.1C. Solenoid valves shall be normally closed and rated for up to 100 psig.
  - g. Ball valves shall be 1-inch, minimum, with stainless steel ball, stem and Teflon seats.
  - h. A Y-strainer with replaceable stainless steel internals shall be provided for the incoming plant water supply. Y-strainer shall be 1-inch, minimum.
5. Solid Shaft Screw
- a. The solid shaft screw shall be of the material and diameter as specified in paragraph 2.1C. The shaft where the flights are attached shall be a minimum of 2-1/2 inches in diameter. Designs incorporating hollow shaft screws for introduction of wash water are not acceptable as an alternate.
  - b. The solid shaft screw shall be designed to transport and dewater the screened material. The distance between the flights shall be arranged to allow transportation into the compaction/washing section.
  - c. The screw flights shall be of decreasing pitch approaching the compaction zone to provide a pre-dewatering stage and shall have a minimum thickness of 1/2 inch. The last flight shall be double thickness and have a minimum hardness of 400 BHN to handle the higher stress of compaction and prevent premature wear.
  - d. After fabrication the screw shall be precision machined to ensure that it is concentric to within 1.5 mm along its length.
  - e. A stainless-steel reinforced brush shall be attached to the flights of the solid shaft screw in the drainage area to clean the trough and prevent debris from blinding the drain holes. The brush shall be attached to the flights using stainless steel hardware.
  - f. To reduce wear on the brush and screw flights, the design shall be such that the screw shall not be allowed to rest in the washer/compactor housing. The screw shall be fully supported and cantilevered from the thrust bearing.
6. Thrust Bearing
- a. An independent thrust bearing shall be mounted between the drive and the washer/compactor body to fully support the screw and handle the axial load created during compaction and reversal of the screw.
  - b. The thrust bearing shall be mounted in a substantial fabricated steel housing and shall utilize tapered roller bearings located between two seals. The screw will be cantilevered from the thrust bearing to prevent the screw from resting inside the screw housing.
  - c. Units submitted without an axial thrust bearing to fully support the cantilevered screw will not be accepted.
7. Support Structure
- a. The washer/compactor shall be supplied with a minimum of two support legs to hold the unit in a horizontal position. Support legs shall attach to the housing using stainless steel hardware.

- b. The support legs shall be fabricated from material as specified in paragraph 2.1C and have a minimum thickness of 3/8 in.
  - c. Support legs shall be designed to handle the forces and loads of the unit such that in the event of a jam in the unit they will not distort or structurally fail.
8. Discharge Pipe
- a. The discharge pipe shall be mounted to the discharge flange of the washer/compactor body and be designed to transport the washed, dewatered and compacted screenings to the appropriate receiving device.
  - b. The discharge pipe shall be constructed of the material as specified in paragraph 2.1C and shall be of the configuration as shown on the Contract Drawings.
  - c. The discharge pipe shall have a minimum inside diameter and expand to a minimum diameter as specified in paragraph 2.1C.
  - d. The discharge pipe shall be supplied with a bagging device to contain and encase dewatered screenings.
  - e. The screenings bagger shall be designed to be fitted with replaceable plastic bags.
9. Cold Weather Protection
- a. The discharge pipe shall be heat traced, insulated and cladded to prevent freezing.
  - b. Heating cable shall be rated at 5 watts per foot, be self - regulating and rated for the operating environment as specified in paragraph 2.1C.
  - c. Insulation shall be minimum 1” thick closed cell neoprene foam.
  - d. Cladding shall be minimum 20 gauge stainless steel as specified in paragraph 2.1C.
  - e. An ambient sensing control thermostat shall be supplied for mounting by the contractor. The thermostat housing shall be rated for the operating environment as specified in paragraph 2.1C but not less than NEMA 4.
  - f. Electrical power shall be 120V/1ph and will be supplied from a local power panel separate from the unit control panel.
10. Drive Assembly
- a. The washer/compactor shall be driven by a heavy-duty, shaft-mounted parallel helical or helical bevel gear reducer. The gear reducer shall be sized to provide the proper input power and torque to operate the washer/compactor and be rated for greater than the nominal horsepower of the drive motor.
  - b. The gear reducer shall have a cast iron housing with a minimum service factor of 1.2.
  - c. Gear reducers shall have ball or roller bearings throughout with all moving parts immersed in oil. Gears shall be of alloy steel with teeth precision ground and polished after casehardening. Shafts shall be of high strength alloy steel ground to required tolerances.
  - d. The gear reducer shall be driven by an inverter duty electric motor. The motor shall be UL rated for the operational environment as specified in paragraph 2.1C. The motor shall be rated for a minimum horsepower and voltage as specified in paragraph 2.1C, with a minimum service factor of 1.0.
  - e. The motors shall be rated at 40°C ambient with Class F insulation and shall have a Class B temperature rise at full load.

## 2.2 CONTROLS AND INSTRUMENTATION

### A. GENERAL

1. Controls for the washer/compactor shall be incorporated in the control panel supplied for the mechanically cleaned bar screen specified in Section 11331.

### B. Local Station

1. Washer/compactor
  - a. Emergency Stop: Push to stop, pull to run pushbutton, NEMA 7 (C1D2) weatherproof

### C. OPERATION

1. When in Automatic mode, the washer/compactor shall be started when a call to run signal is received from a screen or other device, such as a conveyor or flume.
2. The washer/compactor will run in the forward direction when the call to run signal is received. Periodically the washer/compactor will stop and run in the reverse direction, for no more than 8 seconds, and then return to forward operation. This intermittent scrub sequence enhances the washing capability of the unit and resets the spiral brush bristles, ensuring proper cleaning of the drain perforations.
3. The wash water solenoid valve will open whenever the washer/compactor is running in the forward direction.
4. The pan flush solenoid shall operate intermittently based on the operator settable pan flush cycle and duration timers.
5. The washer/compactor will continue to run until the call to run signal is removed. Once this occurs the washer/compactor will continue to run for the time set in the its off delay timer and then stop.
6. The wash water solenoid valve will close once the washer/compactor stops.
7. The pan flush cycle shall stop once the washer/compactor stops.
8. If the jam (over-torque) sensor for the washer/compactor is activated during operation, indicating a jam, the washer/compactor will reverse in an attempt to clear the jam. The washer/compactor will reverse for a set period of time, then run forward again. If the jam has been cleared, the washer/compactor will return to normal operation. If the jam still exists, the washer/compactor will make additional attempts to clear the jam, (3 attempts, maximum). If the jam is not cleared after the final attempt, the washer/compactor will stop, and an alarm signal will be sent by the control system.
  - a. A jam (over-torque) condition in HAND mode immediately stops the washer/compactor and the control system will send an alarm signal.
9. See Mechanically Cleaned Filter Screen (Section 11331-2.3) for additional requirements.

## 2.3 SOURCE QUALITY CONTROL

- A. The washer/compactor system and control panel shall be factory assembled and tested to ensure proper design and satisfactory operation. Equipment shall be shipped in the minimal practical number of pieces for minimal field assembly by the Contractor.

## 2.4 SHOP PAINTING

- A. Stainless steel and other corrosion-resistant surfaces shall not be painted. Gearboxes, Motors, and other manufactured components will receive the manufacturer's standard weather and corrosion-resistant coating.

## 2.5 SPARE PARTS

- A. The following spare parts shall be provided:
  - 1. One (1) Brush with mounting clips and attaching hardware
  - 2. One (1) Set of Anti rotation/wear bars with attaching hardware
  - 3. Three (3) Fuses of each size and type used in the control panel
  - 4. Two (2) Boxes of screenings bags.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify anchors are correctly positioned.

### 3.2 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.

### 3.3 INSTALLATION AND TESTING

- A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify Engineer of any significant deviations.
- B. Installation of the equipment shall be in strict accordance with the contract documents and the Manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractors shall install the anchor bolts in accordance with the Manufacturer's recommendations.
- C. Supplier shall furnish the services of a factory-trained Service Engineer for two (2) trips. One (1) trip of one (1) day for installation inspection services. One (1) trip of one (1) day for start-up, commissioning, and to provide operator training.
  - 1. Equipment shall not be energized, or "bumped", to check the electrical connection for motor rotation without installation inspection and the Service Engineer present.
  - 2. The Service Engineer shall make all necessary adjustments and settings to the controls.

3. The Service Engineer shall demonstrate proper and sequential operation of the washer/compactor. The washer/compactor shall be operated in both Automatic and Hand mode by the Service Engineer during the start-up and commissioning to demonstrate proper operation of the system.

#### 3.4 OPERATOR TRAINING

- A. Provide operator training for Owner's personnel after the system is operational. Training shall take place while manufacturer's representative is at the job site for equipment inspection.

END OF SECTION



## SECTION 11335

### FINE GRIT REMOVAL AND WASHING SYSTEM

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Contractor shall furnish all labor, equipment, materials, tools, and incidental items required to install and place into proper operation one (1) fine grit removal system(s) for settling, condensing, and removing grit particles from screened wastewater before pumping the slurry to one (1) grit washer unit for removing, washing and conveying grit particles as indicated on the drawings. All equipment shall be installed as shown on the plans, as recommended by the supplier, and in compliance with all OSHA, local, state, and federal codes and regulations.
- B. The grit removal system(s) shall be furnished complete with a grit screw, lamella plate separators, grease removal system, grit pump, grit washer, drive motors, gear reducers, support legs, anchor bolts, piping and wiring, controls, and all accessories and appurtenances specified or otherwise required for a complete and properly operating installation.
- C. Grit system(s), washer(s) and controls shall be supplied by a single manufacturer to ensure compatibility and proper operation of the system.
- D. Contractor shall be responsible for coordination of all related parts of the work. Contractor shall verify all structures, piping, wiring, and components are compatible. Contractor shall be responsible for all structural and other alterations required to accommodate equipment differing in dimensions or other characteristics from these specifications and drawings.

##### 1.2 RELATED SECTIONS

- A. General Conditions, Supplementary Conditions, and General Requirements sections apply to work of this Section.
- B. Section 01300 – Submittals
- C. Section 03300 – Concrete
- D. Section 05500 – Miscellaneous Metals
- E. Section 09900 – Special Coatings and Painting
- F. Division 16 – Electrical

##### 1.3 SUBMITTALS

- A. Provide shop drawings and product data in accordance with section 01300 for the equipment being furnished, to include at minimum the following:

1. Certified shop drawings showing the details of construction, dimensions and anchor bolt requirements.
  2. Complete wiring diagrams detailing all required field connections.
  3. Descriptive literature, brochures, and/or catalogs of submitted equipment.
  4. Complete bill of materials for the equipment.
  5. List of Manufacturer's supplied spare parts.
  6. Manufacturer's ISO 9001:2015 certificate of registration
  7. Equipment weights.
  8. A copy of Manufacturer's 3-year factory warranty.
- B. The manufacturer shall furnish operation and maintenance manuals in accordance with the requirements of section 01430 – Operation and Maintenance Manuals, to include at minimum the following:
1. Short- and long-term storage requirements.
  2. Manufacturers unloading instructions.
  3. Manufacturer's installation instructions
  4. Equipment weights and lifting points.
  5. Complete wiring diagrams detailing all required field connections.
  6. Assembly drawings
  7. Maintenance schedule
  8. Maintenance instructions

#### 1.4 REFERENCE STANDARDS

- A. American Iron and Steel Institute (AISI).
- B. American National Standards Institute (ANSI).
- C. American Society for Testing Materials (ASTM).
- D. American Bearing Manufacturers Association (ABMA).
- E. American Gear Manufacturers Association (AGMA).
- F. National Electrical Manufacturers Association (NEMA).
- G. Underwriters Laboratory (UL).

#### 1.5 QUALITY ASSURANCE

- A. Qualifications: Qualified Manufacturers shall have a minimum 25 years' experience manufacturing grit removal and grit washing equipment and upon request will submit to the Engineer and/or Owner documentation of 15 installations with lamella plate separators and grit washing similar to specific equipment herein.
- B. A single manufacturer shall provide complete grit removal system, motors, gear reducers, controls, control panels, and lifting attachments as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.

- C. Grit removal system(s) shall be Manufacturer's standard product and only modified as necessary to comply with the drawings, specifications, and specified service conditions. Equipment manufactured outside the United States, or by third parties, shall not be permitted for this project. The equipment manufacturer shall supply a certificate of origin and letter of compliance confirming both requirements.
- D. All welding shall be performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code.
- E. All stainless-steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid (pickling bath) to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel.
- F. No stainless-steel components may be fabricated or assembled in a factory where carbon steel products are fabricated, in order to prevent contamination by rust.
- G. Manufacturer shall warranty all equipment against faulty or inadequate design, improper assembly, defective workmanship or materials. Materials shall be suitable for the service conditions.
- H. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service prior to delivery, except as required by testing.
- I. The grit removal system(s) shall have the Manufacturer's name, address, and product identification information on a corrosion resistant nameplate securely affixed to the equipment.
- J. Manufacturer shall be ISO 9001:2015 certified and provide the Engineer with a copy of a valid certificate of registration. Equipment suppliers not utilizing ISO 9001 manufacturing facilities shall not be considered or approved for this project.
- K. All control panels shall be fabricated and tested in the manufacturer's UL Authorized control panel shop. The equipment manufacturer shall supply a certificate of conformance confirming this requirement.
- L. Manufacturer shall provide services by a factory-trained service technician, specifically trained on the type of equipment specified. Service technician requirements include, but are not limited to the following:
  - 1. Manufacturer shall have a minimum of ten (10) service technicians based in the United States for field service of the equipment. Manufacturer shall have multiple service locations with a minimum of one dedicated service location for both the eastern and western regions of the US.
  - 2. Service technician shall be present during initial energizing of equipment to determine directional testing.

3. Service technician shall inspect and verify location of anchor bolts, placement, leveling, alignment and field erection of equipment, as well as control panel operation and electrical connections.
4. Service technician shall provide classroom and/or field training on the operation and maintenance of the equipment to operator personnel.

## 1.6 WARRANTY

- A. The manufacturer will warrant against any defects in material or workmanship to the grit removal system. This warranty will commence upon delivery of the products and will expire three (3) years from initial operation of the product. In addition, the manufacturer shall provide a ten (10) year warranty on the horizontal grit screw on the grit removal system.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Shipping:
  1. Ship equipment, material, and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
  2. Pack spare parts in containers bearing labels clearly designating contents and equipment for which they are intended.
- B. Receiving and Storage:
  1. Store and safeguard equipment, material, and spare parts. All spare parts must be stored in accordance with manufacturer's recommendations.

## 1.8 OPERATION AND MAINTENANCE MANUALS

- A. The manufacturer shall furnish operation and maintenance manuals in accordance with the requirements of section 01430 – Operation and Maintenance Manuals.

# **PART 2 PRODUCTS**

## 2.1 GRIT REMOVAL SYSTEM EQUIPMENT

- A. MANUFACTURER:
  1. Huber
  2. Substitutions: Section 01600 - Product Requirements.
- B. MATERIALS
  1. Unless otherwise specified in these specifications, equipment shall be manufactured from AISI 304L austenitic stainless-steel shapes (rods, angles, and channels), pipes, and sheets. All mechanical parts shall be designed to handle the forces that may be exerted on the unit during fabrication, shipping, erection, and proper operation according to the O&M manual.
  2. Equipment shall be manufactured in a stainless-steel only factory to prevent contamination of the stainless steel with foreign contaminants.

3. The equipment, after its fabrication, shall undergo a passivation (pickling) process to ensure maximum resistance to corrosion. All stainless-steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel. Submergence insures complete coverage. Spray on chemical treatments and glass bead blasting are specifically not acceptable due to their inability to provide complete and uniform corrosion protection.

C. DESIGN CRITERIA

**Grit Removal**

Number of Units	One (1)
Average Flow, per Unit	4.5 MGD
Peak Flow, per Unit	12 MGD
Grit Removal Efficiency (Avg Flow)	95% > 106 um
Grit Removal Efficiency (Peak Flow)	95% > 150 um
Total Surface area of Lamella Trays, per Unit	601 ft <sup>2</sup>
Peak Surface Loading Rate	13.87 gpm/ft <sup>2</sup>
Headloss at Peak Flow	8.24 inches

**Grit Pump**

Number of Units	One (1)
Maximum Flow Capacity	150 gpm
Total Dynamic Head	10 feet
Suction Inlet Diameter	4-inch
Discharge Outlet Diameter	4-inch

**Grit Washer**

Number of Units:	One (1)
Design Flow of Grit Slurry from Grit Trap, per Unit	250 gpm
Maximum Flow of Grit Slurry from Grit Trap, per Unit	300 gpm
Grit Processing Capacity, per Unit	1.5 ton/hr
Maximum Water Content in Washed Grit Product at Design Flow	10%
Maximum Volatile Slids Contact in Dried Grit Product at Design Flow	5%
Minimum Capture Rate of 75 um Quartz Sand at Design Flow	95%
Minimum Weir Length	19.6 feet
Tank Water Surface Area	30.5 ft <sup>2</sup>
Maximum Weir Overflow Rate, Including Wash Water	0.031 ft <sup>2</sup> /sec

D. GRIT SYSTEM COMPONENTS

1. Grit Chamber
  - a. Wastewater containing grit shall be directed downwards into the grit rectangular chamber by an inlet baffle plate and into the aerated zone, which creates floatable particles to rise to the surface and are to be removed by a paddle system. Concrete grit chambers with circular or vortex type designs with less efficient grit capture rates, large grit tank storage footprint requirements, and difficult forming construction shall not be acceptable.

- b. After the aeration zone grit particles shall flow into the unaerated section of the grit trap and through the lamella tray inserts where grit shall settle out by gravity through the trays by lamella plate settling principles designed with sufficient surface area for meeting the grit removal efficiencies as specified. The grit shall drop down to the bottom of the grit tank for further processing. Flow shall continue through the system and over the outlet channel weir. Overflow weir shall be sized and supplied by Grit System manufacturer, contractor installed. Grit removal systems that rely on retention time, a forced vortex flow pattern, or without the use of plate settling principles shall not be acceptable.
  - c. Grit collected at the bottom shall be removed axially by a time-controlled shafted horizontal grit screw conveyor and sent to a collection chamber. A grit slurry pump as specified in Section 2.1, C shall be provided to pump the grit slurry mixture out from the collection chamber by non-continuous operation and into a Grit Washer/Classifier unit for grit treatment. Fluidization by use of wash water or by mechanical means of the grit slurry collection chamber before pumping into a grit washing unit is not acceptable. Continuous pumping of grit from grit collection chamber to grit washing/classifying unit is not acceptable.
  - d. Grit chamber footprint shall be a shallow design and not to exceed a total depth from bottom of grit collection chamber to the maximum water level as shown in the drawings. Designs that require an inlet flume constructed from concrete or steel shall not be acceptable for this project.
2. Lamella Tray
- a. Lamella tray inserts shall be made from polypropylene material and shall be constructed within a 304L stainless steel lamella tray frame. Designs consisting of tray type systems that are constructed from less rigid polyethylene material shall not be acceptable. The spacing between each lamella plate shall be 3.14 inches and shall have a thickness of ¼ inches. Lamella package trays shall be a single tray version that shall be supported to a 304L stainless steel structural frame and attached to the concrete channel walls by supporting steel angles. Steel angles shall be provided by the manufacturer and shall be anchored to the concrete walls by installing Contractor.
  - b. Each lamella tray package shall have a width of 5-feet, height of 6.48-feet and depth of 3.6 feet. The overall width of channel required shall not exceed 5-feet.
  - c. Lamella trays shall be sloped 55-degrees for enhancing grit capture efficiency and shall be a removable design from the channel. Trays that are non-modular to facilitate ease of removal for maintenance are not acceptable.
  - d. Lamella tray assembly is required before installation of system into concrete channel. Installation and assembly of the lamella trays shall be performed by the installing Contractor.
3. Grit Screw and Trough
- a. The horizontal grit screw shall have a minimum diameter of 7.48-inches with a minimum shaft diameter of 3.15-inches. The screw flights shall be a minimum of 0.2-inches thick.
  - b. The horizontal grit screw shall be supported by the drive at one end and along their length by sectional bearing liners that shall have a thickness of

- 0.236-inches and shall be constructed of high-density polyethylene (HDPE) material. Grease lubricated bearings are not acceptable.
- c. The drive ends of the horizontal screw shaft tube shall be machined and shrink-fitted with solid stainless-steel stubs.
  - d. The horizontal grit screw drive shall be equipped with a 3-phase, 60 Hertz, 230/460-volt, Class 1, Division 1, continuous-duty motor with leads to a conduit box for outdoor operation. The motor power shall be a minimum of 2.0HP. The screw shall be driven by a shaft mounted gearbox and motor. The gearbox shall have a minimum service factor of 1.0 equivalent to an AGMA Class I rating.
  - e. There shall be a reinforced concrete wall in between the grit removal screw chamber and motor gearbox assembly. A sealing plate shall be installed between the vertical concrete wall and motor gearbox drive. The sealing plate shall have a thickness of 0.6-inches. The drive shall be provided with a stainless-steel stuffing box, seal packing gland and gland follower. The stuffing box discharge shall have a drip lip with a 1-inch NPT connection such that leakage would be drained away from the tank.
  - f. The grit screw shall transport grit towards the collection chamber by timer control and pump as required to a grit washer/classifier.
  - g. The trough shall be installed in sections flanged together and anchored to the concrete channel. The trough shall have a minimum diameter of 8.6-inches and shall be made from 304L stainless steel material. The trough sections and grit screw shall be installed by the installing Contractor.
4. Grease Removal System
    - a. The grit removal unit shall be provided with a grease/scum removal system and grease hopper.
    - b. The grease system shall be provided with a stainless-steel scraper blade, pulled by a drive via a stainless-steel cable. The blade pushes grease along the grease chamber towards a grease hopper and, over a weir, into the grease hopper. The bottom of the grease hopper shall be a connection for contractor supplied pipe to connect to grease pump outside of the grit chamber. The grease shall be pumped through a 2-inch diameter pipe as shown on the drawings.
    - c. The grease/scum pump shall be supplied by the Grit System manufacturer.
  5. Grit Chamber Aeration Zone
    - a. Aeration system shall include an air distributor pipe and header made of PVC pipes and fittings and/or flexible reinforced PVC hose. The grit chamber shall be equipped with a ½-inch diffuser pipe of reinforced PVC hoses.
    - b. All pipe supports and hardware shall be stainless steel.
    - c. The diffuser pipes shall be designed such that they can be removed from the grit chamber without requiring entry of operators into the chamber.
    - d. A single stage side channel blower shall be furnished to provide a minimum air flow of 10 cfm. The blower shall be coupled with a minimum 0.9 HP, 460vac, 60Hz, 3ph, motor suitable for operation in an unclassified location. The contractor shall be responsible for installation of interconnecting air lines between the remotely installed blower and grit aeration zone.

## E. GRIT PUMP

1. The contractor shall supply a suction pipe from the grit collection chamber and a discharge pipe to the grit washer unit as shown on the drawings.
2. The grit pump shall be a horizontal, self-priming centrifugal type design. The casing shall be cast iron Class 30 with integral volute scroll, mounting feet, 3.5-inch Class 30 cast-iron fill port cover plate, 1.25-inch NPT drain plug and a liquid volume and recirculation port. The cover plate is sealed to the housing with two Buna-N O-Rings and shall have a pressure relief valve that shall open at 75-200 PSI.
3. The rotating assembly (impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate and bearing housing) must be replaceable as a single unit without moving the casing or piping.
4. The impeller will be a two-vane, semi-open non-clog type with pump out vanes on the back shroud, and shall be manufactured from Austempered Ductile Iron with an AISI alloy steel shaft. The clearance between the impeller and wear plate is to be incrementally adjustable via the cover plate.
5. The suction check valve will be steel reinforced molded neoprene with a blow-out center to protect against hydraulic shock and additional pressure. It is to be replaceable through the cover plate opening without moving the pipe work.
6. Cast iron Class 30 spool pieces on both suction and discharge port will have one 1.25-inch NPT and one 0.25-inch NPT tapped hole for mounting gauges.
7. Each pump will be supplied with a drain kit that consists of a 10-foot plastic hose and factory installed fittings including stainless steel pipe nipple, busing and ball valve, and an aluminum male quick connect fitting.
8. Each pump will have a minimum 5 hp., Class 1, Division 2, 460VAC, 60Hz, 3ph, 60Hz motor. The power to each pump will be transmitted by two V-belts providing a minimum safety factor of 1.5. Pumps that use a direct drive are not acceptable. The drive assembly must be totally enclosed by a removable fabricated steel guard supplied by the pump manufacturer including their standard paint finish.

#### F. GRIT WASHER

1. Grit Washer Tank
  - a. Water containing grit from a grit chamber shall be introduced through a 6-inch inlet into the vortex chamber, creating a rotating flow pattern, and through the chamber into the grit washer tank. The maximum allowable influent velocity into the grit washer tank shall be less than 0.5 ft/s. The grit slurry mixture shall be fed directly to the grit washing unit without the need for additional screening via a drum screen, designs requiring a screen to meet the performance requirements shall not be allowed. Designs incorporating a tangential side inlet entry or an inlet entry that does not dissipate velocity shall not be acceptable.
  - b. The water flow is directed from an axial flow to a radial flow towards the overflow weir that is provided at the circumference of the grit washer tank. This change of the flow direction leads to effective sedimentation of the grit towards the bottom of the grit washer tank. The grit washer tank shall have a minimum of 0.10-inch wall thickness.
  - c. The classified water shall pass over the circumferential overflow weir with a length of 14.3-feet and discharge out of a single 8-inch clean water outlet.
  - d. The inlet connection of the grit washer unit shall be freely rotatable 360 degrees for site adjustment. Designs that incorporate a fixed inlet connection that does not freely rotate shall not be allowed.



- e. A 4-inch connection with an automatically operated one quarter-turn ball valve shall be provided for removal of organic material out of the conical section of the tank. The ball valve shall be directly flanged to the conical tank without any adapter or connection pieces to avoid clogging issues. The ball valve shall have a PVC body and ball to prevent binding when in contact with abrasive materials. Metallic ball valves which can bind in highly abrasive applications shall not be acceptable.
  - f. A 110VAC, single phase, electrically operated AUMA actuator shall be provided to provide automatic control of the ball valve. The AUMA actuator shall only be acceptable for the grit washer unit. The actuator shall be suitable for operation in a Class 1, Division 1 hazardous location. The stirrer shall move organic matter toward this connection.
  - g. A 110VAC, single phase, pressure probe by VEGA, or approved equal, shall be mounted in the bottom of the grit settling area to monitor the grit level within the tank and to control the operation of the grit stirrer and grit removal screw. The pressure probe shall be suitable for installation in a Class 1, Division 1 hazardous location.
2. Fluidized Grit Bed
- a. A fluidized grit bed shall be maintained in the bottom portion of the grit washer tank. Within this fluidized bed, the grit is intensively washed and organic material is effectively removed from mineral particles.
  - b. The grit washer shall be designed for a water supply of 22 gpm with a minimum pressure of 29 psi with a single 1-inch connection point for connecting to the treatment plants final effluent water supply.
  - c. Wash water shall be introduced into the bottom of the grit washer and dispersed through a perforated diaphragm to generate the fluidized bed in the bottom portion of the grit washer. This wash water shall also effectively flush the organic components out of the fluidized bed towards the overflow weir.
  - d. Wash water through the perforated plate diaphragm shall be distributed uniformly to reduce grit sedimentation on the bottom of the grit tank. The perforated plate neoprene diaphragm shall have a 2mm thickness. A perforated plate design for a true fluidized grit bed and clog free washing system shall be a grit washer design requirement. Designs that exclusively incorporate multiple water or air injection points on the bottom of the grit washer tank as part of the washing feature shall not be acceptable.
  - e. The wash water manifold will be provided with a variable area flow meter with a transparent PVC casing to allow visual inspection of the internal float for manual flow rate confirmation. The variable area flow meter shall be factory installed and attached to the grit washer unit before shipment.
  - f. Wash water control shall be provided via a 1-inch 110V, 60Hz, Class 1, Division 1 solenoid valve and body of valve shall be brass material.
3. Grit Screw
- a. Washed grit shall be removed through a central tube at the bottom of the grit washer. The stirrer shall move washed grit to the central tube. The grit to be removed shall drop into an inclined auger. This auger shall dewater and convey the grit above the level of the overflow weir. The washed and dewatered grit is discharged at the upper end of the auger.
  - b. The auger shall have a discharge height of 79-inches above the floor. The inlet hopper tank shall be provided with a 3-inch (DN 80) drain connection

that is provided with a ball valve. The drain connection shall also be provided with a ¾-inch flush connection with ball valve.

- c. The auger shall have a minimum diameter of 9.56-inches and a minimum 0.20-inch material thickness. The auger shaft shall have minimum diameter of 3.5-inches and a minimum material thickness of 0.20-inches.
- d. The lower grit washer tank shall be bolted flange-connected to the grit discharge trough for easy removal during maintenance. Designs with a welded connection between the screw trough and inlet hopper tank shall not be acceptable.
- e. The screw conveyor trough shall be made of minimum 10/64-inch thick stainless steel and shall have a minimum trough diameter of 10.75-inches.
- f. The screw shall be shafted and shall be made of stainless steel. A shaft-less screw is not acceptable. The lower end of the screw shaft shall be supported by a chilled cast-iron stub bearing with a maintenance-free ceramic sleeve. Wear strips, wear shoes, or liners are not acceptable.
- g. The grit screw design shall have screw flights incorporating varying flight pitches of 5.9-inch/7.8-inch in order to prevent clogging issues within the grit screw. Screws with flight pitches all at the same distance shall not be acceptable.
- h. A screw drive shall be provided at the upper end of the auger. The motor shall be continuous duty rated and shall be selected to match the duty of the particular grit conveying screw. The drive unit shall be directly coupled to the grit conveying screw drive shaft.

4. Grit Stirrer

- a. The center stirrer shaft diameter shall be 60 mm and shall have a thickness of 5 mm. The stirrer arms shall be 30 mm in diameter and constructed of 304L stainless steel. The stirrer shall consist of a minimum of two (2) arm sections. The stirrer design shall promote better discharge of organics, grit bed fluidization, and ability to discharge larger stones.

5. Motors

**Grit Screw**

Maximum Motor Speed:	1760 rpm
Service Factor:	1.15
Rating:	230/460V, 3-phase, 60 Hz
Location Rating:	Class 1, Division 1
Nominal Power Screw Drive Motor:	1.5 hp
Torque must be sufficient to start and operate grit washer without exceeding nameplate ratings for current and power	

**Grit Stirrer**

Maximum Motor Speed:	1760 rpm
Service Factor:	1.15
Rating:	230/460V, 3-phase, 60 Hz
Location Rating:	Class 1, Division 1
Nominal Power Screw Drive Motor:	0.75 hp
Torque must be sufficient to start and operate grit washer without exceeding nameplate ratings for current and power	

## 2.2 CONTROL SYSTEM

- A. All controls necessary for the fully automatic operation of the grit removal system shall be provided, including a single combined NEMA 4X main control panel, and a NEMA 4X local control station per each piece of equipment.
- B. Refer to Specification Section 16480 (“Manufactured Control Panels”) for additional control panel requirements.
- C. The electrical control system shall provide for automatic control of the grit washer via a signal from the feed pump control panel. The grit removal system screws shall be operated by timer.
- D. Control panel shall be suitable for outdoor, wall-mounting. Enclosure shall be NEMA 4X stainless steel with continuous hinge and lockable door latch, and shall include the following:
  - 1. Door-interlocked and fused disconnect
  - 2. 600 VAC terminal block
  - 3. NEMA motor starters and Circuit Breaker Branch Circuit Protection for all electrical motors
  - 4. Panel heater with thermostat
  - 5. Control power transformer with 120 VAC transient voltage surge compressor (TVSC) and fused primary and secondary
  - 6. Programmable logic controller (PLC), Allen Bradley Micro 800
  - 7. Operator Interface (OIU), Allen Bradley PanelView 800
  - 8. Pilot lights for
    - a. Control power on (white)
    - b. Horizontal grit screw running (green)
    - c. Grit aeration blower running (green)
    - d. Grease skimmer running (green)
    - e. Grease pump running (green)
    - f. Grease pump fault (red)
    - g. Grit Screw running (green)
    - h. Grit Stirrer (green)
    - i. Organic Valve open (green)
    - j. Grit Washer Grit Screw fault (red)
    - k. Grit Washer Grit Stirrer fault (red)
    - l. Organic valve fault (red)
  - 9. E-stop push button (red)
  - 10. Reset push button (black)
  - 11. Door mounted elapsed time meters for the following:
    - a. Horizontal grit screw drive
    - b. Grit Washer Screw drive
    - c. Grit Washer Stirrer drive
  - 12. Remote dry contact inputs for the following:
    - a. Machine start
    - b. One spare input
  - 13. Remote dry contact outputs for the following:
    - a. Horizontal grit screw running
    - b. Grease skimmer running

- c. Grease pump running
  - d. Blower running
  - e. Grit washer running
  - f. Grit Pump running
  - g. Faults
  - h. E-stops
  - i. Two spare outputs
14. Flashing alarm light and alarm horn with silencer-reset button
  15. Plastic Nameplates

E. Local Control Station

1. Each grit washer shall be provided with a NEMA 7 (C1D2), weatherproof, Cast Aluminum Local Control Station. Each Local Control Station Shall be equipped with the following devices
  - a. Hand-Off-Auto selector switches for the following
    - 1) Grit Washer drive
    - 2) Stirrer drive
  - b. Grit Washer forward-off-reverse
    - 1) Grit Washer drive
  - c. Spray wash pushbuttons (push-to-test)
    - 1) Solenoid valve
  - d. E-stop pushbutton (red)
2. Each grit system shall be provided with a NEMA 7, Cast Aluminum Local Control Station. Each Local Control Station Shall be equipped with the following devices
  - a. Hand-Off-Auto selector switches for the following
    - 1) Horizontal Grit Screw drive
    - 2) Grease scraper drive
    - 3) Blower
  - b. Forward-off-reverse
    - 1) Grease scraper
  - c. E-stop pushbutton (red)
3. Each grit pump shall be provided with a NEMA 4X, Cast Aluminum Local Control Station. Each Local Control Station Shall be equipped with the following devices
  - a. Grease pump hand-off-automatic
  - b. E-stop pushbutton (red)

2.3 SOURCE QUALITY CONTROL

- A. The grit system and control panel shall be factory assembled and tested to ensure proper design and satisfactory operation. Equipment shall be shipped in the minimal practical number of pieces for minimal field assembly by the Contractor.

2.4 SHOP PAINTING

- A. Stainless steel and other corrosion-resistant surfaces shall not be painted.
- B. Gearboxes, Motors, and other manufactured components will receive the manufacturer's standard weather and corrosion-resistant coating.

- C. All surfaces to be painted (except for corrosion resistant materials) shall be bead blast cleaned to an SSPC-SP-6 finish, removing all dirt, rust, scale and foreign materials. Cleaned surfaces of the equipment shall be shop primed with a five (5) mil coat of Tnemec Series 161HS-1211 primer.

## 2.5 SPARE PARTS

- A. The following Spare Parts shall be included and supplied by Manufacturer:
  - 1. One (1) Proximity switch for grease skimmer system
  - 2. One (1) Drive wire with rollers for grease skimmer system
  - 3. One (1) perforated diaphragm (membrane)
  - 4. One (1) complete solenoid valve assembly
  - 5. One (1) grit pump mechanical seal
  - 6. One (1) set of O-Rings for grit pump cover plate
  - 7. One (1) set of impeller clearance adjustment spacers
  - 8. One (1) set of grit pump V-belts
- B. One set of all special tools, if required, shall be included and supplied by the Manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify anchors are correctly positioned.

### 3.2 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. Coating type and color shall match shop painting. Contractor shall passivate all field welds.
- B. Prior to the assembly all stainless-steel bolts and nut threads shall be coated with a non-seizing compound by the Contractor.

### 3.3 INSTALLATION AND TESTING

- A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify Engineer of any significant deviations.
- B. Installation of the equipment shall be in strict accordance with the contract documents and the Manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractors shall install the anchor bolts in accordance with the Manufacturer's recommendations.

- C. Supplier shall furnish the services of a factory-trained Service Engineer for one (1) trip including a total of four (4) workdays to inspect the installation, observe startup, and provide operator training.
  - 1. Equipment shall not be energized, or “bumped”, to check the electrical connection for motor rotation without installation inspection and the Service Engineer present.
  - 2. The Service Engineer shall make all necessary adjustments and settings to the controls.
  - 3. The Service Engineer shall demonstrate proper and sequential operation of the complete grit removal system. The system shall be operated in both Automatic and Hand mode by the Service Engineer during the start-up and commissioning to demonstrate proper operation of the system.

### 3.4 OPERATOR TRAINING

- A. Provide operator training for Owner's personnel after the system is operational. Training shall take place while manufacturer's representative is at the job site for equipment inspection.

### 3.5 PERFORMANCE TESTING

- A. Grit Washer Grit Quality Test:
  - 1. Summary
    - a. Manufacturer shall field test installed grit washing equipment to demonstrate compliance with performance requirements specified in section herein. The following physical conditions shall be demonstrated by classifier(s):
      - 1) Performance test shall be performed for each grit washer installed.
      - 2) Accept pumped design flow, in the case of the grit washer unit this is as per section 2.1, C grit washer.
      - 3) Produce dry grit with less than 10% moisture content.
      - 4) Have no visible fecal matter (less than or equal to 5% organic content) and be absent of putrescent odor.
      - 5) Operate reliably without breakdown or stoppage due to blockage at all design conditions. Grit washer(s) shall have completed 120-hr systems demonstration prior to start of performance test.
      - 6) Require minimal operation and maintenance.
      - 7) Performance data will not be evaluated on a combined average of all units tested. Each unit must meet the design requirements.
    - b. Owner shall furnish labor for each sample collection and the manufacturer shall pay cost of laboratory analysis as specified herein, unless otherwise negotiated with owner. Performance analysis will be carried out at laboratory approved by owner.
  - 2. Compliance
    - a. If test results demonstrate that equipment does not conform to requirements of specifications concerning organics residual and percent moisture, manufacturer shall have the opportunity to make improvements at no cost to owner.
    - b. Manufacturer shall perform a second test. If the second test has not successfully passed the organic and moisture performance parameters as specified, the OWNER will modify the contract cost or reject the grit

washing equipment as a whole based first on failure of organic content, if organics content is acceptable then on moisture content as follows:

- 1) Organics content
    - a) 5% or less- 100% payment
    - b) Greater than 5% but less than 7.5% - 75% payment
    - c) Greater than 7.5% but less than 10% - 50% payment
    - d) Greater than 10%, equipment will be rejected and manufacturer shall reimburse owner of all costs for providing and installing grit washing equipment.
  - 2) Moisture content
    - a) 10% or less – 100%
    - b) Greater than 10%, but less than 20% - 75% payment
    - c) Greater than 20%, but less than 30% - 50% payment
    - d) Greater than 30%, equipment will be rejected and manufacturer shall reimburse owner of all costs for providing and installing grit washing equipment.
  - c. Owner and/or owner's representative shall be present for test.
3. Performance Requirements
- a. Prior to performance test, washer shall have completed 120-hr systems demonstration test, and grit shall be produced from grit discharge minimum of one week prior. If grit has not yet discharged from unit(s) within one week of performance test, manufacturer shall supply and fill unit(s) with amount of sand recommended in order to create a base and start producing grit. Unit(s) shall operate for one week following addition of supplemental sand prior to start of performance test.
  - b. Manufacturer shall guarantee and demonstrate that the grit washer(s) supplied shall meet the following performance requirements:
    - 1) Grit Washer(s) shall be capable of accepting minimum flow of as per section 2.1, C grit washer from grit storage hopper of grit removal system containing grit, and possibly other settleable solids including vegetable matter, cigarette butts, popsicle sticks, rags, etc., without plugging problems and loss of performance stipulated herein.
    - 2) Grit discharged to dumpster for disposal shall be clean with solids containing no visible fecal matter, and shall be free of putrescible odors.
    - 3) Organic content of grit discharged from each unit shall be 5% or less. The combined average organic content of all units tested is not acceptable. All vegetable matter within the sample shall remain and be included as part of the test.
    - 4) Moisture content of grit discharged from each unit shall be 10% or less. The combined average moisture content of all units tested is not acceptable. All vegetable matter within the sample shall remain and be included as part of the test.
    - 5) Washer shall operate reliably without breakdown or stoppage due to blockage at all design conditions and shall require minimal operation and maintenance.
4. Test Procedure
- a. As a requirement of this specification the manufacturer shall demonstrate that the grit washer(s) conform with the performance and operating criteria

specified herein and the following tests shall be conducted at site on each operating grit washer unit:

- 1) Contractor shall provide clamp on type flow meter and shall be attached to grit delivery pipe from the grit pump and after calibration, flow readings shall be taken for a minimum three pumping cycles, or over one-half hour of continuous run time, to demonstrate the grit classifier is operating at the specified flow.
- 2) The organic content and moisture tests shall take place over a two-week period. Plant staff shall take three (3) random 2-cup samples taken any 3 days within a consecutive two-week period for a total of nine (9) samples. Samples shall be taken immediately upon discharge from each classifier, sealed in a vapor tight container and sent out for testing the same day.
- 3) The test results and observations shall be submitted for approval and acceptance by OWNER.

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. Krohne
  - 2. Rosemount
  - 3. ABB
  - 4. 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. 4-20mA Output
- 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 Krohne model IFC100 or equivalent.

## 2.4 METER CRITERIA

### A. Schedule:

<b>Meter Identification</b>	Aeration Basin Influent Flow (Alternate)	Headworks Effluent Flow	WAS Flow	RAS Flow
<b>Pipe Size and Material</b>	16-inch DIP	16-inch DIP	6-inch DIP	12-inch DIP
<b>Meter Flow Range</b>	0 – 8,500 gpm	0 – 8,500 gpm	0 – 1,000 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 11351

### CLARIFIER EQUIPMENT

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Contractor shall furnish all labor, equipment, materials, tools, and incidental items required to install and place into proper operation one (1) clarifier. All equipment shall be installed as shown on the plans, as recommended by the supplier, and in compliance with all OSHA, local, state, and federal codes, and regulations.
- B. The clarifiers shall be furnished complete with center drive, collector mechanism, skimmer and scum box, assembly hardware, anchor bolts and controls for operation of the clarifiers, and all accessories and appurtenances specified or otherwise required for a complete and properly operating installation.
- C. Contractor shall be responsible for coordination of all related parts of work. Contractor shall verify all structures, piping, wiring, and components are compatible. Contractor shall be responsible for all structural and other alterations required to accommodate equipment differing in dimensions or other characteristics from these specifications and drawings.

##### 1.2 RELATED SECTIONS

- A. Section 01300 – Submittals
- B. Section 03300 – Concrete
- C. Section 05500 – Miscellaneous Metals
- D. Section 09900 – Special Coatings and Painting
- E. Section 11352 – Weirs and Baffles
- F. Division 16 – Electrical

##### 1.3 SUBMITTALS

- A. Provide shop drawings and product data in accordance with section 01300 for the equipment being furnished, to include at minimum the following:
  - 1. Certified shop drawings showing the details of construction, dimensions, and anchor bolt requirements.
  - 2. Complete wiring diagrams detailing all required field connections.
  - 3. Descriptive literature, brochures, and/or catalogs of submitted equipment.
  - 4. Calculations showing the structural capability of the clarifier mechanism to withstand the momentary peak torque.
  - 5. Complete bill of materials for the equipment.
  - 6. List of Manufacturer's recommended spare parts.

7. Calculations substantiating the continuous torque rating of the main gear set in accordance with standard ANSI / AGMA 2001.
8. Operation and maintenance manuals in accordance with the requirements of section 01430.
9. Manufacturer's valid ISO 9001:2008 certificate of registration
10. Equipment weights and lifting points.
11. Short- and long-term storage requirements.
12. Manufacturer's installation instructions.
13. Installation Reference Lists
14. Sludge Header Calculations: Confirming the velocity and headloss through each orifice.
15. Sludge Header Field Testing Report: Conducted on a full scale on a clarifier designed and manufactured by the supplier. The report shall conclude that the actual RAS withdrawal profile for the tested hydraulic header operating at 100% design RAS flow rate and near 50% turndown is consistent with the design intent, that is, the profile of the calculated orifice flows indicate that larger volumes of sludge are removed at greater distances from the tank center. The testing and report shall be performed by a licensed Professional Engineer.
16. Valid Welder Certifications
17. A copy of Manufacturer's factory warranty.

#### 1.4 REFERENCE STANDARDS

- A. American Iron and Steel Institute (AISI).
- B. American National Standards Institute (ANSI).
- C. American Society for Testing Materials (ASTM).
- D. American Bearing Manufacturers Association (ABMA).
- E. American Gear Manufacturers Association (AGMA).
- F. National Electrical Manufacturers Association (NEMA).
- G. Underwriters Laboratory (UL).

#### 1.5 QUALITY ASSURANCE

- A. Qualifications: Qualified Manufacturers shall have a minimum 20 years' experience manufacturing clarifiers, with no fewer than 20 operating installations of the type specified herein located in the USA. Manufacturer shall provide a list of 5 names and dates of installations for verification by the Engineer or Owner's Representative.
- B. A single manufacturer shall provide all components including but not limited to the clarifier, motors, gear reducers, controls, and control panels as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.
- C. Clarifier shall be Manufacturer's standard product and only modified as necessary to comply with the drawings, specifications, and specified service conditions.



- D. All welding is performed in accordance with American Welding Society (AWS) Structural Welding Code.
- E. All stainless-steel components shall undergo a passivation process to ensure maximum resistance to corrosion. All stainless-steel surfaces shall be thoroughly cleaned and glass bead-blasted to a minimum SSPC-SP-6 finish. The use of nitric and hydrofluoric acid passivation is not acceptable due to the negative impact these chemicals have on the environment.
- F. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or installation, defective workmanship or materials, and breakage or other failure. Materials shall be suitable for service conditions.
- G. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practices. The fabrication shall be performed by the equipment manufacturer at the manufacturer's facility located within the continental USA; all welding shall be performed by direct employees of the manufacturer, each welder shall be certified in accordance with AWS or ASME. Welder certificates shall be provided to the Engineer upon request.
- H. Each clarifier shall have the Manufacturer's name, address, and product identification information on a corrosion resistant nameplate securely affixed to the equipment.
- I. Clarifier manufacturer shall be ISO 9001:2008 certified and provide the Engineer with a copy of a valid certificate of registration.

#### 1.6 WARRANTY

- A. The equipment shall be warranted by the manufacturer for a period of one (1) year from the date of Owner Acceptance.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Shipping
  - 1. Ship equipment, material, and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
  - 2. Pack spare parts in containers bearing labels clearly designating contents and equipment for which they are intended.
- B. Receiving and Storage:
  - 1. Store and safeguard equipment, material, and spare parts. All spare parts must be stored in accordance with manufacturer's recommendations.

#### 1.8 OPERATION AND MAINTENANCE MANUALS

- A. The manufacturer shall furnish operation and maintenance manuals in accordance with the requirements of section 01430 – Operation and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.1 CLARIFICATION EQUIPMENT

- A. Manufacturers:
1. Kusters
  2. WesTech
  3. Lakeside
  4. Substitutions: Section 01600 - Product Requirements.
- B. The manufacturer shall be successful in the experience of manufacture, installation, operation, and servicing of equipment of the type, size, quality, performance, and reliability equal to that specified. The manufacturer shall submit evidence of experience having supplied at least twenty (20) installations of similar type and size in the past five (5) years.
- C. Suppliers not meeting the experience clause identified in section 1.5.A shall provide a performance and payment bond for 100% of the contract amount. The bond shall be issued by a surety with an FSR rating of no less than "A". A letter of surety shall be provided with the pre-approval to confirm bondability. The owner and/or engineer reserves the right to reject any manufacturer should insufficient or incomplete data be provided to determine an approved equal manufacturer status.
- D. GENERAL DESIGN REQUIREMENTS
1. Structural Steel: ASTM A-36 and shall conform to requirements of the AISC "Speciation of the design, fabrication and erection for structural steel for buildings" Latest edition, except that the maximum allowable stress for the loading conditions of any member shall be 2/3 the value allowed by the AISC.
  2. Thickness of Structural Steel shall be no less than ¼ inch.
  3. Welding: All A-36 steel, both submerged and non-submerged, shall be continuously seal welded. Stitch or skip welding is not permitted.
  4. The clarifier components shall be designed for all bolted connections, field welding will not be permitted.
  5. The Contractor shall be required to make any necessary modifications to the new or existing concrete to accommodate the equipment furnished. The manufacturer shall ensure the manufacturer furnished anchor bolt templates are properly designed for the application.
  6. Edge Grinding: Sharp projections of cut or sheared edges of ferrous metal shall be ground to a radius by a power grinder as required to ensure satisfactory coating adhesion.

E. DESIGN CRITERIA (per Clarifier)

Maximum Influent Flow (MGD):	4.2
Maximum RAS Flow (MGD):	2.1
AGMA Rated Continuous Torque (ft-lbs):	16,000
Momentary Peak Torque:	2x Continuous
Minimum Main Gear Pitch Diameter (in):	30
Minimum Main Bearing Diameter (in):	35
Tip Speed (ft/ min):	8
Tank Diameter (ft):	78
Sidewater Depth (ft):	14

Floor Slope (in/in):	1:12
Feedwell Diameter (ft):	16
Feedwell Depth (ft):	5
Minimum Drive Motor Horsepower:	0.75
EDI Well Diameter (ft):	8
EDI Well Depth (ft):	3
Operational Environment:	Non-Hazardous
Stainless Steel Hardware Grade:	304 / 316
Center Column Diameter (in):	24

F. PERFORMANCE AND DESIGN REQUIREMENTS

1. Each clarifier shall be capable of processing the specified maximum flow of municipal wastewater and shall be capable of efficiently separating solids from the treated liquid.
2. All components shall be designed and manufactured so the clarifier(s) can withstand the structural force exerted by momentary peak torque. All structural and functional parts shall be adequately sized to prevent deflection and vibration which could impair operation.

G. CLARIFIER COMPONENTS

1. Center Column
  - a. The center column shall Support entire sludge collector mechanism including inboard end of the access bridge; sized and designed by collector manufacturer. Minimum wall thickness of 1/4 inch; mounted at center of basin. Shall be provided and designed to support all required static and dynamic loads. The column shall be designed for 2 times the continuous operating torque identified in section 2.2.B.
  - b. The bottom of the column shall have a bolting flange for anchorage to the concrete tank using stainless steel anchor bolts. The Manufacturer shall provide a steel template/grout shield to accurately locate anchors and allow for grouting beneath the pier after final plumbing.
  - c. The column shall have gusset plates located at the top and bottom flanges for added strength.
2. Center Drive Cage
  - a. The drive cage shall be a steel box truss capable of carrying dead load of rake arms plus its own dead load, as well as design total torque assuming entire design torque is distributed uniformly along each rake arm: bolted to spur gear assembly that rotates center cage; bolted to rake arms and influent well hangers (if used).
  - b. Structural calculations shall be provided verifying the structural ability of the drive cage. The cage shall be designed for 2 times the continuous operating torque identified in Table 2.2.B.
3. Feedwell
  - a. Welded steel concentric with center column supported by center cage or access bridge; top edges approximately 4 inches above tank water surface. Size shall be as identified in Table 2.2.B.
  - b. Four baffled slots at liquid level to permit removal of floating material in well; 12 inches long; extending 2 inches below low-water level.
  - c. Feedwell plate sections shall be designed to bolt together.
4. EDI Well

- a. Mounted concentric with center column, supported by center cage; top edge approximately 4 inches above water surface; designed to diffuse influent into tank to greatest extent possible by use of energy-dissipating nozzles. Closed and sealed bottom within 1 inch of center column. Size shall be as identified in Table 2.2.B.
  - b. The EDI well shall be equipped with multiple curved outlet ports located on the side of the well. The ports shall be arranged evenly around the EDI and shall discharge the liquid into the direction of rotation to further dissipate energy and enhance flocculation.
  - c. Two 3" x 5" grit drains shall be provided on the EDI.
5. Rotating Truss Arms
- a. Each designed for 2 times the continuous torque identified in Table 2.2.B. Total torque shall be assumed to be distributed uniformly along each truss arm.
  - b. Truss arm design shall conform to slope of tank floor; consisting of structural steel triangular or box trusses attached rigidly to the center cage. Shall not incorporate use of any tie rods; self-supporting and without tie rods. Designed to support the sludge header assembly, as needed.
6. Sludge Manifold and Collection Header
- a. Each collector shall be provided with a fabricated steel rotating sludge manifold that is rigidly attached to the lower end of the drive cage. The manifold shall encompass the influent pier and be provided with upper and lower seals to limit the passage of fluid between the manifold and pier. The bottom of the manifold shall be hollow and completely cover the sludge withdrawal opening while riding on a full diameter seal ring and mounting plate assembly
  - b. To assure uniform sludge draw off, a galvanized steel header assembly shall be provided that will consist of a tapered tube section that varies in size from a maximum near the tank center to a minimum at its outer end. The longitudinal cross-sectional axis of the header shall be mounted at an angle of 45 degrees with the tank bottom. The leading edge of the header shall extend forward and down 2 inches at an angle of 45 degrees to provide an equalizing vane as an integral part of the header and to direct the sludge into the orifice's area of influence. A flange shall be provided at the inner end of each header for connecting the fabricated steel center outlet manifold. The header shall be supported using the truss arm and/ or stainless-steel tie-rods.
  - c. Inlet orifices shall be spaced at regular intervals along the length of the header. The orifices shall vary in size from a minimum near the tank center to a maximum at the outer end and shall be accurately located. The orifices shall be designed to withdraw sludge volumes proportional to their respective swept areas of the tank at all flows. Detailed calculations shall be submitted to show the velocities, the tank area served by each orifice, the respective orifice size, as well as the velocity through the orifice at maximum and minimum RAS flows.
7. Walkway and Service Platform
- a. Welded steel truss or beam bridge construction and composed of two main members laterally braced together. UHMW-PE slide plates and anchor bolts for wall support shall be provided.
  - b. Bridge shall be capable of supporting dead loads plus minimum walkway live load of 50 pounds per square foot with deflection of maximum  $L/360$

- of span for dead load plus live loads; cambered for 1/3 live load plus dead load.
- c. Walkway shall be supported at the drive service platform and the concrete wall. The service platform shall be located around the center drive and provide a minimum clearance of 1 foot 6 inches around all sides of the drive mechanism.
  - d. Handrail: The walkway and platform shall be provided with mechanical handrail 42" high, double row 1.5" diameter aluminum pipe, and 0.25" x 4" kickplates on both sides. Walkway trusses may serve as the handrail if the top chord is 3'-6" above the walking surface.
  - e. Decking: The entire walkway shall be covered with aluminum I-bar grating, 1.25" thick, attached with aluminum grating clips and stainless-steel hardware. The service platform shall be covered with 0.25" aluminum checkered plate.
8. Skimmer and Scum Removal
- a. A surface skimming system shall be provided and consist of two (2) skimming arms with skimmer heads, and a scum collection box. The skimmer arms shall span from the feedwell to the scum baffle and shall be supported by and rotate with the truss arms. Each skimmer head shall be designed to maintain constant contact with the scum baffle and shall include a 60-durometer neoprene wiper.
  - b. The scum box shall be peripherally located and supported by steel support angles. The scum box shall be a minimum of 4'-0" wide x 4'-2" in length and constructed from 1/4" steel plate and angles.
  - c. An auto flush valve assembly shall be provided and mounted on the scum box. The valve body and parts shall be corrosion resistant material of either stainless steel or brass. The valve shall automatically open and close with each pass of the skimmer arm. The seal shall be a BUNA-N rubber type and properly seal without leakage. The duration and volume of flush water shall be adjustable.
9. Center Drive Mechanism
- a. General: The center clarifier drive mechanism shall consist of an electrical motor, primary reducer, intermediate gear reducer and a main gear set consisting of a spur pinion and internal tooth spur gear.
  - b. Motor: The clarifier drive shall be driven by an electric motor. The motor shall be UL rated for the operational environment as specified in Table 2.2 B. The 1 HP motor shall be rated for 230/ 460V, 60 Hz, 3-phase operation with a minimum service factor of 1.0.
  - c. Primary Reducer: A primary hydraulic reducer shall transmit torque to the intermediate reducer and provide overload protection. The hydraulic system shall be self-contained, and fully enclosed in a 304 stainless steel enclosure. The enclosure shall also function as the fluid reservoir and shall provide a minimum 8-gallon capacity. The hydraulic system shall include: a hydraulic motor, a hydraulic pump, an aluminum manifold assembly, a flow directional valve, a pressure relief valve, an oil filter assembly, an oil filter replacement indication gage, a 6-inch diameter glycerin filled torque indication gage and all necessary hoses and fittings.
  - d. Intermediate Reducer: The intermediate reducer shall be a planetary type, providing no less than 90% gear efficiency. All lubrication of the planetary gearing shall be oil. Grease lubrication is not permitted. The planetary reducer shall be designed for a 200,000-hr. service life at the rpm and torque

specified in Table 2.2.B. The output shaft of the intermediate reducer shall be keyed to a heat-treated spur pinion.

- e. Final Reducer: The main gear shall include an internal tooth spur gear and spur pinion. The main gear material shall be ASTM A536 Ductile iron, 80,000 psi minimum tensile strength. The pinion shall be constructed from AISI 4150 steel, hardened to a minimum 340 Bhn.
- f. Final Reducer: The main gear shall include an internal tooth spur gear and spur pinion. The main gear material shall be forged alloy steel, induction hardened to a minimum 53Rc. The pinion shall be constructed from AISI 4150 steel, hardened to a minimum 340 Bhn.
- g. Turntable Base: Fabricated Steel, ASTM A36, minimum 36,000 psi tensile strength; able to be bolted to center column and to provide support for internal spur gear, the entire rotating collector mechanism and one end of the access bridge. Cast iron housing are not permitted.
- h. Main Bearing: The main bearing shall consist of hardened steel chrome ball bearings and nylon spacer (1" minimum), each riding on a contoured, hardened steel raceway set as part of a precision bearing. The main bearing diameter shall be as identified in Table 2.2.B of these specifications.
- i. Torque Overload Protection: The clarifier drive shall include a hydraulic torque overload protection system. Mechanical overload devices are not permitted due to their inherent inaccuracy. Two overload switches shall be provide, one for "alarm" set at 100% of the continuous torque identified in Table 2.2.B, and one for "motor cut-off" set at 130% of the continuous torque identified in Table 2.2.B. Additionally a pressure relieve valve shall be provided set at 150% of the continuous torque identified in Table 2.2.B. All switches shall be current rated for 120 VAC. Each switch shall be NEMA rated for the specified environment identified in Table 2.2.B of these specifications. The torque indication gage shall be 6 inches in diameter, glycerin filled with a scale that displays actual operating torque (ft-lbs or N-m).
- j. Condensate Removal: A condensate removal system shall be included to automatically remove condensate from the main gear housing. The condensate system shall include a 1" galvanized steel piping with vertical stem. The pipe arrangement shall be designed to provide constant removal of condensate from the main gear housing. A minimum of 6" clearance shall be provided below the low point drain to allow for easy access by plant personnel.
- k. Coatings: Each clarifier drive mechanism shall be factory coated with 2 coats (2-3 mils per coat, minimum DFT) of Tnemec epoxy prior to shipment.

## 2.2 CONTROLS AND INSTRUMENTATION

### A. GENERAL

- 1. The clarifier control panel shall be the supplier's standard UL listed enclosure and wired for 460 volts, 3-phase, 60 Hz electrical service. The enclosure shall be furnished completely pre-wired and tested, requiring only mounting and connection to field mounted electrical devices. The control panel shall include all equipment required to control the clarifier specified herein.
- 2. Refer to Specification Section 16480 ("Manufactured Control Panels") for additional control panel requirements.

3. The control panel enclosure shall be NEMA rated for the specified environment identified in Table 2.2.B of these specifications. The enclosure shall house the control devices, relays, terminal blocks, and motor starter. All hinges and latches shall be corrosion resistant.

**B. OPERATION**

1. The control system shall be equipped with one (1) ON / OFF / AUTO position selector switch. In the Off mode the clarifier drive will not run. In the ON mode the clarifier drive shall run continuously. In the AUTO position, the clarifier drive shall run based on on/off commands from the plant SCADA system. The unit shall automatically restart after power failure. The following items shall be included in each control panel.
  - a. Clarifier run light (green)
  - b. Torque “alarm” light (amber)
  - c. Torque “motor cut out” light (red)
  - d. UL 508A Listed industrial controls label
  - e. “Alarm” horn
  - f. Reset push button
  - g. On/Off selector switch
  - h. Relays and control power transformers as required
  - i. Main Breaker
  - j. Main door mounted disconnect switch with through the door lockable handle

**C. COMPONENTS**

1. Enclosure
  - a. Enclosures shall be NEMA rated as required, for the specified environment identified in Table 2.2.B of these specifications.
  - b. Enclosure shall house the circuit breaker, motor starter, control devices, relays, and terminal blocks.
2. Control Devices
  - a. Pilot devices shall be mounted on the enclosure front panel door.
  - b. Indicator lights shall be LED type. Selector switches shall be heavy duty NEMA type.
  - c. Control transformer shall be protected by two (2) primary fuses and one (1) secondary fuse. The 120-volt secondary shall have one leg grounded.
  - d. Auxiliary relay contacts shall be included for clarifier drive, Run, Off, alarm, and motor cut out overload signal outputs. The contacts shall be rated 10-amp, 240 VAC, resistive load.
  - e. Relaying shall be included for clarifier drive start control input from the plant SCADA system as indicated on electrical plans. The contacts shall be rated 10-amp, 240VAC, resistive load.
  - f. Starter shall be integral to the enclosure.
  - g. Provide the following sets of auxiliary dry terminal blocks for monitoring by Owner’s SCADA system:
    - 1) Running
    - 2) Fault
    - 3) High Torque
    - 4) ON/OFF/AUTO switch “Not In Auto”
  - h. Provide the following relaying for control of the clarifier drive by the plant SCADA system:

- 1) Clarifier drive On/Off control

## 2.3 SOURCE QUALITY CONTROL

- A. Clarifier components and control panel shall be factory assembled and tested to ensure proper fit and satisfactory operation. Equipment shall be shipped in the minimal practical number of pieces for minimal field assembly by the Contractor.

## 2.4 SHOP PAINTING

- A. Stainless steel and other corrosion-resistant surfaces shall not be painted. Gearboxes, Motors, and other manufactured components will receive the manufacturer's standard weather- and corrosion-resistant coating. All fabricated steel components shall be coated in accordance with Section 09900.

## 2.5 SPARE PARTS

- A. The following spare parts shall be provided:
  1. Two (2) Hydraulic Oil Filters
  2. One (1) Skimmer Neoprene

## **PART 3 EXECUTION**

### 3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify anchors are correctly positioned.

### 3.2 INSTALLATION AND TESTING

- A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify Engineer of any significant deviations.
- B. Installation of the equipment shall be in strict accordance with the contract documents and the Manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractors shall install the anchor bolts in accordance with the Manufacturer's recommendations.
- C. Supplier shall furnish the services of a factory-trained Service Engineer for Three (3) trips and Five (5) days for start-up, commissioning, and operator training.
  1. Equipment shall not be energized, or "bumped", to check the electrical connection for motor rotation without installation inspection and the Service Engineer present.
  2. The Service Engineer shall test rotate each clarifier for 2 complete revolutions, inspect the installation, and make recommendations for any necessary mechanical adjustments by the Contractor.
  3. The Service Engineer shall conduct a torque test during the start-up and commissioning to demonstrate proper operation of the overload system.

END OF SECTION



## SECTION 11352

### WEIRS AND BAFFLES

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. The contractor shall furnish and install fiberglass weir plates, scum baffle plates, and scum baffle supports as shown on the plans. Included shall be necessary butt and splice plates at each weir and baffle plate joint to prevent short circuiting. Necessary fiberglass washers and stainless-steel mounting hardware shall also be included. All hardware shall be type 316 stainless steel unless otherwise specified by the engineers.
- B. Contractor shall be responsible for coordination of all related parts of work. Contractor shall verify all structures, piping, wiring, and components are compatible. Contractor shall be responsible for all structural and other alterations required to accommodate equipment differing in dimensions or other characteristics from these specifications and drawings.
- C. Related Sections:
  - 1. Section 11351 – Clarifier Equipment
  - 2. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

##### 1.2 REFERENCES

- A. American Iron and Steel Institute (AISI).
- B. American National Standards Institute (ANSI).
- C. American Society for Testing Materials (ASTM).
- D. American Bearing Manufacturers Association (ABMA).
- E. American Gear Manufacturers Association (AGMA).
- F. National Electrical Manufacturers Association (NEMA).
- G. Underwriters Laboratory (UL).

##### 1.3 SUBMITTALS

- A. Shop Drawings
  - 1. Manufacturer's catalog information, descriptive literature, specifications and identification of materials of construction, including resins and glass fiber content and layout for FRP constructions.
  - 2. Detailed drawings that show equipment fabrication dimensional layouts, bill of materials, bolt and anchor locations, method of attachment including number, locations

and size of fasteners, and shall be based on field measurements by the Contractor to ensure proper installation.

B. Quality Control Submittals

1. Manufacturer's Certificate of Compliance.
2. Special shipping, storage and protection and handling instructions.
3. Manufacturer's written/printed installation instructions.
4. Certified test reports of the physical and mechanical properties of the product. Each panel shall have the following minimum physical properties:

<u>Property</u>	<u>Test</u>	<u>Minimum Value</u>
Tensile Strength	ASTM D-638	19,400 psi
Flexural Strength	ASTM D-790	28,500 psi
Flexural Modulus	ASTM D-790	1,550,000 psi
Barcol Hardness	ASTM D-2853	57.8
Water Absorption	ASTM D-570	0.157%

1.4 DELIVERY AND STORAGE

- A. Ship equipment pre-assembled to the degree that is practicable.
- B. Provide storage instructions indicating specific requirements to ensure there is no damage to or deterioration of components.

1.5 WARRANTY

- A. Manufacturer shall warrant the weirs and scum baffles to be free of defects in materials and workmanship for a period of one year after the date of Substantial Completion.

1.6 COORDINATION

- A. Manufacturer shall coordinate the weir and scum baffle design and installation requirements with the clarifier mechanism, scum box and launder effluent channel configurations.

**PART 2 PRODUCTS**

2.1 WEIRS AND BAFFLES

- A. Manufacturers:
  - a. MFG
  - b. FFI
  - c. Enduro
  - d. Substitutions: Section 01600 – Product Requirements
- B. Manufacturer and supplier of material shall be NSF61 certified and listed on NSF website as a certified manufacturer.
- C. Manufacturer and supplier to supply a performance bond.

- D. Manufacturer of products shall be ISO 9001 certified.
- E. FRP products will be manufactured entirely in the U.S.A.
- F. Supplier of FRP material shall be the manufacturer of the FRP material.
- G. Except for bolts and hardware specified herein, the weirs, scum baffles and supports shall be polyester plastic resin, reinforced with glass fiber. All weir plates, weir washers, weir splice plates, scum baffle panels, scum baffle splice plates and baffle support brackets shall be fiberglass reinforced plastic molded to produce uniform smooth surfaces. The surface shall be resin rich, free of voids and porosity, without dry spots, crazes or unreinforced areas and shall provide for increased corrosion resistance and UV protection. The weirs and scum baffles shall be MFG Construction and Water Products Aqua in color.
- H. The weir plates, splice plates and weir washers shall be 1/4" thick plastic laminate. Weir plates shall not exceed 16' in length unless otherwise noted. The specific dimensions of the weirs and scum baffles shall be as shown on the drawings. Oversized mounting holes in the weir plates shall be provided for vertical and horizontal alignment of at least 2" with 5" diameter FRP weir washers to cover the holes. The weirs shall be mounted with 1/2" x 3 3/4" stainless steel expansion anchors 2' on center for curved runs and 1' on center for straight runs. Cut ends of non-standard lengths shall be sealed with resin.
- I. Scum baffle panels and splice plates shall be 1/4" thick plastic laminate. The scum baffle panels shall be 12" high and shall not exceed 16' in length unless otherwise noted. Flanged scum baffle plates with a 3/4" turn back top and bottom are also available. Splice plates shall be 6" x 12".
- J. Baffle Support Brackets
  - a. Size: 1/4 inch thick, 3 inches wide.
    - i. Non-algae sweep tank design:
      - 1. Upper baffle support bracket; 6 inch x 9 inch
      - 2. Lower baffle support bracket; 6 inch x 8 inch
    - ii. Algae sweep tank design:
      - 1. Upper "L" baffle support bracket design; 6 inch x 9 inch
      - 2. Lower baffle support bracket design; 6 inch x 8 inch
  - b. Slotted to allow at least 1-1/2 inches vertical and horizontal adjustments.
- K. The brackets shall be installed on 4' centers. Fastening holes in the scum baffle panel shall be countersunk to accommodate flat head fasteners. Cut ends of non-standard lengths shall be sealed with resin.
- L. Expansion anchors, nuts, bolts, washers and other hardware shall be Type 304 or 316 stainless steel.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. The installation contractor shall field verify existing dimensions and install the weir and scum baffle in accordance with the Contract Drawings, approved shop drawings and

manufacturer's recommendations. Field cutting of panels will be allowed to complete the structure. All field cut or drilled edges shall be sealed per the manufacturer's recommendations. All of the fasteners required for installation shall be supplied by the weir and scum baffle manufacturer.

- B. Weirs and scum baffles shall be carefully aligned and leveled to the elevations shown on the drawings. In the completed installation, no variation greater than 1/8" shall exist between any two notches of the weir plate in any one tank. In addition, the average deviation from one quadrant of the weir to any other shall not exceed 1/16". The installation contractor shall apply a suitable sealant between the weir and the wall to prevent the flow of liquid between the weir and the tank wall.

END OF SECTION

## SECTION 16050

### BASIC ELECTRICAL MATERIALS AND METHODS

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

###### A. General Conditions:

1. The accompanying General Conditions (front-end specifications) shall apply to and form a part of this section.

###### B. General Requirements:

1. Carefully examine General Conditions, other specification sections, and other drawings (in addition to Electrical) in order to be fully acquainted with their effect on electrical work.
2. Do all work in compliance with all applicable codes, laws, and ordinances, the National Electrical Safety Code, the National Electrical Code (hereinafter referred to as "Code"), applicable energy codes, and the regulations of the local utility companies. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like.
3. Cooperate with other trades and contractors at job. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.
4. The Owner shall be provided access to all software to include copies of software for all systems provided under this division of the specifications. Software shall be password protected where applicable.
5. Only qualified electrical sub-contractors will be allowed to submit proposals for this project. In order to be considered qualified, contractor shall have completed a minimum of five (5) projects of similar type/scope and equal or greater magnitude and complexity within the last ten (10) years. Sub-contractors without qualifications will be rejected. If desired, potential electrical sub-contractors may submit qualification evidence for review and pre-bid approval a minimum of ten (10) days prior to bid. Previous projects used to meet this experience requirement must have included similar (or greater) scopes of work for each of the following areas:
  - a. Power Systems.
  - b. Control Systems.
  - c. Instrumentation Systems.
6. Electrical contracting firm shall be licensed as an electrical contractor in the state where work will be performed

##### 1.2 GENERAL SCOPE OF ELECTRICAL WORK (REFER TO DRAWINGS FOR OTHER SPECIFIC SCOPE ITEMS)

- ###### A.
1. Furnish all labor and materials to complete electrical work as shown on drawings and/or herein specified.

- B. Remove all existing electrical equipment and wiring made obsolete by this project and remove or relocate all electrical services located on or crossing through the project property, either above or below grade, which would obstruct the construction of the project or conflict in any manner with the completed project or any code pertaining thereto. Dispose of salvageable materials as directed by the Engineer. Contractor shall schedule meeting to review scope of electrical demolition and to confirm scope and phasing of proposed demolition with the owner in the presence of the prime consultant prior to start of any electrical demolition.
- C. Furnish and install complete power distribution system as shown on drawings and/or specified herein.
- D. Furnish and install disconnect switches for motors as shown on drawings and/or specified herein.
- E. Furnish and install complete electrical grounding systems as shown on drawings and/or specified herein.
- F. Install and connect electrical equipment mentioned in Division 16 Specifications or noted in drawings, whether furnished by electrical contractor or by others.
  - 1. Where shown or specified, equipment furnished by others shall be installed and connected under this Contract.
  - 2. Where shown or specified, Contractor shall receive, unpack, check and assume custody of equipment furnished by Others. Contractor shall assume responsibility for care and safekeeping of this equipment, when delivered into his custody. He shall protect it from moisture, dust and damage during construction and until Owner acceptance of project.
- G. Furnish and install complete electrical lighting systems as shown on drawings and/or specified herein.
- H. Furnish and install all electrical items shown on drawings and/or herein specified, unless shown or specified otherwise.
- I. Furnish and install complete controls, instrumentation & auxiliary systems as shown on drawings and/or specified herein.
- J. Furnish and install a complete Surge Protection System as shown on drawings and/or specified herein.
- K. Procure and pay for permits and certificates as required by local and state ordinances and fire underwriter's certificate of inspection.
- L. Balance loads as equally as practicable on services, distribution feeders, circuits and buses. Provide typewritten directory for each panel.
- M. Unless specifically indicated or required otherwise, terminate all circuitry/cabling provided within this contract at associated equipment/devices/etc. in accordance with all applicable codes, standards and supplier requirements, whether associated equipment/device/etc. is furnished within this contract or by others.

- N. Complete field testing, adjustment & startup of all systems listed above as shown on drawings and/or specified herein.

## **PART 2 PRODUCTS**

### **2.1 APPROVED MATERIALS AND DEVICES**

- A. Where not otherwise specified, provide only new, standard, first-grade materials/systems throughout, conforming to standards established by Underwriter's Laboratories, Inc., and so marked or labeled, together with manufacturer's brand or trademark. All equipment/systems subject to approval of Engineer before installation. All like items and associated equipment/systems shall be of one manufacturer.
- B. To ensure proper coordination, it is intended that all electrical equipment and materials specified in Division 16 of these specifications and shown on the electrical drawings be furnished and installed by the electrical sub-contractor. It will not be permissible for any of these items to be furnished directly by the general contractor without the electrical contractor's coordination.
- C. To ensure commonality of spare parts, it is required that the electrical contractor provide the same brand for all circuit breakers, starters, power equipment, etc. provided under the following divisions of these specifications:
  - 1. SECTION 16055: POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES
  - 2. SECTION 16410: SAFETY SWITCHES AND FUSES
  - 3. SECTION 16441: POWER PANELBOARDS - CIRCUIT BREAKER TYPE
  - 4. SECTION 16442: LIGHTING PANELBOARDS

### **2.2 SUBMITTALS**

- A. All submittals to the design team shall be accompanied by a letter summarizing all proposed deviations from specified products or pre-approved substitutions. The absence of such a letter shall be understood to indicate that the contractor intends to meet all contract requirements, regardless of cut-sheets/data-sheets provided within the submittal.
- B. Submit to Engineer ten (10) days prior to bid date three (3) copies of any items and/or manufacturers which are proposed as substitutes for those specified.
- C. Submit to Engineer promptly after award of Contract and prior to purchasing, the number of copies required by the contract. All drawings of a specific item or system shall be made in one submittal, and within thirty (30) days after award of Contract. Shop drawings of all power equipment shall contain exact details of device placement, phasing and numbering, in form of elevations, for each major piece of equipment. Shop drawings shall be submitted on the following:
  - 1. SECTION 16055: POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES
  - 2. SECTION 16289: SURGE PROTECTIVE DEVICES
  - 3. SECTION 16410: SAFETY SWITCHES AND FUSES
  - 4. SECTION 16441: POWER PANELBOARDS - CIRCUIT BREAKER TYPE
  - 5. SECTION 16442: LIGHTING PANELBOARDS

6. SECTION 16480: MANUFACTURED CONTROL PANELS
  7. SECTION 16511: LIGHTING MATERIALS AND METHODS
  8. SECTION 16850: ELECTRICAL HEAT TRACING SYSTEMS
  9. SECTION 16900: SCADA SYSTEM
  10. ALL POWER DISTRIBUTION EQUIPMENT (i.e. SWITCHBOARDS, PANELBOARDS, DRY TYPE TRANSFORMER, ETC.)
  11. ALL ELECTRICAL AND TELECOMMUNICATION EQUIPMENT LAYOUTS - Submittals shall include ¼" = 1'-0" CAD drawings (hand drawn sketches will not be accepted) of each electrical room, IT room, electrical equipment stand, generator area, or any other similar area with electrical equipment. Drawings shall indicate all panelboards, transformers, switchboards, generators, equipment racks, control panels, HVAC equipment, etc. that are located in each electrical/IT area. Layouts shall show that each piece of electrical equipment has the clearances, working space and dedicated equipment space required by applicable codes. No conduits to equipment within these areas shall be installed until submittals have been provided and returned without exception by the design team.
  12. ALL CONTROL ITEMS & SYSTEMS
- D. The contractor shall fully review, comment upon and correct all shop drawings as required to assure compliance with contract documents prior to submittal to Engineer. The failure of the contractor to properly review and correct shop drawings prior to submittal will result in rejection of shop drawings by the engineer. Review by the Engineer will be for general conformance with contract documents. The contractor shall be fully responsible for correctness of all submitted dimensions, details, quantities and locations.
- E. None of the above items shall be installed until shop drawings or catalog data have been reviewed by Engineer without rejection or required resubmittal. Any listed item not submitted, even if specified, shall be considered not acceptable and shall be removed if directed.
- F. Any required resubmittal will be reviewed by the Engineer for conformance with previously issued comments only. The contractor shall be responsible for verifying that all items not specifically requiring resubmittal have not been altered from the previously reviewed submittal.
- G. Material proposed for substitution shall be of the same quality, perform the same functions, conform to such physical dimensions and appearance as are required by the Engineer. All material proposed for substitution is subject to the approval of the Engineer and his authority for approval is final. No material proposed for substitution will be considered unless all submittal data complies with the drawings and specifications of Section 16 as to time of submission, number of copies of submittal, and detail requirements.
- H. Samples of material shall be furnished where required by drawings or Division 16 Specification, or as requested by the Engineer on items proposed as substitutes.
- I. Submit to Engineer a certificate of final inspection from local inspection department.



## **PART 3 EXECUTION**

### **3.1 SITE VISIT**

- A. The Contractor shall visit the site to determine existing dimensions and conditions affecting electrical work. Failure to do so in no way relieves Contractor of his responsibility under Contract.

### **3.2 CLEARANCE WITH UTILITIES**

- A. It shall be the responsibility of this Contractor, prior to bid, to reaffirm with the utility companies involved, that the locations, arrangement (and with power company voltage, phase, and metering required) and connections to utility service are in accordance with their regulations and requirements. If their requirements are at variance with these drawings and specifications, the Contract price shall include any additional cost necessary to meet those requirements without extra cost to Owner after a contract is entered into.
- B. On many projects the utility company may levy charges due to locations, size or type service involved. The Contractor shall be responsible for these charges (including permanent meter deposit), unless such charges are not available prior to bid and Contractor so documents as described below. The meter deposit will be refunded to the contractor at time of Owner's acceptance.
- C. Should above cost not be available, prior to bid, Contractor must submit a letter signed by a responsible utility company person so stating with his bid and in turn must be submitted by Prime Contractor with his bid to Owner. The cost will then be deleted from the Contract and become responsibility of the Owner.
- D. Arrange with utility companies for such services as shown or herein specified and installation of meter where shown. Furnish with shop drawings a signed document from utility companies describing the location and type of services to be furnished and any requirements they may have. This document shall be signed for each utility company by a person responsible for granting such service.

### **3.3 WORKMANSHIP**

- A. All work shall be in accordance with the latest editions of NFPA 70 (National Electrical Code), NFPA 101 (Life Safety Code), National Electric Safety Code, International Building Code, applicable NECA standards and the rules and regulations of State and Local Authorities Having Jurisdiction.
- B. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance upon completion.
- C. All equipment, devices, etc. shall be installed in accordance with manufacturer's recommendations.
- D. All items shall be installed straight and plumb in a workmanlike manner and care shall be exercised so that like items are mounted the same position, heights and general location.

- E. Keep site clean of accumulation of cartons, trash and debris.

### 3.4 SAFETY

- A. The contractor is solely responsible for all job safety. Engineer assumes no responsibility for job safety. Maximum consideration shall be given to job safety and only such methods as will reasonably ensure the safety of all persons shall be employed. The codes and regulations of OSHA shall be given strict compliance as well as such other codes, laws, and regulations as may be applicable.

### 3.5 CONTRACT DOCUMENTS

- A. Contract documents indicate diagrammatically, extent, general character and approximate location of work. Where work is indicated but minor details omitted, furnish and install it complete so as to perform its intended functions. For details and mechanical equipment, follow drawings provided by other disciplines (Architectural, Mechanical, Structural, Civil, etc.) and fit electrical work thereto.
- B. Contract documents consist only of the hardcopy documents issued by the Prime Engineer. Electronic documents issued directly by the electrical engineer to the contractor and/or its sub-contractors/vendors are issued for convenience only (electronic documents are not formal contract documents).
- C. If the contractor and/or one of its suppliers require a one-time transfer of electronic files of the current electrical construction documents to prepare shop drawings (or for another similar purpose), it shall:
  1. Sign a waiver prepared by the electrical engineer prior to the transmittal of these files.
  2. Agree to pay the electrical engineer a fee of \$50.00 per drawing, up to a maximum of \$400 per transfer, payable upon receipt of the files.
  3. To the fullest extent permitted by law, indemnify, hold harmless, and defend JRA from all claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the use of the CAD files.
- D. Take finish dimensions at job in preference to scaled dimensions.
- E. Except as above noted, make no changes in or deviations from work as shown or specified except on written order of Engineer.

### 3.6 UNDERGROUND UTILITY/EQUIPMENT COORDINATION

- A. Prior to commencement of work, verify exact locations of all existing or proposed underground utilities and/or underground equipment and verify that proposed electrical installation does not conflict with these items. Notify Engineer immediately if any conflict is found.

### 3.7 EQUIPMENT STORAGE

- A. Store all electrical equipment in dry, covered locations as directed by equipment manufacturers. Contractor shall be responsible for replacing or repairing improperly-stored equipment as directed by Engineer.

### 3.8 EXCAVATION, CUTTING AND PATCHING

- A. Perform all cutting and excavating as necessary for installation of electrical systems, unless specifically covered under another section. After Engineer's observation, complete all excavation, filling and backfilling as directed under specifications for preparation of site and earthwork. Foundations for equipment shall be as specified under concrete section. Concrete pads shall be minimum of 6" thick; unless greater thickness required by equipment manufacturer. Obtain specific approval of Engineer before cutting into any structural members.
- B. For all such work employ competent workmen, and finish up in neat and workmanlike manner, equal to quality and appearance to adjacent work.

### 3.9 PENETRATIONS

- A. All penetrations in water tight barriers shall be made so that barrier rating is not compromised. Furnish roof flashing for all equipment installed under Division 16 that penetrates through the roof. Appropriate flashing is specified under roofing and sheet metal section. Supply these flashings for installation under roofing and sheet metal section.
- B. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly to maintain the fire/smoke rating of the associated membrane.
- C. Where penetrations are required through structural elements, verify penetration locations and sizes with structural engineer. In no case shall the structural integrity be compromised without written approval from structural engineer.

### 3.10 INSTALLATION OF EQUIPMENT - GENERAL

- A. Care shall be exercised in exact routing and location of all items so as not to obstruct access to equipment, personnel walkways, or expose it to potential mechanical damage.
- B. Items shall be securely anchored and/or fastened. Provide proper support for all equipment, devices, conduits, boxes, panels, etc. as required by code and for a workmanlike installation. Provide guy wiring for wood poles where required to prevent leaning. All construction shall meet the seismic design requirements of the building code. Items (especially transformers, light fixtures, equipment racks, freestanding gear, etc.) installed in seismic zones C, D, E or F shall be supported and braced per applicable codes and standards.
- C. All wall, pole or frame-mounted electrical equipment shall be mounted to metal unistrut (or similar) frames of same material as electrical equipment. For example, pole-mounted stainless steel disconnect switches shall be mounted to stainless steel unistrut frames.
- D. All electrical equipment, furnished by Contractor or by others shall be covered and protected during construction.
- E. All control cabinets, panels, motor control centers and other electrical cabinets and enclosures shall have all trash removed and be vacuumed clean. All foreign paint, etc.,

shall be removed from exterior and all scratches in finish touched up with same color and material as original. Any rusted areas shall be sanded, primed and repainted.

- F. All relays, starters, push-button and other control devices shall be cleaned and if necessary, lubricated with CRC 2-26 to assure free operation.

### 3.11 MOTORS, STARTERS AND CONTROLS

- A. Unless otherwise specified or shown, all motors will be furnished and installed under other sections of this specification.
- B. Electrical Contractor shall install all starters and all electrical power wiring and connections to motors and starters.
- C. Unless otherwise specified or shown, all control items for motors shall be furnished, installed and wired in conduit by the electrician.

### 3.12 CIRCUITS AND BRANCH CIRCUITS

- A. Outlets shall be connected to branch circuits as indicated on drawings by circuit numbers. No more outlets than are indicated shall be connected to a circuit.
- B. Branch circuit homeruns shall be installed as shown on drawings. Multiple homerun conduits shall not be combined by contractor into larger, single homerun conduits unless specific permission is granted by the Engineer.

### 3.13 LUG/TERMINAL RATINGS

- A. All lug/terminal ratings, sizes, locations, types, etc. shall be coordinated with the associated conductor sizes, types, routings, etc. by the contractor.
- B. All lugs/terminals/etc. shall be rated for 75 degree C terminations (minimum, unless specified otherwise).

### 3.14 EQUIPMENT FAULT CURRENT RATINGS

- A. All equipment and breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated distribution equipment. All interrupting ratings shall be full ratings. Where new devices or breakers are added to existing distribution equipment, the new devices/breakers shall have interrupting ratings matching or exceeding that of the existing distribution equipment.

### 3.15 OUTLET LOCATION

- A. Symbols shown on drawings and mounting heights indicated on drawings and in specifications are approximate only. The exact locations and mounting height must be determined on the job and it shall be the Contractor's responsibility to coordinate with other trades to ensure correct installation.

### 3.16 IDENTIFICATION

- A. Each panel shall have each circuit identified. Panels without branch circuit nameplates shall have typewritten directories.

- B. Each individually mounted switch, circuit breaker, starter and/or any other control or protective device shall identify equipment fed and fuse size, if any, by engraved plastic nameplate, white with black letters, screw attached.
- C. See Specification Section 16075 for additional requirements.

### 3.17 GROUNDING

- A. All equipment shall be grounded and bonded in accordance with all state/local regulations, The National Electrical Code and as specified herein.

### 3.18 PAINTING

- A. Refer to Painting/Finishing specifications for requirements regarding field painting of exposed conduit. Any scratches, dents or rust spots in conduit electrical enclosures, panels, motor control or any other electrical items shall have the dents removed, and they, along with any rust spots or scratches, sanded and touched up with the same exact color paint as original finish.

### 3.19 ACCEPTANCE TESTING

- A. Upon completion of work, the entire electrical system installed within this project shall be tested and shall be shown to be in perfect working condition, in accordance with the intent of the specifications and drawings. It shall be the responsibility of the Electrical Contractor to have all systems ready for operation and to have an electrician available to operate same in accordance with and under the supervision of the observation representative(s) of the Engineer. The Electrician shall be available to assist in removal of panel fronts, etc., to permit inspection as required.
- B. The electrical sub-contractor shall include in bid price start-up assistance and training from a certified representative of the manufacturer for the following systems:
  - 1. SECTION 16850: ELECTRICAL HEAT TRACING SYSTEMS
  - 2. SECTION 16900: SCADA SYSTEM

### 3.20 OPERATION AND MAINTENANCE DATA

- A. One set of marked "AS BUILT" drawings, three (3) sets of all equipment catalog and maintenance data and three (3) sets of all final shop drawings, on all equipment requiring same shall be turned over to owner. These items shall be bound in hard back book. Contractor shall explain and demonstrate all systems to Owner's representative.

### 3.21 GUARANTY-WARRANTY

- A. Furnish a written Guarantee-Warranty, countersigned and guaranteed by General Contractor, stating:
  - 1. That all work executed under this section will be free from defects of workmanship and materials for a period of one (1) year from date of final acceptance of this work.
  - 2. Above parties further agree that they will, at their own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

END OF SECTION 16050

## SECTION 16055

### POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES

#### PART 1 GENERAL

##### 1.1 SCOPE OF WORK

- A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:
  - 1. Power Distribution System Electrical Studies.

#### PART 2 PRODUCTS

##### 2.1 GENERAL REQUIREMENTS

- A. Short Circuit Studies, Protective Devices Evaluation Studies, Protective Device Coordination Studies and Arc Flash Hazard Studies shall be performed by the same entity, which shall be a Professional Engineer registered in the state where the equipment will be installed. The studies shall be per the requirements set forth in the latest edition of NFPA 70E-Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E, Annex D.
- B. The studies shall be submitted to the Engineer prior to shipment of any electrical distribution equipment.
- C. The studies shall include all portions of all electrical systems affected by the project (including any existing systems/equipment) from the utility service to any existing equipment at the facility (including all existing equipment fed from the same service point as any new equipment) and to all new equipment installed under this contract. All induction motors 50 HP or below and fed from the same bus may be grouped together. All induction motors greater than 50 HP shall be included individually with associated starters and feeder impedance. See individual study sections below for additional scope requirements.
- D. The studies shall be performed using the latest revision of the SKM Systems Analysis Power\*Tools for Windows (PTW) or EasyPower software program.
- E. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.
- F. The contractor shall be responsible for collecting data on any existing or proposed electrical equipment, devices, conductors, etc. as required to prepare the study, and shall supply pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the studies to be completed prior to shipment of equipment.

- G. The Power Distribution System Electrical Studies shall be performed by Square 'D' or Cutler Hammer; or a third-party vendor if specifically approved by the engineer prior to preparation of the studies.
- H. The proposed vendor shall have completed a minimum of five (5) equivalent Arc-Flash Hazard Studies in the past three (3) years.

## 2.2 SHORT CIRCUIT STUDY

- A. The Short Circuit Study shall be performed with aid of a computer program. The study input data shall include the power company's short circuit contribution, resistance and reactive components of the branch impedances, X/R ratios, base quantities selected, and other source impedances.
- B. Short circuit momentary duty values and interrupting duty shall be calculated on each individual basis with the assumption that there is a three-phase bolted short circuit at the respective switchgear bus, switchboard, low voltage motor control center, distribution panelboard, and other significant locations throughout the system.
- C. The short circuit tabulation shall include symmetrical and asymmetrical fault currents, and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contributions from each connected branch, including motor back EMF current contributions shall be listed with its respective X/R ratio.

## 2.3 PROTECTIVE DEVICE EVALUATION STUDY

- A. The Protective Device Evaluation Study shall be performed to determine the adequacy of circuit breakers, switches, transfer switches, and fuses by tabulating and comparing the short circuit rating of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied.
- B. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the Engineer's attention.

## 2.4 PROTECTIVE DEVICE COORDINATION STUDY

- A. The Protective Device Coordination Study shall be performed to provide the necessary calculation and logic decisions required to select or to check the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. The objective of the study is to obtain optimum protective and coordination performance from these devices.
- B. The coordination study shall show the best coordination attainable for all breakers down through the largest breaker at each piece of distribution equipment. Coordination study shall demonstrate selective coordination where required by applicable codes or contract documents.
- C. Phase and ground overcurrent protection shall be included as well as settings of all other adjustable protective devices. Where ground fault protection is used, coordination of the



ground fault protection with the first downstream overcurrent phase protection device shall be demonstrated.

- D. All restrictions of the National Electrical Code shall be adhered to and proper coordination intervals and separation of characteristic curves be maintained.

## 2.5 ARC-FLASH HAZARD STUDY

- A. The Arc-Flash Hazard Study shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
- B. The Arc-Flash Hazard Study shall be performed in conjunction with a short-circuit Study and a time-current coordination Study.
- C. The Arc-Flash Hazard Study shall be performed for the following equipment:
  - 1. All Distribution Equipment – This includes but is not limited to the following:
    - a. Switchgear
    - b. Switchboards
    - c. Motor Control Center
    - d. All Lighting and Power Panelboards
    - e. Fused Disconnect Switches rated greater than 100A
  - 2. Separately enclosed devices fed from protection device rated greater than 100A - This includes but is not limited to the following:
    - a. Control Panels
    - b. VFD's
    - c. RVSS
- D. A generic Arc-Flash label shall be applied to other electrical equipment that has not been included in the study. This includes but is not limited to the following equipment:
  - 1. Non-fused Disconnect Switches
  - 2. Fused Disconnect Switches rated 100A or less
  - 3. Transformers
  - 4. Control Panels, VFD's, RVSS, etc. rated 100A or less
- E. Where a main protective device is provided, the study shall be performed on the line side and load side of the main. The worst-case result shall be used for the study result and label.
- F. The Study shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
- G. Where incident energies are calculated to fall within the high marginal region of a given Hazard/Risk Category Level, the Hazard/Risk Category Level shall be increased one level.
- H. The Arc-Flash Hazard Study shall be performed in compliance with the latest IEEE Standard 1584, the IEEE Guide for Performing Arc-Flash Calculations. Where IEEE 1584 does not have a method for performing the required arc-flash calculations (such as for single phase equipment), calculations shall be performed and system shall be modeled

using modules/methods as recommended by the arc flash software supplier (for example, using SKM Unbalanced/Single Phase Studies module for modeling single phase systems).

- I. Equipment labels to identify AFIE and appropriate Hazard/Risk Category in compliance with NFPA 70E and ANSI Z535.4 (latest version of these requirements) shall be provided to the Electrical Contractor. The Electrical Contractor shall affix the labels to the distribution equipment devices as directed by the equipment manufacturer. These labels shall, at a minimum, include the following:
  1. WARNING label.
  2. Hazard/Risk Category.
  3. Arc Flash Boundary Distance.
  4. Incident Energy (in cal/cm<sup>2</sup>) at Working Distance.
  5. Shock Hazard Voltage.
  6. Limited Approach Boundary Distance.
  7. Restricted Approach Boundary Distance.
  8. Prohibited Approach Boundary Distance.
  9. Equipment Name.
  10. Name of Firm who prepared the Study.
  11. Project Number of the Firm who prepared the Study.
  12. Date that the Study was prepared.
  13. Method for calculating analysis data.
  14. Statement to read: “Any system modification, adjustment of protective device settings, or failure to properly maintain equipment will invalidate this label” (or equivalent).

## **PART 3 EXECUTION**

### **3.1 SUBMITTAL REQUIREMENTS**

- A. The results of the studies shall be summarized in a final report. The report shall include the following sections:
  1. General:
    - a. Description, purpose, basis and scope of the studies
    - b. Single line diagram of the portion of the power system which is included within the scope of the work. The single line diagram shall fit on one sheet of paper (size as required) unless approved otherwise by engineer. The following information shall be shown on the single line diagram:
      - 1) Device Name
      - 2) Branch Fault Currents with directional indicators
      - 3) General Location (for busses only)
      - 4) Other basic component information such as cable type, cable length, breaker rating, buss short circuit rating, transformer voltages, transformer size, fuse size, etc..
  2. Short Circuit Study:
    - a. Tabulation of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
  3. Protective Device Evaluation/Coordination Study:

- a. Protective devices time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
  - b. Fault current calculations including definitions of terms and a guide for interpretation of computer printout.
  - c. Documentation from utility company on their letterhead showing their anticipated values of available short circuit currents X/R ratios and protective devices with which the power distribution system will coordinate.
  - d. Time-current characteristics of the respective protective devices shall be plotted on log-log paper. Plots shall be printed in color with a dedicated color and pattern for each curve for clear identification.
  - e. Plots shall include complete titles, respective single line diagrams and legends, and associated power company's relay or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breakers trip curves and fuses.
  - f. The coordination plots shall indicate the type of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents.
  - g. The coordination plots for phase and ground protective devices shall be provided on a system basis.
  - h. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.
4. Arc-Flash Hazard Study:
- a. Tabulation of device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
  - b. Recommendations for reducing AFIE levels and enhancing worker safety.
- B. Furnish all labor, materials, calculations, electrical equipment, technical data and incidentals required to provide a complete short circuit study, coordination study and arc flash hazard study of protective devices, busses, etc. from the utility service to any existing equipment at the facility and all new equipment installed under this contract.
- C. The study shall comply with the following applicable provisions and recommendations of the latest revisions of the following: ANSI C37.5, IEEE Standard No. 399, and IEEE Standard No. 141.
- D. Submit calculations and results of the short circuit, protective device evaluation and coordination and arc flash hazard studies prior to submitting shop drawings for new equipment. Contractor shall verify that all proposed equipment is properly rated per the short circuit and protective device evaluation portions of the study prior to releasing equipment for manufacturing.
- E. Submit a copy of a sample typical arc flash label layout (meeting requirements outlined above) that will be used for the project.

- F. Submit final electronic copies of all SKM program files/models/input data/etc. used to perform the study to the owner with final close-out documents. These files shall be complete as required to allow future users to recreate the study.

### 3.2 INSTALLATION

- A. Contractor shall adjust all breaker settings as recommended by the coordination study prior to energizing equipment.
- B. Contractor shall affix arc flash hazard notification labels (as determined by the results of this study) to each piece of distribution equipment prior to energization of equipment. A generic arc-flash warning label shall be affixed to any electrical equipment not included in the analysis as outlined above.
- C. Where short circuit rating of equipment is dependent on setting of upstream overcurrent device, provide and install label for equipment indicating the required settings of the associated device.

END OF SECTION 16055

## SECTION 16060

### GROUNDING

#### PART 1 GENERAL

##### 1.1 GENERAL

- A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO GROUNDING OF THE FOLLOWING:
  - 1. Service Equipment.
  - 2. Transformers.
  - 3. Non-current carrying conductive surfaces of equipment.
  - 4. Metal Buildings.
  - 5. Structures.
  - 6. Other Equipment.

##### 1.2 GENERAL REQUIREMENTS

- A. All equipment, building steel, and main service shall be effectively and permanently grounded with a conductor cross section as required by the National Electrical Code and of capacity sufficient to ensure continued effectiveness of the ground connections for fault current. Ground conductors shall be as short and straight as possible, protected from mechanical injury and, if practicable, without splice or joint.
- B. All grounding connections shall be installed in accordance with the National Electrical Code and all local codes and requirements. Such codes shall be considered minimum requirements and the installation of the grounding system shall ensure freedom from dangerous shock voltage exposure and provide a low impedance ground fault path to permit proper operation of overcurrent and ground fault protective devices.

#### PART 2 PRODUCTS

##### 2.1 CONDUCTORS

- A. All grounding conductors shall be insulated with green colored, 600 volt insulation unless noted otherwise.
- B. Motors having power supplied by single conductor wire in conduit shall be grounded through the conduit system. Flexible conduit shall be "jumpered" by an appropriate bonding conductor.
- C. Supplemental grounding system conductors shall be bare, softdrawn, stranded, single conductor copper wire, and generally sized as follows (unless shown otherwise on plans):
  - 1. Switchgear, motor control centers, and power transformer #4/0 minimum or as shown on plans.
  - 2. Power panels, #2/0.
  - 3. Control panels and consoles, #4.
  - 4. Process Motors, #1/0.
  - 5. Building Columns, #4/0.

6. Light Poles, #2.
7. Telephone Backboard & Cabinet ground busses, #2.

## 2.2 GROUNDING ELECTRODES

- A. Grounding electrodes shall be copper-clad steel rods 3/4 inch in diameter and ten feet long. Where longer electrodes are necessary to reduce the ground resistance, Contractor shall provide sectional rods, connectors, drive heads, etc.

## 2.3 CONNECTIONS

- A. All conductor-to-conductor, conductor-to-ground rod, conductor-to-structure, conductor-to-fence connections of #6 and larger sized conductors and underground ground connections shall be permanent exothermic welded connections (Cadweld or equal) unless otherwise noted on applicable drawings.
- B. Connections to equipment shall be by bolted compression type lugs (except for motors). When the conductor is #6 and larger, the lug shall be joined to the conductor by an exothermic weld (Cadweld or equal).
- C. Motors to be grounded by the grounding conductors run with the power conductors shall have a split-post grounding stud installed in the connection box.
- D. Each cast pull box or junction box shall have a ground lug, connected to largest ground conductor to enter box.
- E. Ground connections at conduit terminations shall be made by approved grounding bushings (see Raceways Specification Section for additional requirements).

## 2.4 MANUFACTURERS

- A. Conduit clamps and connectors shall be manufactured by Raco, OZ., or Ercon.
- B. Lugs shall be as manufactured by Square "D", Burndy, or T and B.
- C. Exothermic weld connections shall be as manufactured by Cadweld, or approved equal.
- D. Ground rods shall be as manufactured by Joslyn or McGraw Edison.
- E. Split post grounding shall be as manufactured by Burndy or T and B.

# PART 3 EXECUTION

## 3.1 MAIN SERVICE GROUND

- A. The main service grounding electrode system shall consist of the following items bonded together by the grounding electrode conductor:
  1. The main underground cold water pipe (metal).
  2. The metal frame of the building.
  3. Driven ground rods. Ground rods shall be embedded at the lowest point in the building and below the permanent moisture level. Ground rods shall be spaced a

minimum of ten (10) feet apart and connected in parallel until resistance to ground does not exceed five (5) ohms.

- B. The grounding electrode system shall be connected to the grounded conductor (neutral) on the supply side of the service disconnecting means by a grounding electrode conductor not smaller than that shown in Table 250.66 of the N.E.C. The main service equipment grounding conductor shall be connected to the grounding conductor on the supply side of the service disconnecting means in accordance with Table 250.122 of the N.E.C. for the ampere rating of the service entrance equipment. Where in a service entrance switchboard, the equipment grounding conductor shall not be less than 25% of the main bus rating. These connections shall be made inside the service entrance equipment enclosure.

### 3.2 TRANSFORMER GROUNDS

- A. Dry type insulation transformers with a grounded conductor in the secondary shall be grounded in accordance with N.E.C. Section 250-30.

### 3.3 EXPOSED NON-CURRENT-CARRYING METAL PARTS

- A. General: Ground connections to equipment or devices shall be made as close to the current carrying parts as possible, that is, to the main frame rather than supporting structures, bases or shields. Grounding connections shall be made only to dry surfaces that are clean and dry. Steel surfaces shall be ground or filed to remove all scales, rust, grease, and dirt. Copper and galvanized steel shall be cleaned to remove oxide before making welds or connections. Code size ground conductors shall be run in all power conduits and properly terminated at each end.
- B. Ground conductors shall be routed as straight as possible. Where possible, ground conductors shall be routed such as to avoid bends exceeding 90 degrees or with a radius of less than 8".
- C. Motors: Exposed non-current-carrying metal parts, shall be grounded by a grounding conductor either run with power conductors, and/or separate grounding conductors. Drawings will show method(s) to be used. The ground conductors with all motor conductors shall be connected to the ground buss in the motor connection box. Jumper connections shall be installed between frames and rigid conduit for equipment having flexible conduit connections (sealtight). All AC motor grounds shall provide a low impedance path to ground. Connections from the supplemental grounding system (when specified) shall be made directly to the motor frame. Additionally, utilization equipment connected to the motor (pump, fan, mixer, etc.) shall be bonded to the motor with flexible braid-type bonding strap to ensure equalization of ground potentials.
- D. Raceways & boxes: All raceways, conduits, armored or shielded cable and all exposed non-current carrying metal parts shall be grounded. Such items shall be bonded together and permanently grounded to the equipment ground buss. Metallic conduits shall be connected by grounding or clamps to ground buss. Flexible "jumpers" shall be provided around all raceway expansion joints. Bonding straps for steel conduit shall be copper. Jumper connections shall be provided to effectively ground all sections of rigid conduit connected into plastic pipe. No metallic conduit shall be left ungrounded. In conduit systems interrupted by junction or switch boxes where locknuts and bushings are used to

secure the conduit in the box, the sections of conduit and box must be bonded together. If conduit, couplings or fittings have a protective coating or non-conductive material, such as enamel, such coating must be thoroughly removed from threads of both couplings and conduit and the surface of conduit or fitting where the ground clamp is secured.

- E. Enclosures: Metal conduits entering free standing motor control centers, switchboards or other free standing equipment shall be grounded by bare conductors and approved clamp. Any conduits entering low voltage (480 volts or below) equipment through sheet metal enclosure and effectively grounded to enclosure by double locknut or hub need not be otherwise bonded.
- F. Equipment: In addition to equipment grounding provisions mandated by code requirements, additional equipment grounding provisions (including local ground rods, connections, etc.) shall be provided by the contractor as directed by equipment suppliers.
- G. Both ends of ground busses in motor control centers, switchboards, etc., shall be separately connected to the main ground buss to form two separate paths to ground.
- H. Fences and Grills: Fences and metal grills around equipment carrying voltage above 500 volts between phases shall be bonded together and to ground. Fences and grill work shall be grounded at every post, column, or support, and on each side of every gate.

#### 3.4 ACCEPTANCE DOCUMENTATION AND TESTING

- A. Contractor shall take and store photographs of all underground grounding system connections prior to burial of connections, for review by Engineer.
- B. Upon completion of work, the entire ground system shall be shown to be in perfect working condition, in accordance with the intent of the Specifications.
- C. Contractor shall measure the resistance between the main ground bonding jumper to true earth ground using the Fall of Potential method as described by ANSI/IEEE Standard 81 (“Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of an Earth System”). If the measured value is greater than five ohms, additional grounding electrodes shall be installed as described in Part 3.1 above. The final ground resistance value shall be submitted in writing, and documented via picture of the meter reading from the Fall of Potential test, to the Engineer prior to the final observation, and shall be included in final O&M documentation.

END OF SECTION 16060



## SECTION 16075

### ELECTRICAL IDENTIFICATION

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Wire and cable identification.
- B. Pullbox & Junction Box Identification
- C. Electrical distribution & utilization equipment identification.
- D. Emergency and Standby Power receptacle identification.
- E. Instrument and control device identification.
- F. Raceway identification.

#### PART 2 PRODUCTS

##### 2.1 WIRE AND CABLE IDENTIFICATION

- A. Intermediate Locations:
  - 1. Wires and cable labels shall be white, thermal transfer, halogen-free, flame-retardant marker plates (sized to accommodate three lines of text) permanently affixed to the associated cable with UV-resistant plastic wire ties. Labels shall be Panduit #M200X/300X series or equal.
- B. Circuit/Cable Termination Locations:
  - 1. Wires and cable labels shall be non-ferrous identifying tags or pressure sensitive labels unless noted otherwise.

##### 2.2 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

- A. Labels on electrical distribution & utilization equipment shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive unless noted otherwise.

##### 2.3 INSTRUMENT AND CONTROL DEVICE IDENTIFICATION

- A. Instruments and control device labels shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment or the adjacent, visible mounting surface with silicone adhesive or stainless steel wire ties.

##### 2.4 RACEWAY IDENTIFICATION

- A. Raceway labels shall be white thermal transfer marker plates permanently affixed to the associated raceway with stainless steel wire ties, with two wire ties (one on either end of

marker plate to provide a flush installation) where possible. Labels shall be Panduit #M300X series or equal.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Any proposed deviation in identification methods and materials from those described herein shall be submitted to Engineer for review and comment prior to installation.
- B. Contractor shall provide all labeling or identification required by applicable local, state and national codes. These specifications do not intend to itemize all code-required labeling or identification requirements.
- C. All labels/identification shall be positioned such as to be readable from the normal perspective without adjusting wiring/cables/labels. For example, labels/identification of wires/cables within cable trays shall be positioned to point towards the viewer (typically downward for overhead cable trays, or upward for cable trays within trenches).
- D. All labels/identification (except for handwritten labels on concealed pullbox/junction box covers as noted below) shall be typewritten/printed/engraved in a neat, workmanlike, permanent, legible, consistent and meaningful manner. Labels shall not be handwritten unless specific approval is granted by engineer.

### **3.2 WIRE AND CABLE IDENTIFICATION**

- A. General:
  - 1. Where cabling is exposed (such as within cable trays), provide two wire ties per cable (one on either end of marker plate to provide a flush installation). Where cabling is concealed (such as within pullboxes/wireways), one wire tie per cable will be acceptable.
- B. Intermediate Locations:
  - 1. Thermal transfer labels shall be securely fastened to all wiring and cabling in the following locations:
    - a. Wireways
    - b. Pullboxes/Junction boxes larger than 4-11/16"
    - c. Pullboxes/Junction boxes through 4-11/16" where wires and cables are not easily identifiable via the color coding and box labeling
    - d. Vaults & Manholes
    - e. Approximately every 50 feet within cable trays (especially at locations where cables exit or diverge). Labels within cable trays shall be grouped (rather than being pre-labeled on cables and pulled into cable trays).
    - f. Other similar intermediate locations.
  - 2. Labels shall be stamped or printed with the following data so that the feeder or cable can be readily identified and traced:
    - a. From where the circuit originates (including panel designation and circuit number):
      - 1) Ex: "FROM: PP-A CIR. 3 (IN MAIN ELEC ROOM)"
    - b. To where the circuit extends (using the common name of the equipment):

- 1) Ex: "TO: RTU-6 (ON ROOF)"
  - c. The purpose of the circuit:
    - 1) Ex: "POWER"
  - d. The set number (If parallel power feeds are used).
    - 1) Ex: "SET NO. 3 OF 4"
- C. Circuit/Cable Termination Locations:
  - 1. Where multiple termination points exist within a circuit origination point (panelboard, switchboard, MCC, starter, etc.) or other similar circuit endpoint (control panel, etc.), labels shall be securely fastened to all ungrounded and neutral conductors to clearly identify the terminal and/or circuit number associated with each conductor. For example, within lighting panels, each phase and neutral conductor shall be labeled near the terminals at a clearly visible location with the associated circuit number(s), so that if all conductors were unterminated, the labels would clearly indicate which conductor was associated with each circuit.
- D. Refer to Specification Section 16120 for all color-coding requirements of wires and cables.

### 3.3 PULLBOX & JUNCTION BOX IDENTIFICATION

- A. Concealed pullboxes/junction boxes:
  - 1. Front surface of all pullbox/junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be neatly marked with the ID of circuits/cables contained with permanent black marker on cover of box (Ex: "RP-1A Cir. 1, 2 & 3"). Additionally, front surface of box shall be painted red where box contains fire alarm system cabling.
- B. Exposed pullboxes/junction boxes:
  - 1. Interior surface of all pullbox/junction box covers in exposed areas shall be labeled "Power", "Telecommunications", "Fire Alarm" or with other similar general text neatly with permanent black marker to indicate function of box. Circuit/cable labeling within box (see above) shall identify specific cables contained. Additionally, interior surface of cover shall be painted red where box contains fire alarm system cabling.
- C. Where pullboxes/junction boxes are named on contract documents (Ex: "PULLBOX #3"), an engraved nameplate shall be installed on the front surface of the box to identify the name.

### 3.4 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

- A. General:
  - 1. All new and existing equipment modified by this project shall include arc-flash warning labels in accordance with NEC article 110.16.
- B. All Panels, Motor Control Centers, Switchboards, Switchgear, Transformers, Etc.:
  - 1. Engraved nameplates identifying name of equipment, nominal voltage and phase of the equipment and where the equipment is fed from shall be installed on front

surface of all panels, motor control centers, switchboards, switchgear, transformers, etc.:

- a. Ex: First Line: "NAME: RP-A", Second Line: "120/208V-3Ø-4W", Third Line: "FED FROM: PP-A CIR. 4 (IN MAIN ELEC ROOM)"
  2. Refer to Panelboard Specification Sections for additional labeling requirements (circuit directory cards, permanent circuit labels, permanent circuit numbers, etc.) required inside panelboards.
- C. Safety/Disconnect Switches and Utilization Equipment (HVAC Equipment, Pumps, Powered Valves, Control Panels, Starters, Etc.)::
1. Engraved nameplates identifying equipment being fed and where the equipment is fed from shall be installed on front surface of all disconnect switches (including both visible blade type switches and toggle-type switches) and on utilization equipment (where not clearly identified by immediately adjacent local disconnect switch):
    - a. Ex: First Line: "RTU-6", Second Line: "FED FROM: PP-A CIR. 5"
  2. Where safety/disconnect switches are installed on the load side of variable frequency drives, the safety/disconnect switch shall be furnished with an additional engraved nameplate to read: "WARNING: TURN OFF VFD PRIOR TO OPENING THIS SWITCH".
  3. Safety/Disconnect switches feeding equipment that is fed from multiple sources (such as motors with integral overtemperature contacts that are monitored via a control system) and Utilization Equipment fed from multiple sources shall be furnished with an additional BLACK-ON-YELLOW engraved nameplate to read: "WARNING: ASSOCIATED EQUIPMENT FED FROM MULTIPLE SOURCES – DISCONNECT ALL SOURCES PRIOR TO OPENING COVER".

### 3.5 INSTRUMENT AND CONTROL DEVICE IDENTIFICATION

- A. New Instruments and control devices (whether furnished by contractor or not) shall be labeled with black-on-white engraved nameplates permanently affixed to the equipment or to the adjacent, readily-visible mounting surface with silicone adhesive or stainless steel wire ties.
1. Instruments and process control devices (float switches, etc.) shall be labeled with instrument name and, where available, instrument ID number.
  2. Pushbutton stations shall be labeled with equipment being controlled. Labels shall be installed on front surface (or adjacent mounting surface) of all pushbutton stations.
  3. Thermostats and other similar HVAC control devices installed in process areas shall be labeled with equipment being controlled. Labels shall be installed on front surface (or adjacent mounting surface) of all thermostats and other similar HVAC control devices.

### 3.6 RACEWAY IDENTIFICATION

- A. Each exposed raceway shall be labeled at the point where it becomes concealed, such as where it enters a concrete floor slab, a concrete wall, the ground, etc.
- B. Each raceway entering in-grade or on-grade pullboxes/junction boxes, where the conduits are only visible inside the box, shall be labeled within the box at the point where the raceway becomes concealed.

- C. Raceway nameplates shall identify:
  - 1. The location of the other end of the raceway (“TO MCC-1” or similar). If the other end of the raceway is at an intermediate, named pullbox (“INSTRUMENTATION PULLBOX #4” or similar), that pullbox name shall be labeled rather than the endpoint of the circuitry.

### 3.7 OTHER IDENTIFICATION

- A. Factory-engraved coverplates identifying functions of light switches and other similar devices shall be installed where so required by plans/specifications.

END OF SECTION 16075

## SECTION 16110

### RACEWAYS

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:
1. Conduits
  2. Conduit Fittings
  3. Couplings & Connectors
  4. Bushings
  5. Raceway Hardware, Conduit Clamps & Supports
  6. Watertight Entrance Seal Devices

#### PART 2 PRODUCTS

##### 2.1 CONDUITS

- A. PVC-Coated Rigid Steel:
1. The PVC coated rigid metal conduit must be UL Listed. Hazardous location fittings, prior to plastic coating must be UL listed. All conduit and fittings must be new, unused material. Applicable UL standards may include: UL 6 Standard for Safety, Rigid Metal Conduit, UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.
  2. The PVC-coated rigid metal conduit shall be ETL PVC-001 listed.
  3. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
  4. Form 8 Condulets<sup>®</sup>, 3/4" through 2" diameters, shall have a tongue-in-groove "V-Seal" gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be available.
  5. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
  6. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
  7. Form 8 Condulets<sup>®</sup> shall be supplied with plastic encapsulated stainless steel cover screws.
  8. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
  9. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30deg.F (-1deg.C).

10. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
  11. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
  12. Independent certified test results shall be available to confirm coating adhesion per ETL PVC-001 standards under the following conditions:
    - a. Conduit immersed in boiling water with a minimum mean time to adhesion failure of 200 hours. ASTM D870)
    - b. Conduit and conduit exposure to 150deg F (65deg C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D11513.
    - c. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
    - d. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
    - e. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1.
    - f. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.
  13. Water tight flex connectors used in areas where PVC coated metal conduit is utilized shall be PVC coated also.
  14. Shall be as manufactured by Perma-Cote, Plastibond, Korkap, Ocal or Okote.
- B. Rigid Galvanized Steel and I.M.C.:
1. Shall be galvanized outside and inside by hot dipping.
  2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.
- C. E.M.T.:
1. Shall be Electro-Galvanized.
  2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.
- D. Rigid Aluminum:
1. Shall be manufactured of 6063 Alloy, T-1 temper.
  2. Shall be as manufactured by Republic, Wheatland, Triangle, Pittsburg Standard, Youngstown, Allied or equal.
- E. Schedule 40 and 80 PVC:
1. Shall be composed of polyvinyl chloride and shall be U.L. rated type 40 or 80 for use with 90 degree rated conductors. Conduit shall conform to NEMA Standards and applicable sections of N.E.C.
  2. The conduit manufacturer shall have had a minimum of 5 years experience in the manufacture of the products. Non-metallic raceways shall be as manufactured by Carlon, Triangle, Can-Tex, Allied or equal.
- F. HDPE Innerduct
1. Shall be composed high density polyethylene and shall be orange in color, unless noted otherwise.

2. Shall be corrugated unless noted otherwise.
  3. Shall be manufactured by Carlon, Ipex or equal.
- G. Flexible Metallic Conduit:
1. Shall be continuous spiral wound and interlocked galvanized material, code approved for grounding.
- H. Liquidtight Flexible Metallic Conduit:
1. Shall be galvanized steel-core sealtite, code approved for grounding.
  2. Shall have an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core.
  3. Shall be as manufactured by Electric-Flex, Anaconda or equal.

## 2.2 FITTINGS, COUPLINGS & CONNECTORS

- A. Rigid Galvanized Steel and I.M.C. couplings and connectors shall be standard threaded type, galvanized outside and inside by hot dipping. Threadless and clamp type are not acceptable. Couplings/connectors shall be as manufactured by Raco, Efcor, or Appleton or equal.
- B. All fittings, conduit bodies, couplings and connectors (**including, but not limited to, condulettes, conduit couplings, connectors, hubs, nipples, unions, expansion fittings, explosion proof seal-offs, threaded hole closures, and seal-tight connectors, etc.**) used in areas where PVC-Coated Rigid conduit is used shall also be PVC-coated.
- C. All fittings, conduit bodies, couplings and connectors (**including, but not limited to, condulettes, conduit couplings, connectors, hubs, nipples, unions, expansion fittings, explosion proof seal-offs, threaded hole closures, and seal-tight connectors, etc.**) installed in other wet, exterior or process areas where PVC-coated conduit systems are not required, shall be aluminum or stainless steel type. Standard steel fittings will not be acceptable.
- D. All rain tight connectors shall be threaded Myers or approved equal, rated for outdoor application.
- E. E.M.T. couplings and connectors shall be set screw, or steel compression type. All couplings and connectors shall be 720B, 730, 750B, or 760 series of Efcor or equal series of Raco. Pressure indented type connectors or cast metal will not be approved for any location. E.M.T. couplings and connectors shall be as manufactured by O-Z/Gedney, T&B, Efcor, Raco, Midwest or equal. E.M.T. fittings, couplings and connectors located within concrete (where allowed) shall be compression type and shall be adequately sealed with tape to ensure a concrete-tight seal.
- F. Rigid Aluminum couplings and connectors shall be standard threaded type, of the same alloy as the associated conduit. Threadless and clamp type are not acceptable. Fittings shall be as manufactured by Thomas & Betts, Crouse-Hinds, Appleton, Pyle-National or equal.
- G. All PVC couplings, adapters, end bells, reducers, etc., shall be of same material as conduit.



- H. Liquidtight Flexible Metallic Conduit connectors shall be liquidtight with insulating throat or end bushing, designed for application with Liquidtight Flexible Metallic Conduit. Fittings shall be as manufactured by Efcor, Raco, Midwest or equal.
- I. All LB unilets sizes 1 ¼” or larger shall have rollers.
- J. Miscellaneous conduit fittings shall be as manufactured by Appleton, Crouse-Hinds, Pyle-National, Russell & Stoll or equal.

### 2.3 BUSHINGS

- A. All non-grounding rigid bushings 1-1/4” and larger shall be the insulating type (O-Z/Gedney type “BB” or equal by T&B, Midwest Electric or Penn Union).
- B. All non-grounding rigid bushings 1” and smaller shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. Non-grounding rigid conduit bushings shall be O-Z/Gedney type “B” or equal by T&B, Midwest Electric or Penn Union.
- C. All grounding rigid bushings shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. All grounding rigid conduit bushings shall be O-Z/Gedney type “BLG” or equal by T&B, Midwest Electric or Penn Union.

### 2.4 HARDWARE, CONDUIT CLAMPS AND SUPPORTS

- A. All hardware such as expansion shields, machine screws, toggle bolts, “U” or “J” bolts, machine bolts, conduit clamps and supports shall be of corrosion resistant materials (stainless steel, aluminum, galvanized or plated steel, or other approved materials).
- B. Hardware in contact with aluminum handrails, plates or structural members and all hardware in exterior, wet or corrosive areas shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.
- C. Supports in exterior, process, wet or corrosive locations shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.
- D. Supports in extremely corrosive environments (such as chlorine or fluoride storage rooms) shall be PVC-Coated steel unless specifically noted otherwise.
- E. Hardware and conduit clamps shall be as manufactured by Efcor, Steel City, G.A., Tinnerman or equal.

### 2.5 WATERTIGHT ENTRANCE SEAL DEVICES

- A. For new construction, seal devices shall consist of oversized sleeve and malleable iron body with sealing rings, pressure rings, sealing grommets and pressure clamps as required (O-Z/Gedney type FSK/WSK or equal).

- B. For cored-hole applications, seal devices shall consist of assembled dual pressure disks with neoprene sealing rings and membrane clamps as required (O-Z/Gedney type CSM or equal).

## **PART 3 EXECUTION**

### **3.1 RACEWAY APPLICATION**

- A. Minimum Diameter: 3/4-inch.
- B. Raceway Type: Raceway types shall be as specified below, unless indicated otherwise on drawings:
  - 1. Exterior, Exposed: Rigid Aluminum unless otherwise noted.
  - 2. Exterior, Used for Instrumentation Circuits: See Below.
  - 3. Other Exterior (Concrete-Encased or Direct Earth Buried): Schedule 40 PVC. PVC conduit shall convert to metallic conduit prior to exiting concrete-encasement or direct earth burial. See “transition” items below for additional requirements. Conduits shall be left exposed until after Engineer’s observation.
  - 4. Interior, Exposed:
    - a. Hazardous Locations: Rigid Aluminum .
    - b. Wet Locations (including, but not limited to, Pump Rooms, Areas with exposed piping, Dewatering Rooms, Wet Wells, Underground Vaults, and other similar locations): Rigid Aluminum .
    - c. Dry Locations: Rigid Aluminum.
    - d. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): Schedule 80 PVC.
  - 5. Interior, Concealed:
    - a. Embedded inside Poured Concrete Walls, Ceilings or Floors, with a minimum of 2” of concrete between finished surface and outer wall of conduit on all sides, where no anchor bolts, screws or other similar items will be installed: Schedule 40 PVC. PVC conduit shall convert to metallic conduit (exact type as specified elsewhere within this section) prior to exiting poured concrete-encasement of wall, ceiling, floor or ductbank. See “transition” items below for additional requirements.
    - b. Other Raceways Embedded inside Poured Concrete Walls, Ceilings or Floors (not meeting requirements above): PVC-Coated Rigid Steel
    - c. Other Raceways: E.M.T.
  - 6. Raceways used for Instrumentation Circuits:
    - a. Typical Dry or Wet Locations: Rigid Aluminum .
    - b. Underground or Locations Embedded inside Poured Concrete: PVC-Coated Rigid Steel.
    - c. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): PVC-Coated Rigid Steel.
  - 7. Terminations at motors, transformers and other equipment which has moving or vibrating parts:
    - a. Exterior or Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Liquidtight Flexible Metallic Conduit (shall generally not exceed 24 inches in length) with watertight fittings.

- b. Dry, Interior Locations: Flexible Metallic Conduit (shall generally not exceed 24 inches in length).
- 8. Terminations at instruments:
  - a. Liquidtight Flexible Metallic Conduit (shall generally not exceed 12 inches in length) with watertight fittings.
- 9. Terminations at fixtures mounted in grid-type ceilings:
  - a. Flexible Metallic Conduit or MC cabling (shall generally not exceed 72 inches in length and shall run from junction box to fixture, not from fixture to fixture).
- 10. Transition from underground or concrete-encased to exposed:
  - a. Convert PVC to PVC-Coated Rigid Steel utilizing PVC-Coated Rigid Steel 90 degree bends (and vertical conduits as required by application) prior to exiting concrete/grade (except at outdoor pull boxes and under freestanding electrical equipment, where terminations shall be by PVC end bells installed flush with top of slab). Exposed portions of these coated conduits shall extend a minimum of 6" above floor level, and shall be installed at uniform heights.

### 3.2 RACEWAY INSTALLATION

#### A. General:

- 1. Follow methods which are appropriate and approved for the location and conditions involved. Where not otherwise shown, specified, or approved in a particular case, run all wiring concealed.
- 2. Where conduit crosses a structural expansion joint an approved conduit expansion fitting shall be installed.
- 3. Where any run of rigid aluminum conduit (including bends) exceeds 50' in length, an approved conduit expansion fitting shall be installed (beginning at center of run) at intervals not to exceed 50' on center.
- 4. A non-conductive polypropylene pull string, properly tied/secured at either end, shall be installed in all empty conduits.
- 5. Metal conduit field-cuts shall be cut square with a hacksaw and the ends reamed after threading.
- 6. PVC conduit field-cuts shall be made with hacksaw, and ends shall be deburred.
- 7. All PVC joints shall be made as follows:
  - a. Clean the outside of the conduit to depth of the socket, and the inside of socket with an approved cleaner.
  - b. Apply solvent cement as recommended by the conduit manufacturer to the interior of the socket and exterior of conduit, making sure to coat all surfaces to be joined.
  - c. Insert conduit into the socket and rotate 1/4 to 1/2 turn and allow to dry.
- 8. All metallic conduit installed below grade or within concrete shall be coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint prior to installation.
- 9. Install ground wire sized per N.E.C. Table 250.122 in all conduits.
- 10. Use of running threads is absolutely prohibited. Conduit shall be jointed with approved threaded conduit couplings. Threadless and clamp type not acceptable.
- 11. Conduits shall be sized in accordance with latest National Electrical Code except when size shown on drawings.

12. Exposed, field-cut threads on all metal conduits shall be painted with zinc primer (for Galvanized Rigid or I.M.C.) or urethane paint (for PVC-Coated Rigid Steel) as recommended by conduit manufacturer .
13. Installation of PVC coated conduit systems shall be performed in strict accordance with the manufacturer's installation instructions. Damage to PVC coated conduit coating shall be touched up with patching compound as directed by manufacturer. To assure correct installation, the installer shall be certified by the manufacturer to install coated conduit.

B. Routing/Locating:

1. Exposed conduit runs shall be run level and plumb and shall, on interior of buildings, be run parallel and/or at right angles to building walls and/or partitions.
2. Conduit with an external diameter larger than 1/3 the thickness of a concrete slab shall not be placed in the slab. Conduits in slab shall not be spaced closer than 3 diameters on center.
3. Conduit run in ceiling spaces shall be run as high as possible, all at same level, and shall be supported from building structure. Do not support conduit from any other installation.
4. Conduit run within exterior CMU, concrete or other similar walls shall be run within the CMU cells / concrete structure / etc. Conduits shall not be run on the outside surface of CMU cells / concrete structure / etc. underneath exterior veneers / etc., which could cause a thermal break in the wall insulation or a future water intrusion problem.
5. Install conduit runs to avoid proximity to steam or hot water pipes. In no place shall a conduit be run within 6" of such pipes except where crossing is unavoidable, then conduit shall be kept at least 3" from the covering of the pipe crossed.
6. Before installing raceways for motors, HVAC equipment and other fixed equipment, check location of all equipment connections/terminal boxes with equipment supplier and locate and arrange raceways appropriately.
7. No conduit for instrumentation shall be run closer than 12 inches to parallel power conduits.
8. A minimum of 12" of clearance (or more as required by associated utility companies) shall be provided between the finished lines of exterior, underground conduit runs and exterior, underground utilities (gas, water, sewer, etc.).
9. Where any portion of raceway is installed in a wet environment (such as below grade) and located at a higher elevation than the raceway termination point in a dry environment, install watertight compound inside raceway at termination around cabling to prevent transfer of water through conduit system. Watertight compound shall be rated for the potential water head pressure, based on the assumption that ground water level would be at grade level.

C. Bends:

1. Do not make bends (in any raceway, including flexible conduits) that exceed allowable conductor bending radius of cable to be installed or that significantly restrict conductor flexibility.
2. All bends within concrete-encased ductbanks installed in exterior locations shall be long radius bends (24" minimum bending radius – varies with conduit diameter).

3. All bends in raceways containing multi-conductor power cables (such as shielded VFD cables) shall be long radius bends (24" minimum bending radius – varies with conduit diameter).
4. Where numerous exposed bends or grouped together, all bends shall be parallel, with same center and shall be similar in appearance
5. All PVC elbows, bends, etc., shall be either factory bends or made with an approved heat bender.

D. Support:

1. Anchor conduit securely in place by means of approved conduit clamps, hangers, supports and fastenings. Arrangement and methods of fastening all conduits shall be subject to Engineer's direction and approval. All conduits shall be rigidly supported (wire supports may not be used in any location). Use only approved clamps on exposed conduit.
2. Rigid Aluminum Conduits shall be supported at intervals not to exceed 5' on center.
3. Conduit in riser shafts shall be supported at each floor level by approved clamp hangers.
4. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameters of conduits.
5. Where installed in seismic zones, suspended raceways shall be braced in two (2) directions as required to prevent swaying and excessive movement.
6. Raceways installed on top of flat roofing shall be supported a minimum of 3 ½" above roof with rubber block supports (Cooper B-Line Dura-Blok or equal). Installation shall be in strict accordance with support manufacturer's instructions and recommendations.

E. Terminations:

1. All conduit connections to sheet metal cabinets or enclosures located in exterior or wet locations shall terminate by use of rain tight (Meyers) hubs.
2. In wet, exterior or process areas, conduits shall NOT enter tops of enclosures. All conduits shall enter enclosures from bottom, left or right sides of the enclosure (utilizing rain-tight Meyers hubs as indicated above).
3. Where rigid or I.M.C. conduits enter sheet metal boxes, they shall be secured by approved lock nuts and bushings.
4. Where metal conduits enter outdoor pull boxes, manholes, under freestanding electrical equipment or other locations where direct metal-to-metal contact does not exist between enclosure and conduit, grounding bushings shall be installed. Each grounding bushing shall be connected to the enclosure ground and all other grounding bushings with properly sized grounding conductors.
5. Where E.M.T. enters sheet metal boxes they shall be secured in place with approved insulating fittings.
6. Where PVC enters outdoor pull boxes, manholes or under freestanding electrical equipment, PVC end bells shall be installed.
7. Contractor shall be responsible for coordinating required conduit sizes with equipment hubs/conduit entry provisions (such as at motor tap boxes) prior to installation of conduit systems. Contractor shall field adjust final conduit sizes at terminations where so required (only as allowed by code) from those indicated on plans to coordinate with equipment hubs/conduit entry provisions.

8. Where conduit terminates in free air such that associated cabling/circuitry becomes exposed (such as at cable trays, etc.), conduit shall generally terminate in a horizontal orientation (to prevent dust/debris/etc. from entering conduit system). Where vertical conduit termination is necessary, the termination shall be provided with cord-grip conduit terminations to seal the conduit system.
9. Conduit ends shall be carefully plugged during construction.
10. Permanent, removable caps or plugs shall be installed on each end of all empty raceways with fittings listed to prevent water and other foreign matter from entering the conduit system.

F. Penetrations:

1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly. Refer to drawings and other specifications for additional requirements.
2. All penetrations shall be at right angles unless shown otherwise.
3. Structural members (including footings and beams) shall not be notched or penetrated for the installation of electrical raceways unless noted otherwise without specific approval of the structural engineer.
4. Dry-packed non-shrink grout or watertight seal devices shall be used to seal openings around conduits at all penetrations through concrete walls, ceilings or aboveground floors.
5. All raceways entering structures, or where water is otherwise capable of entering equipment/devices through the raceway system, shall be sealed (at the first box or outlet) with foam duct sealant to prevent the entrance of gases or liquids from one area to another or into equipment/devices.
  - a. Where the elevation of the raceway penetration (into the structure) is no more than 15' below the other (higher) end of the same raceway, Polywater FST sealant (rated to hold back up to 22' of continuous water head pressure), or pre-approved equal, shall be used.
  - b. Where the elevation of the raceway penetration (into the structure) is between 15' and 75' below the other (higher) end of the same raceway, Polywater PHRD Custom Mechanical Seals (rated to hold back up to 36psi or 83' of continuous water head pressure), or pre-approved equal, shall be used.
  - c. Where the elevation of the raceway penetration (into the structure) is more than 75' below the other (higher) end of the same raceway, the contractor shall propose a custom solution designed to hold back or to drain the possible water within the associated raceway. Submittals shall be provided to the engineer for review/approval, including a summary of the anticipated elevations/PSIs, details of the proposed installation, cut-sheets of devices/materials, etc.
6. Additionally, where necessary to ensure that water does not enter equipment/devices through the raceway system (where raceways extend to equipment/devices from wet areas), junction boxes with drain assemblies in bottom shall be located at low point of raceway system near equipment/devices (to drain water out of raceway system before it enters equipment/devices). Contractors shall provide drains in raceway systems where so necessary to prevent water entry into equipment/devices. In special applications (such as to instruments, etc.), where cabling rated for exposed application is provided, contractor may propose short air gaps (approximately 6" or less) between the end

of the conduit system and the equipment/device cable entry (to be made with cable gland connectors) to prevent water in conduit system from entering equipment/devices in lieu of drained junction boxes.

7. All raceways passing through concrete roofs or membrane-waterproofed walls or floors shall be provided with watertight seals as follows:
  - a. Where ducts are concrete encased on one side: Install watertight entrance seal device on the accessible side of roof/wall/floor as directed by equipment manufacturer.
  - b. Where ducts are accessible on both sides: Install watertight entrance seal device on each side of roof/wall/floor as directed by equipment manufacturer.
8. All raceways passing through walls of rooms containing/storing noxious chemicals (chlorine, ammonia, etc.) or through hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS or equal).
9. All raceways terminating into electrical enclosures/devices/panels/etc. located in hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS, EZS or equal) within 18" of the termination.

G. Exterior Electrical Ductbanks:

1. Where exterior electrical concrete-encased ductbanks are indicated on drawings, conduit runs between buildings or structures shall be grouped in concrete-encased ductbanks as follows:
  - a. A minimum of 3" of concrete shall encase each side of all ductbanks.
  - b. A minimum of 1 1/2" of separation shall be provided between each conduit within ductbanks. PVC spacers shall be installed at the necessary intervals prior to placement of concrete to maintain the required spacing and to prevent bending or displacement of the conduits.
  - c. Top of concrete shall be a minimum of 30" below grade. A continuous magnetic marking tape shall be buried directly above each ductbank, 12" below grade.
  - d. Exact routing of ductbanks shall be field verified and shall be modified as necessary to avoid obstruction or conflicts.
  - e. Underground electrical raceways shall be installed to meet the minimum cover requirements listed in NEC Table 300.5. Refer to drawings for more stringent requirements.

END OF SECTION 16110

## SECTION 16116

### AUXILIARY SYSTEM CABLES, 0-50V

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Cables rated for 0V-50V application

#### PART 2 PRODUCTS

##### 2.1 GENERAL

- A. Unless specified otherwise, all cables within the scope of this specification section shall:
  1. Be rated for exposed cable tray installation.
  2. Be plenum rated (Class 1 Control cabling and Instrumentation cabling installed in conduit or exposed in cable tray in non-plenum areas is not required to be plenum-rated).
  3. Be UL-rated for the proposed application.
  4. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
  5. Utilize copper conductors.
  6. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
  7. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
  8. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.

##### 2.2 INSTRUMENTATION CABLING

- A. In addition to above requirements, and unless specified otherwise, Instrumentation cabling shall:
  1. Be #16AWG minimum.
  2. Be rated for 300V.
  3. Have aluminum foil shielding.
  4. Have stranded, twisted conductors.
  5. Have PVC insulation/jacket with ripcord.
  6. Be manufactured by Belden, AlphaWire or General Cable.

##### 2.3 CLASS 1 CONTROL CABLING (120VAC CONTROL CIRCUITS, ETC.)

- A. In addition to above requirements, and unless specified otherwise, Class 1 control cabling shall:
  1. Be rated for 600V.
  2. Be industrial grade.
  3. Have stranded conductors.



4. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
5. Be manufactured by Belden, AlphaWire or General Cable.

#### 2.4 CLASS 2 & 3 CONTROL CABLING (FED FROM CLASS 2 OR 3 POWER SUPPLIES)

- A. In addition to above requirements, and unless specified otherwise, Class 2 & 3 control cabling shall:
1. Be rated for 300V.
  2. Be shielded if so recommended by the system supplier/integrator.
  3. Have twisted conductors.
  4. Have plenum-rated insulation/jacket with ripcord.
  5. Be manufactured by AlphaWire, Belden, General Cable, Superior Essex or West Penn.

#### 2.5 NETWORK CABLING

- A. Furnish and install all Ethernet, Fiber Optic and Backbone Copper Telephone cabling in accordance with all BICSI requirements and in accordance with other applicable specification sections.

### **PART 3 EXECUTION**

#### 3.1 GENERAL INSTALLATION

- A. Routing:
1. All wires and cables shall be installed in conduit unless specifically noted otherwise. Where conduit is not otherwise required by contract documents, 0-50V Cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
    - a. Cabling is plenum-rated, multi-conductor.
    - b. Cabling is supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
    - c. Cabling is neatly formed, bundled and tied with plenum-rated Velcro straps on intervals not to exceed 30" on center.
    - d. Properly-sized conduit(s) are provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings, within walls or through walls).
    - e. Cabling is not a part of a Fire Alarm System, Smoke Control System, Emergency Generator Control System or other life-safety related system.
  2. End bushings shall be provided on both ends of all raceway terminations.
  3. No splices shall be pulled into conduit.
  4. No cabling shall be pulled until conduit is cleaned of all foreign matter.
- B. Penetrations:
1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.
  2. For cabling not installed in conduit:

- a. Fire/smoke barrier penetrations shall be sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.
    - 3. For cabling installed within conduit from endpoint to endpoint:
      - a. Fire/smoke barrier penetrations shall be sealed utilizing fire caulk or other equivalent firestop systems around perimeters of conduits per UL requirements.
    - 4. For cabling installed within cable trays:
      - a. Fire/smoke barrier penetrations shall be sealed with one of the following methods:
        - 1) Continuous cable tray through the penetration, with a combination of large firestop pillows and small firestop pillows contained, supported and secured (to prevent unauthorized removal) on both sides by aluminum wire mesh and firestop putty. Firestop pillows shall be STI Series SSB or equal and Firestop putty shall be STI Spec Seal or equal.
        - 2) Cable tray broken at the penetration, with fire/smoke barrier penetrations sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.
  - C. Excess Cabling:
    - 1. Excess cabling shall be neatly coiled within all junction boxes, pullboxes, wireways, etc. and at all terminations as required to allow future re-termination of cabling.
  - D. Terminations:
    - 1. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See below for general termination hardware requirements.
    - 2. Cabling shall be neatly formed, bundled and tied at all terminations.
- 3.2 SPLICES/CONNECTIONS/TERMINATIONS:
- A. Network Cabling:
    - 1. Network and fiber optic cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.
  - B. Control Cabling:

1. Connections shall be made with T & B Sta-Kon wire joints EPT66M, complete with insulating caps. To be installed with WT161 Tool or C nest of WT11M Tool, Ideal Super - Nuts (not wire nuts), Ideal Wing Nuts, or Buchanan Elec. Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators to be installed with C24 pressure tool.
- C. Shielded cabling:
1. Unless directed otherwise by the system supplier, 0-50V cable shielding shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.
  2. Shielded cabling shall be continuous from endpoint to endpoint and shall not be spliced without prior written approval from the Engineer.

### 3.3 LABELING

- A. Refer to Specification Section 16075 for all labeling requirements.

END OF SECTION 16116

## SECTION 16120

### POWER CONDUCTORS AND CABLES 51V-600V

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Power Wires and Cables
- B. Low Voltage Wires and Cables

#### PART 2 PRODUCTS

##### 2.1 POWER WIRES AND CABLES - 600 VOLT

- A. General: Conductors shall have current carrying capacities as per N.E.C. and with 600 volt insulation, #12 minimum except for controls and fixture wire. Conductors shall be copper.
- B. General Application (see below for exceptions):
  - 1. At or Below Grade (including within slab-on-grade):
    - a. #8 or larger conductors:
      - 1) XHHW or RHH/RHW/USE stranded (in conduit).
    - b. #10 or smaller conductors for circuits terminating at motors:
      - 1) THHN/THWN or XHHW stranded (in conduit).
    - c. #10 or smaller conductors (excluding circuits terminating at motors):
      - 1) THHN/THWN or XHHW solid (in conduit).
  - 2. Above Grade:
    - a. #8 or larger conductors:
      - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
    - b. #10 or smaller conductors for circuits terminating at motors:
      - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
    - c. #10 or smaller conductors (excluding circuits terminating at motors):
      - 1) THHN/THWN, XHHW or RHH/RHW/USE solid (in conduit).
  - 3. Power Wire and cable shall be as manufactured by Southwire, Rome, Encore Wire, American Insulated Wire, Okonite, Phelps-Dodge, Americable, Aetna or approved equal.
- C. VFD Cabling
  - 1. Wiring/Cabling installed between each VFD (Variable Frequency Drive) and the associated motor shall be multi-conductor shielded VFD power cable with the following characteristics:
    - a. Multi-conductor cable with three (3) power conductors and three (3) ground conductors
    - b. Soft annealed flexible stranded copper conductors.
    - c. 1kV cross-linked polyolefin insulation (to resist the potential reflected voltages experienced in 600VAC VFD applications).
    - d. Metallic shielded providing 100% shield coverage

- e. Oil, abrasion, chemical & sunlight resistant thermosetting compound outer jacket.
  - f. Flexible TC-ER rated, UL listed for use in cable trays.
  - g. Equal to AmerCable #37-108VFD cable.
- D. Emergency Feeder Wiring
- 1. Where specifically required by NEC articles 700, 701, or other similar sections, feeder-circuit wiring for emergency systems and legally-required standby systems shall be a listed electrical circuit protective system consisting of 2-hour fire-rated, mineral insulated, copper-sheathed wiring cable (Pyrotex System 1850 or equal).
- E. Class 1 Control Cabling (120VAC Control Circuits, Etc.)
- 1. Unless specified otherwise, Class 1 control cabling shall:
    - a. Be rated for exposed cable tray installation.
    - b. Be plenum rated (Class 1 Control cabling and Instrumentation cabling installed in conduit or exposed in cable tray in non-plenum areas is not required to be plenum-rated).
    - c. Be UL-rated for the proposed application.
    - d. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
    - e. Utilize copper conductors.
    - f. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
    - g. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
    - h. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.
    - i. Be rated for 600V.
    - j. Be industrial grade.
    - k. Have stranded conductors.
    - l. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
  - 2. Control cabling shall be as manufactured by Belden, AlphaWire or General Cable.
- F. Fixture Wiring
- 1. Conductor Types:
    - a. Type TFFN or XFF.
  - 2. Minimum Sizes:
    - a. For fixtures up to 300 watts: #16.
    - b. For fixtures over 300 watts up to 1500 watts: #14.
    - c. For fixtures over 1500 watts: as required.
    - d. Conductors to concrete pour fixtures: #12.

3. Fixture wire shall extend only from fixture to first junction, and not over 6 feet, except for concrete pour units.

## 2.2 WIRE CONNECTIONS:

- A. All connector types:
  1. Shall be properly rated for the proposed application by UL and per the manufacturer.
- B. At Motor Connections (within motor terminal boxes):
  1. On Unshielded Wire:
    - a. Single conductor per phase: shall be made with insulated set screw connectors or 3M 5300 Series 1kV Motor Lead Connections kits with mechanical lugs as required.
    - b. Multiple conductors per phase: shall be made with insulated mechanical lugs, rated for the associated motor cable types, by Polaris or Ilsco.
  2. On Shielded Power Wire:
    - a. The braided shields and internal grounding conductors of shielded power (not instrumentation) cables shall be grounded at BOTH ends (at VFD/starter and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.
- C. Other Dry locations:
  1. On Wire larger than #10: shall be made with solderless, non-insulated compression-type connectors meeting requirements of Federal Specification WS-610e for Type II, Class 2 and shall be covered with Scotch #33 electrical tape so that insulation is equal to 150% of conductor insulation.
  2. On Wire #10 and smaller: shall be made with one of the following:
    - a. Ideal Wing Nuts or equal by 3M .
    - b. Ideal Push-In Wire Connectors (for #12 and smaller only).
- D. Other Wet/Damp locations:
  1. On Wire larger than #10: shall be made with underground/direct-burial, waterproof rated EPDM or TPE-insulated connectors by Ilsco, Burndy or T&B.
  2. On Wire #10 and smaller: shall be made with one of the following:
    - a. Ideal Weatherproof or Underground Wire Connectors pre-filled with 100% silicone sealant as required by the application.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION

- A. All wires and cables shall be installed in conduit unless specifically noted otherwise.
- B. All joints and splices on wire shall be made with solderless connectors, and covered so that insulation is equal to conductor insulation.
- C. No splices shall be pulled into conduit.

- D. No conductor shall be pulled until conduit is cleaned of all foreign matter.
- E. Wire and cable shall be neatly formed, bundled and tied in all panelboards, wireways, disconnect switches, pullboxes, junction boxes, cabinets and other similar electrical enclosures.
- F. All wires and cables installed in underground or other wet locations shall be rated by the manufacturer for wet locations.
- G. Network cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.
- H. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See above for general termination hardware requirements.

### 3.2 POWER WIRE AND CABLE INSTALLATION:

- A. No power conductor shall be smaller than #12 except where so designated on the drawings or hereinafter specified.
- B. Multi-wire lighting branches shall be used as indicated.
- C. Where more than three current-carrying conductors are installed in a single raceway or cable, conductors shall be derated as indicated in NEC Table 310.15(B)(3)(a).
- D. Raceways/cables shall generally not be installed exposed to sunlight on roofs unless specifically required. Where raceways or cables are installed exposed to sunlight on roofs, conductors shall be derated with ampacities adjusted per NEC Table 310.15(B)(3)(c).
- E. In installing parallel power conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size, the same type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded at both ends in an approved manner.
- F. In installing overhead main power services, a minimum of 5'-0" of cable per run shall be extended beyond the weatherhead(s) for connection to service drop. Confirm exact requirements with local utility company.

### 3.3 WIRE CONNECTIONS

- A. See Part 2 above for material types.
- B. Aluminum Wire Connections:
  - 1. Where aluminum wiring is allowed, connections shall utilize compression fittings, no exceptions (Anderson Versa Crimp or equal).
- C. Any stranded wire connection to wiring devices shall be made with crimp type terminals.

- D. All electrical connections and terminals shall be tightened according to manufacturer's published torque-tightening values with calibrated torque wrenches as required to clearly indicate final torque value to the contractor. Where manufacturer's torque values are not provided, those specified in UL 486A & 486B shall be used.
- E. All connections and connector types shall be installed in strict compliance with all requirements of the connector manufacturer.
- F. Under no condition shall the specified conductors be connected to terminals rated less than 75°C. Where conductors sized #1 or smaller are shown to be terminated at equipment and the terminals of that equipment are rated for less than 75°C, contractor shall install junction box near equipment to capture the specified conductors, splice with compression connections (rated for a least 75°C) and extend conductors with ampacity rating as required by NEC (based on terminal temperature rating) to equipment terminals. The length of the conductors to be terminated shall be as directed by the AHJ but not less than 48 inches.

### 3.4 SHIELDED CABLE INSTALLATION

- A. Shielded VFD (power) cables:
  - 1. The braided shields and internal grounding conductors of shielded VFD (power) cables shall be grounded at BOTH ends (at VFD and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.
  - 2. Contractor shall coordinate the necessary size of conduit with the outer diameter of the proposed cable type to verify that the raceway loading does not exceed NEC requirements prior to rough-in of the conduit system.
- B. Shielded instrumentation (low voltage) cables:
  - 1. The outer foil of shielded instrumentation cables shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.

### 3.5 LOW VOLTAGE (LESS THAN 50V) CONTROL AND NETWORK CABLE INSTALLATION:

- A. All wires and cables shall be installed in conduit unless specifically noted otherwise. Low voltage control and/or network cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
  - 1. Cabling shall be plenum-rated, multi-conductor.
  - 2. Cabling shall be supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
  - 3. Cabling shall be properly bundled with plenum-rated Velcro straps on intervals not to exceed 30" on center.
  - 4. Properly-sized conduit(s) shall be provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings or through walls). End bushings shall be provided on both ends of all raceway terminations. All



fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.

3.6 CIRCUITS AND BRANCH CIRCUITS

- A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be connected to a circuit.

3.7 LABELING AND COLOR CODING OF WIRE AND CABLE

- A. Refer to Specification Section 16075 for all labeling requirements.
- B. A color coding system as listed below shall be followed throughout the network of branch power circuits as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
A	BLACK	BLACK	BROWN
B	RED	ORANGE (FOR HI- LEG)	ORANGE
C	BLUE	BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
GROUND	GREEN	GREEN	GREEN

- C. Where dedicated neutrals are installed for multi-wire branch circuits, the neutral conductors shall be color coded as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
NEUTRAL A	WHITE W/ BLACK TRACER	WHITE W/ BLACK TRACER	GRAY W/ BROWN TRACER
NEUTRAL B	WHITE W/ RED TRACER	WHITE W/ ORANGE TRACER (FOR HI-LEG NEUTRAL)	GRAY W/ ORANGE TRACER
NEUTRAL C	WHITE W/ BLUE TRACER	WHITE W/ BLUE TRACER	GRAY W/ YELLOW TRACER

- D. Control Conductors: Shall be color coded by use of colored “tracers”. No control circuit shall contain two identical conductors. For example, a set of five (5) control conductors for a pushbutton station represents one (1) control circuit which would require five (5) uniquely-colored control conductors.

3.8 TESTING

- A. The insulation resistance of all feeder conductors (feeding electrical distribution equipment such as switchboards, panelboards, transfer switches, transformers, etc.) shall be tested at the load side of the feeder breaker with a 1000-volt DC Megger Tester prior

to energization or final termination. Any feeder conductor with an insulation resistance less than the recommended minimums in the latest version of NETA Acceptance Testing Specification (“ATS”) standard shall be replaced by the contractor at the contractor’s expense. All final test results shall be clearly documented (with date, time, feeder, results, test equipment, etc.), and the final test results shall be submitted to the design team for review.

END OF SECTION 16120

## SECTION 16130

### OUTLET BOXES, JUNCTION BOXES, WIREWAYS

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Outlet and Junction Boxes
- B. Pull Boxes
- C. Wireways

#### PART 2 PRODUCTS

##### 2.1 OUTLET BOXES & JUNCTION BOXES (THROUGH 4-11/16")

- A. Sheet Metal: Shall be standard type with knockouts made of hot dipped galvanized steel as manufactured by Steel City, Raco, Appleton, Bowers or equal.
- B. Cast: Shall be type FS, FD, JB, GS, or SEH as required for application as manufactured by O-Z/Gedney, Appleton, or equal.
- C. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal.

##### 2.2 JUNCTION AND PULL BOXES (LARGER THAN 4-11/16")

- A. Oil-Tight JIC: Shall be Hoffman Type CH box or approved equal.
- B. Galvanized Cast Iron or Cast Aluminum: Shall be O-Z/Gedney or approved equal.
- C. Stainless Steel: Shall be as manufactured by O-Z/Gedney, Hoffman or approved equal. Boxes shall have continuous hinges, seamless foam-in-place gaskets and screw-down clamps.
- D. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal. Boxes shall have hinged covers and screw-down clamps.
- E. Wireways: Shall be standard manufacturer's item as manufactured by Hoffman, Square "D", Burns, B & C or equal. Wireways shall have hinged covers and screw-down clamps.
- F. Pre-cast Polymer Concrete Below-Grade Hand Holes & Pull Boxes:
  - 1. Enclosures, boxes and cover are required to be UL Listed and conform to all test provisions of ANSI/SCTE 77 "Specifications For Underground Enclosure Integrity" for Tier 15 applications (15,000lb design load and 22,500lb test load) unless noted otherwise.

2. All covers shall have a minimum coefficient of friction of 0.05 in accordance with ASTM C1028 and the corresponding Tier level shall be embossed on the top surface.
  3. Cover shall be bolt-down include factory-labeling to read “Electric”, “Communications” or other as directed.
  4. Hardware shall be stainless steel.
  5. Shall be Quazite PG/LG Style or approved equal.
- G. Galvanized Cast Iron Below-Grade Pull Boxes:
1. Enclosures, boxes and cover are required to conform to AASHTO H-20 requirements for deliberate vehicular traffic applications unless noted otherwise.
  2. Cover shall be checkered, bolt-down include factory-labeling to read “Electric”, “Communications” or other as directed.
  3. Hardware shall be stainless steel.
  4. Shall be furnished with grounding kit.
  5. Shall be O-Z/Gedney Type YR or approved equal.
- H. Above-Grade Padmounted Low Profile Pull Boxes:
1. Construction:
    - a. 12Ga. stainless steel base with 12Ga aluminum top with brushed finish, and structural bracing as required.
    - b. Continuous base frame with open bottom and eight (8) ½” x 1” slots for securing box to concrete pad below and a center support member.
    - c. Two (2) full-size swing-open lids with full-length, stainless steel continuous hinges, lifting handles, key-locking provisions and provisions for latching lids in open position (with stainless steel chain or approved equal).
    - d. Guides on lid and base frame as required to ensure proper closing of box and to provide increased security.
    - e. Aluminum or stainless steel barrier between power & instrumentation areas within box if box is used for both power and instrumentation wiring.
    - f. Other stainless steel hardware as required.
  2. Minimum Dimensions:
    - a. Power: 40 inches square x 18 inches high.
    - b. Instrumentation: 24 inches square x 18 inches high.
  3. Manufacturer:
    - a. Electrical Enclosure Mfg. (Pell City, AL).
    - b. Ebox (Pelham, AL).
    - c. Approved Equal.
- I. Above-Grade Padmounted Transclosure Pull Boxes:
1. Construction:
    - a. 12Ga.aluminum with brushed finish.
    - b. Continuous top and bottom support frames with open bottom and slots as required for securing box to concrete pad below and a center support member.
    - c. Roof with 1” crest on each unit and gutters between each unit.
    - d. Vents (with screens) on top and bottom around perimeter of box.

- e. Full-size swing-out doors on two (2) opposing sides with weld-on barrel hinges (minimum of two per door) and key-locking “L”-handles with roller rods.
  - f. Stainless steel barrier between power & instrumentation areas within box if box is used for both power and instrumentation wiring.
  - g. Other stainless steel hardware as required.
2. Minimum Dimensions:
    - a. Power: 42 inches square x 42 inches high.
    - b. Instrumentation: 42 inches square x 42 inches high.
  3. Manufacturer:
    - a. Electrical Enclosure Mfg. (Pell City, AL).
    - b. Ebox (Pelham, AL).
    - c. Gilbert Electrical Systems
    - d. Approved Equal.

## **PART 3 EXECUTION**

### **3.1 APPLICATION**

- A. General
  1. All boxes and wireways shall be of sufficient size to provide free space for all enclosed conductors per NEC requirements. Fill calculations shall be performed by contractor per NEC requirements.
- B. Outlet Boxes & Junction Boxes (through 4-11/16”)
  - a. Sheet metal boxes shall be used on concealed work in ceiling or walls.
  2. Cast boxes shall be used wherever Rigid or I.M.C. conduits are installed. Cast boxes shall be Cast Aluminum wherever installed in same locations as Rigid Aluminum conduit
  3. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
  4. Except when located in exposed concrete block, switch and receptacle boxes shall be 4" square for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.
  5. When installed in exposed concrete block, switch and receptacle boxes shall be square type designed for exposed block installation.
  6. Ceiling outlet boxes shall be 4" octagon 1-1/2" deep or larger required due to number of wires.
  7. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.
- C. Junction & Pull Boxes (larger than 4-11/16”)
  1. For all below grade exterior use and elsewhere as shown:
    - a. In areas subject to future vehicular traffic: shall be galvanized cast iron (rated AASHTO H-20 Loading unless noted otherwise).
    - b. In areas not subject to vehicular traffic: shall be galvanized cast iron or pre-cast polymer concrete (rated for Tier 15 Loading unless noted otherwise).

2. All boxes installed exposed in exterior or wet areas shall be stainless steel (NEMA 4X).
3. All boxes installed exposed in corrosive areas shall be stainless steel (NEMA 4X).
4. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
5. Padmounted Pull Boxes shall be installed as shown on Plans or as required by project conditions. Transclosure-style Padmounted boxes shall be installed wherever required by the quantities and sizes of conductors. Contractor shall submit all Padmounted Pull Box types prior to ordering for engineer's review and comment.
6. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.
7. All others shall be oil tight JIC box not less than 16 gauge.

### 3.2 INSTALLATION

#### A. General

1. All boxes and wireways shall be securely anchored.
2. All boxes shall be properly sealed and protected during construction and shall be cleaned of all foreign matter before conductors are installed.
3. All boxes and wireways shall be readily accessible. Contractor shall be responsible for furnishing and installing access panels per architect's specifications. Locations shall be as directed by the architect as required to make boxes, wireways, electrical connections, etc. accessible where above gypsum board ceilings or in other similar locations.
4. All metallic boxes and wireways shall be properly grounded.
5. Refer to Specification Section 16075 for identification requirements.

#### B. Outlet Boxes & Junction Boxes (through 4-11/16")

1. Boxes shall be provided with approved 3/8" fixture studs were required.
2. Recessed boxes for wiring devices, surface fixtures, or connections, shall be set so that the edge of cover comes flush with finished surface.
3. There shall be no more knockouts opened in any sheet metal box than actually used.
4. Any unused opening in cast boxes shall be plugged.
5. Back to back boxes to be staggered at least 3 inches.
6. Under no circumstances shall through-the-wall boxes be used.

#### C. Junction & Pull Boxes (larger than 4-11/16")

1. Pull boxes shall be installed as indicated on plans and/or as required due to number of bends, distance or pulling conditions.
2. Boxes to be imbedded in concrete shall be properly leveled and anchored in place before the concrete is poured.
3. All pull boxes and/or junction boxes installed exterior below grade, shall have their tops a minimum of 1-1/2 inches above surrounding grade and sloped so that water will not stand on lid. A positive drain shall be installed, to prevent water accumulation inside.
4. Above grade pull boxes shall be installed on concrete anchor bases as shown on Plans.

- D. Wireways and/or wall-mounted equipment
1. Mount each wireway to channels of the same metal type as the wireway.
  2. Conductors serving a wireway shall be extended without reduction in size, for the entire length of the wireway. Tap-offs to switches and other items served by the wireway shall be made with ILSCO type GTA with GTC cap.

END OF SECTION 16130

## SECTION 16140

### WIRING DEVICES

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Wiring Devices
- B. Plates
- C. Finishes

#### PART 2 PRODUCTS

##### 2.1 WIRING DEVICES AND PLATES

- A. Switches shall be AC type, extra-heavy duty industrial grade (unless otherwise shown) of ratings shown on drawings. Switches shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.
- B. Receptacles shall have blade configuration and shall be heavy duty industrial grade (unless otherwise shown) of current and voltage rating as shown on drawings. Receptacles shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.
- C. All GFCI-type receptacles shall continuously self-test and shall trip/deny power if the receptacle does not provide proper GFCI protection or if the line/load terminations are miswired and shall provide visual indication of power status, trip conditions, ground fault conditions and end-of-life status.
- D. Each wiring device shall have a plate (see "Finishes" section below for specific requirements).

##### 2.2 FINISHES

- A. All wiring devices (switches, receptacles, etc.) shall be colored to match the coverplates described below. For instance, all items covered by stainless steel, aluminum or malleable iron plates shall be gray in color.
- B. Coverplates for recessed, wall-mounted electrical items (switches, receptacles, telephone outlets, etc.) shall be stainless steel unless shown otherwise.
- C. Coverplates, trim rings, etc. for recessed, floor-mounted electrical items (floor outlets, underfloor duct junctions, etc.) shall match finish of building hardware (302/304 stainless steel, brass, etc.) in area installed.
- D. Coverplates for exposed electrical items (switches, receptacles, telephone outlets, etc.) shall be of same material as exposed boxes (see Outlet Box Specification for required material type) and shall have beveled edges.



- E. Coverplates for receptacles in wet locations shall be metallic, in-use type, rated for wet locations per NEC requirements unless noted otherwise.
- F. See “Electrical Identification” specification section for coverplate labeling requirements.

## **PART 3 EXECUTION**

### **3.1 GENERAL MOUNTING**

- A. Symbols on drawings and mounting heights are approximate. The exact locations and mounting heights shall be determined on the job, and it shall be the Contractor's responsibility to coordinate with all trades to secure correct installation. For example, Contractor shall coordinate exact mounting heights over counters, in or above backsplashes, in block walls, and at other specific construction features.
- B. Verify all door swings with Architectural. Locate boxes for light switches within four inches of door trim on swing side (not hinge side) of door.
- C. Devices and associated plates shall not be used as support; outlet boxes shall be rigidly supported from structural members.
- D. Mount all straight-blade receptacles vertically with ground pole up, unless specifically noted otherwise.
- E. Unless otherwise shown or required by local handicap codes, outlet boxes shall be the following distances above the finished floor unless otherwise noted.
  - 1. Receptacles and telephone outlets in offices and other finished areas: 1'-6" to the center of the box.
  - 2. Receptacles and telephone outlets in equipment rooms and other unfinished areas: 4'-0" to the center of the box.
  - 3. Receptacles over counters: As Noted
  - 4. Switches, general: 4'-0" to the top of the box.
  - 5. Push-button, etc., general: 4'-0" to the top of the box.
  - 6. Other device types: verify with engineer prior to rough-in.

END OF SECTION 16140

## SECTION 16289

### SURGE PROTECTIVE DEVICES

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (<1000 V) power distribution and control equipment.
- B. The specified unit(s) shall provide effective high energy transient voltage surge suppression, surge current diversion and high frequency noise attenuation in all electrical modes for equipment connected downstream from the facility's meter or load side of the main overcurrent device. The unit(s) shall be connected in parallel with the facility's wiring system.
- C. The unit(s) shall be designed and manufactured in North America by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacturer of such products for minimum of ten (10) years.
- D. All products that are submitted according to these specification will be required to meet this specification in it's entirety for both service and distribution TVSS systems. Any product that is submitted and does not comply with all parts of this specification will be subject to rejection.

##### 1.3 DEFINITIONS

- A. VPR: Voltage Protection Rating.
- B. SPD: Surge Protective Device(s)
- C.  $I_{(n)}$ : Nominal Discharge Current

##### 1.4 SUBMITTALS

- A. See specification section 16050.
- B. Product Data: For each type of product indicated. Include:
  - 1. Maximum Single Impulse Surge Current Rating.
  - 2. Surge Life (Repetitive Surge) Rating.
  - 3. UL1449 (Latest Edition) Voltage Protection Ratings (VPR).
  - 4. UL1449 (Latest Edition) Nominal Discharge Current ( $I_n$ ).
  - 5. Product dimensions and weights.
  - 6. Furnished specialties and accessories.

- C. Qualification Data:
- D. Safety Agency File Number.
- E. ISO 9001-2008 Certification.
- F. ISO 1401-2001 Certification.
- G. Operation and Maintenance Data: For SPDs to include all submittal data and any applicable operation and maintenance manuals.
- H. Warranties: Sample of special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
- B. The unit shall be UL 1449 Listed and CUL Approved as a Surge Protective Device and UL 1283 Listed as an Electromagnetic Interference Filter
- C. Provide 2<sup>nd</sup> party certified data demonstrating SPD response to ANSI/IEEE C62.41.2-2002 standard waveforms when tested according to IEEE C62.45.
- D. Comply with NFPA 70.
- E. All SPDs provided within this project at the service entrance, distribution panels, and sub-panels shall be from the same manufacturer.

#### 1.6 PROJECT CONDITIONS

- A. Service Conditions: Rate SPDs for continuous operation under the following conditions unless otherwise indicated:
  - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
  - 2. Operating Temperature: 30 to 150 deg F.
  - 3. Humidity: 0 to 95 percent, non-condensing.
  - 4. Altitude: Less than 13,000 feet above sea level.

#### 1.7 COORDINATION

- A. Where field-mounted SPD's are specifically shown on plans, coordinate locations of field-mounted SPDs to allow adequate clearances for maintenance.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Replaceable Protection Modules: 1 of each size and type installed, where field-replaceable modular SPDs are provided.
  - 2. Fuses: 1 of each size and type installed, where field-replaceable fuses are provided.

## **PART 2 PRODUCTS**

### **2.1 SURGE PROTECTIVE DEVICES**

- A. Manufacturer:
  - 1. Integral Devices: Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.), or by Surge Suppression Inc. if all of the performance of this specification are met and all UL listing of the equipment manufacturer are met.
  - 2. External Devices (where specifically specified on plans): Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.) or Surge Suppression Inc.
- B. Each Surge Protective Device shall:
  - 1. Be internal to the associated distribution equipment (without violating any applicable UL listings) unless specifically shown otherwise on plans.
  - 2. Be UL 1449 (Latest Edition) listed.
  - 3. Have short-circuit current rating complying with UL 1449 (Latest Edition), that matches or exceeds the short-circuit rating of the associated distribution equipment.
  - 4. Be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
  - 5. Have fuses, rated at 200-kA interrupting capacity.
  - 6. Have a minimum UL 1449 Nominal Discharge Current ( $I_n$ ) Rating of 20kA.
  - 7. Be fabricated using bolted compression lugs.
  - 8. Provide suppression for all ten (10) modes of protection.
  - 9. Have LED indicator lights for power and protection status of each phase.
  - 10. Have audible alarm, with silencing switch, to indicate when protection has failed.
  - 11. Have form-C contacts rated at 2 A and 24-V ac minimum, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with facility monitoring and control system if monitoring by that system is required by plans or other specifications.
  - 12. Have six-digit transient-event counter, mounted to front of equipment door, set to totalize transient surges (externally mounted SPD's may have the transient – event counter mounted on the visible face of the SPD).
  - 13. Meet all UL 96A requirements (for Lightning Protection Systems) where the device is installed at a service entrance of the facility. At a minimum, these devices shall:
    - a. Be marked as Type 1 or Type 2 SPDs with product Identity consisting of “Surge Protective Device” or “SPD”, and identifying all ratings so required by UL96A and the 4 digit alpha numeric Control Number.

- b. Have a minimum UL 1449 Nominal Discharge Current ( $I_n$ ) Rating of 20kA.
  - c. Be UL listed and labeled with holographic label.
- C. Peak Single-Impulse Surge Current Rating shall be meet the following minimums unless specifically shown otherwise on plans:

Application	Per Phase	Per Mode
Service Entrance Devices	240 kA	120 kA
Downstream Devices	160 kA	80 kA

- D. The ANSI/UL 1449 voltage protection rating (VPR) in grounded wye circuits, the SPDs shall not exceed the following:

Modes	208Y/120V	480Y/277V	600Y/347V
L-N,L-G, N-G	800	1200	1500
L-L	1200	2000	2500

- E. The ANSI /UL 1449 VPR for 240/120 V, 3-wire or 4-wire circuits with high leg shall not exceed the following:

Modes	240/120V
L-N,L-G, N-G	1200/800

## 2.2 ENCLOSURES

- A. Where external units are specifically specified on plans, units not mounted within electrical distribution equipment (such as switchboards, MCC's, etc.) shall be provided in enclosures with NEMA enclosure ratings that match or exceed the NEMA enclosure ratings of the equipment from which the units are fed. For example, a unit fed from a NEMA 4X stainless steel panelboard shall also be mounted within a NEMA 4X stainless steel enclosure.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. All SPD's shall be integrally-mounted within the associated distribution equipment unless specifically shown otherwise on plans.
- B. Install SPDs at service entrance on load side, with ground lead bonded to service entrance ground.

- C. Install SPDs downstream of the service entrance with conductors or buses between suppressor and points of attachment as short and straight as possible. The lead lengths between the TVSS unit and the equipment being protected shall not exceed fourteen (14) inches without approval from the engineer. Do not bond neutral and ground. Leads shall be as straight as possible with no sharp bends.
- D. Where externally-mounted SPD's are specifically shown on plans, provide circuit breaker as directed by the SPD supplier as a dedicated disconnecting means for SPD unless otherwise indicated.

### 3.2 FIELD QUALITY CONTROL

- A. Ensure that interiors are free of foreign materials and dirt.
- B. Check and test switches, pushbuttons, meters for proper operation.
- C. Check and test indicating lights for proper operation and color.
- D. Perform manufacturer's on site field test procedures.

### 3.3 STARTUP SERVICE

- A. Do not perform insulation resistance (MEGGER) tests of the distribution wiring equipment with the SPDs installed. Disconnect all wires, including neutral, before conducting insulation resistance tests, and reconnect immediately after the testing is over.

### 3.4 SYSTEM WARRANTY

- A. The SPD system manufacturer shall warranty the entire SPD system against defective materials and workmanship for a period of ten (10) years from the date of substantial completion. This warranty is in effect as long as the unit is installed in compliance with the manufacturer's installation, operation, and maintenance manual, UL Listing requirements, and any applicable national or local electrical codes.
- B. Any SPD device which shows evidence of failure or incorrect operation, including damage as the result of lightning strikes, during the warranty period shall be replaced by the manufacturer at no charge to the owner. Warranty will provide for multiple exchanges of any inoperable devices at any time during the warranty period which starts at the date of substantial completion of the system to which the surge suppressor is installed.
- C. The manufacturer is required to have a nationwide network of factory-authorized local service representatives for repair and service of this product. The manufacturer shall have a dedicated 1-800 telephone number for service problems and questions. This number shall be manned by a knowledgeable factory employee to ensure prompt response to any emergency situation that may arise.

END OF SECTION 16289

## SECTION 16410

### SAFETY SWITCHES AND FUSES

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Safety Switches
- B. Fuses
- C. Branch Feeders
- D. Feeders

#### PART 2 PRODUCTS

##### 2.1 SAFETY SWITCHES

- A. Safety switches shall be quick-make, quick-break, NEMA heavy duty type HD, fused or nonfused as shown. Switch blades shall be fully visible in the off position.
- B. Safety switches shall be furnished with transparent internal barrier kits to prevent accidental contact with live parts. Barriers shall provide finger-safe protection when the switch door is open and shall allow use of test probes and removal of fuses without removing barrier.
- C. Fused switches shall have provisions for class R, rejection type fuses.

##### 2.2 FUSES (600V)

- A. Fuses for all branch switches shall be Bussman Mfg. Co., Dual Element, Class "R" Fusetron.
- B. Fuses for main switch/switches shall be Bussman Mfg. Co. Hi-Cap.

##### 2.3 MANUFACTURER

- A. Safety switches shall be as manufactured by Square 'D' or Cutler Hammer.
- B. Fuses shall be as manufactured by Bussman Mfg. Co. or equal.

#### PART 3 EXECUTION

##### 3.1 SAFETY SWITCHES

- A. Safety switches shall be installed as shown on the plans and in accordance with N.E.C.
- B. Locations shown for safety switches on plans are diagrammatical only. Exact locations shall be field coordinated by contractor as required to provide code-required clearances.

- C. Switch enclosures shall be rated NEMA I indoors in dry locations and NEMA 4X stainless steel outdoors and in wet or process areas.
- D. Adequate support shall be provided for mounting safety switches. Safety switches shall not be mounted to the associated equipment (unless the safety switch is furnished with the equipment).

### 3.2 FUSES

- A. Fuses shall be sized as shown on drawings, unless a smaller size is required by the associated equipment supplier, in which case the contractor shall provide fuses sized as directed by the associated equipment supplier at no additional cost.
- B. Provide not less than one spare set of fuses for each size used. Provide an additional spare set for each five sets of same size fuses used.

END OF SECTION 16410



## SECTION 16441

### POWER PANELBOARDS - CIRCUIT BREAKER TYPE

#### PART 1 GENERAL

##### 1.1 GENERAL

- A. The work under this section includes but is not limited to the following:
  - 1. Power Panelboards
  - 2. Power Circuit Breakers

#### PART 2 PRODUCTS

##### 2.1 PANELBOARDS - GENERAL

- A. Panelboards shall be dead front type, having lugs only or circuit breaker in mains as shown in panelboard schedule with circuit breaker branches.
- B. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on plans. Such rating shall be established by heat rise test with Maximum hot spot temperature on any connector or bus bar not to exceed 50 degrees C rise above ambient at full rated load. Heat rise test shall be conducted in accordance with UL Standard UL67. Bus structure shall be tin-plated copper. All neutral busses shall be full size. All panelboards shall contain ground buss.
- C. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
- D. Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. Panelboards shall be suitable for use as service equipment when required.
- E. Main and sub-feed lugs shall be provided with AL/CU compression lugs suitable for the quantities and sizes of conductors required.
- F. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.
- G. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

##### 2.2 CIRCUIT BREAKERS

- A. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated (or can be adjusted to is 1200A or higher, breakers shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.

- B. Circuit breakers shall be quick-make and quick-break, whether actuated automatically or manually. Circuit breakers shall have inverse time tripping characteristics with automatic release which shall trip free of the handle. Circuit breaker handles shall be three distinct positions—"OFF", "ON", and "TRIPPED". When a circuit breaker opens on overload or short circuit, the operating handle shall automatically assume the "TRIPPED" position.
- C. Multipole breakers shall be internal common trip with single operating handle. External handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).
- D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.
- E. Circuit breakers shall be of the bolt-on type.
- F. Circuit breakers shall be "FA" frame and larger.
- G. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
- H. The front face of all circuit breakers shall be flush with each other. Breaker numbers shall be permanently attached to trim.
- I. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

### 2.3 CABINETS, TRIM AND WIREWAY SPACE

- A. Clear space from bottom of lugs to bottom of wireway shall be not less than 6 inches for 400 amps and below, 10 inches for 600 amps, 12 inches for 800 amps and above.
- B. Panelboard interiors shall be fastened to cabinets by adjustable aligning supports.
- C. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets.
- D. Fronts of cabinets shall be made from a single sheet of full finished steel having the door cut out. Doors shall have flush hinges, and lock utilizing all metal construction (with all locks keyed alike). Front shall be attached to cabinets with hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim. Front shall be provided with a metal directory and holder with clear plastic covering welded to the inside of the door. Fronts shall be code gauge full-finished steel with rust inhibiting primer and baked enamel finished in ASA #49 gray. Panelboards installed in corrosive, exterior or wet locations shall have NEMA 4 stainless steel enclosures.

- E. Each section of multi-section panelboards shall be of matching heights and depths.
- F. Panelboard enclosures shall be furnished as shown on panel schedule on plans for surface, flush or motor control center mounting.

#### 2.4 MANUFACTURER

- A. Panelboards shall be as manufactured by Square 'D' or Cutler Hammer.

### **PART 3 EXECUTION**

#### 3.1 INSTALLATION

- A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to ensure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6'-7" A.F.F..
- B. Wiring in panelboard gutters shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.

#### 3.2 PERFORMANCE TESTING

- A. The ground-fault protection system when provided shall be performance tested after installation by a qualified person(s) using primary current injection in accordance with the instructions provided with the equipment and NEC requirements. A written record of the testing shall be provided.
- B. The arc energy reduction protection system when provided shall be performance tested after installation by a qualified person(s) using primary current injection in accordance with the instructions provided with the equipment and NEC requirements. A written record of the testing shall be provided.

#### 3.3 PANEL IDENTIFICATION

- A. Refer to Specification Section 16075.

END OF SECTION 16441

## SECTION 16442

### LIGHTING PANELBOARDS

#### PART 1 GENERAL

##### 1.1 GENERAL

- A. The work under this section includes but is not limited to the following:
  - 1. Lighting Panelboards
  - 2. Circuit Breakers

#### PART 2 PRODUCT

##### 2.1 PANELBOARDS

- A. Enclosure:
  - 1. Panelboards shall be dead front type and shall be in accordance with Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and so labeled.
  - 2. Panelboards installed in dry locations shall have enclosures fabricated from sheet steel and shall be finished in ASA #49. Panelboards installed in corrosive, exterior or wet locations shall have NEMA 4 stainless steel enclosures.
  - 3. The door shall have a cylinder type lock. Lock shall be held in place by concealed screw to a captive nut, welded to inside of door. All locks shall be keyed alike.
  - 4. A metal framed circuit directory card holder with clear plastic covering shall be factory-mounted on the inside of door.
  - 5. Panels for 20 or more circuits, including spares and spaces, shall be 20 inches wide.
  - 6. Panelboards enclosures shall be as shown on panel schedule on plans for surface, flush or motor control center mounting.
  - 7. Provide hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim.
  - 8. Each section of multi-section panelboards shall be of matching heights and depths.
- B. Bussing/Lugs:
  - 1. Ampacity and service voltage of main buss, lugs or main breakers and branch circuit breakers shall be as shown on drawings.
  - 2. All bussing and associated connectors shall be tin-plated copper.
  - 3. All panelboards shall contain ground buss.
  - 4. Entire panelboard shall be capable of withstanding a short circuit not less than the interrupting capacity of any breaker in the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. Interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
  - 5. Buss connectors shall be for distributed phase arrangement.

6. Main and sub-feed lugs shall be provided with AL/CU compression lugs suitable for the quantities and sizes of conductors required.
  7. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.
  8. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
  9. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations
- C. Breaker arrangement and numbering:
1. Panelboards shall be factory assembled with branch breakers arranged exactly as indicated on plans.
  2. Breakers shall be numbered vertically beginning top left. Multi-section panelboards shall be numbered consecutively through all sections.
  3. Breaker numbers shall be permanently attached to trim.
  4. Main breakers shall be vertically-mounted (branch-mounted or back-fed main breakers will not be acceptable unless specifically so shown on plans).

## 2.2 CIRCUIT BREAKERS

- A. Circuit breakers shall be quick break, quick make, thermal magnetic type, for alternating current. Breakers shall trip free for the handle and tripping shall be indicated by the handle assuming a position between OFF and ON.
- B. Circuit breakers shall be of the bolt-on type.
- C. Multi-pole breakers shall be internal common trip with single operating handle; external handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).
- D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with multi-pole breakers or handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these multi-pole breakers or handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.
- E. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
- F. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

### 2.3 SPECIAL REQUIREMENTS

- A. Any special requirements on the drawings, such as for increased interrupting rating, ground fault protection, etc., shall supersede these specifications, but only insofar as that particular requirement is concerned.
- B. Lighting panels larger than 400A shall conform to the requirements for power panels.

### 2.4 MANUFACTURER

- A. Panelboards shall be as manufactured by Square 'D' or Cutler Hammer.

## **PART 3 EXECUTION**

### 3.1 INSTALLATION

- A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to ensure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6'-7" A.F.F..
- B. Wiring in panelboard wireways shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.
- C. For all flush-mounted panelboards, a minimum of three (3) one-inch empty conduits shall be stubbed out above the nearest accessible ceiling space for future use.

### 3.2 PANEL IDENTIFICATION

- A. Refer to Specification Section 16075.

END OF SECTION 16442

## SECTION 16480

### MANUFACTURED CONTROL PANELS

#### PART 1 GENERAL

##### 1.1 SCOPE

- A. This section describes control stations, PLC panels, motor control panels, manufactured control panels, and other similar panels specified herein. Specifications herein are intended as an extension of requirements in other Divisions of these specifications where reference is made to Electrical Specifications.

##### 1.2 DEFINITIONS

- A. "Control Stations": Enclosures (with all required accessories) containing only door-mounted pushbuttons, indicator lights and/or selector switches (no electronic components or starter/controller equipment).
- B. "Control Panels": Enclosures (with all required accessories) containing equipment/devices other than door-mounted pushbuttons, indicator lights and/or selector switches (such as electronic components, starter/controller equipment, etc.).

##### 1.3 SUBMITTALS

- A. Provide the following for each control panel:
  - 1. A job-specific, custom wiring diagram
    - a. The wiring diagram shall clearly show all components (whether the components are mounted internal or external to the control panel enclosure).
    - b. All wires and terminal blocks shall be clearly labeled.
    - c. Diagram shall be in accordance with NEMA/ICS standards.
  - 2. Size, type and rating of all system components.
  - 3. Unit frontal elevation and dimension drawings.
  - 4. Internal component layout diagrams.
  - 5. Manufacturer's product data sheets for all components.
- B. A Bill of Materials shall be included with catalog information on all components.
- C. Information shall be included on any proprietary logic component sufficient to demonstrate its ability to perform the required functions.
- D. The following calculations shall be submitted:
  - 1. Thermal calculations showing amount of panel cooling/ventilating/heating required for each control panel, per ambient requirements listed below and operating temperature limitations of all equipment/devices within each control panel. See Part 2 below for requirements for forced air ventilation rather than air conditioning. Panel shall be oversized, interior equipment/devices shall be derated, and solar shielding shall be provided as required to allow the use of forced air ventilation as the cooling method. Air conditioning, ventilation, and/or

heating equipment shall each have ratings/capacities at least 20% larger than required by calculations below unless noted otherwise:

- a. Thermal calculations used for sizing cooling/ventilation systems for each control panel located in exterior or non-conditioned spaces shall assume:
    - 1) Ambient exterior air temperature ranges of -5 degrees F to 105 degrees F.
    - 2) Full solar contact where applicable (not applicable where enclosures are fully protected from solar contact using solar shields separated from panel enclosure with standoffs or similar).
    - 3) No wind.
    - 4) Heat loss from interior equipment (electronics, etc.) per equipment supplier's information.
  - b. Thermal calculations used for sizing heating systems for each control panel shall assume:
    - 1) Ambient exterior air temperature ranges of -5 degrees F to 105 degrees F.
    - 2) No heat loss by interior components of control panel.
    - 3) No solar gain on exterior of control panel.
    - 4) Doubling of heating wattage required to account for wind where control panels are located outdoors.
    - 5) Minimum temperature difference (due to heating) of 10 degrees F to prevent condensation, regardless of equipment temperature limitations.
2. Load calculations showing the sizing of all power supplies provided (with spare capacity as specified). Power supplies shall each have ratings/capacities at least 20% larger than required by load calculations unless noted otherwise.
  3. Load calculations showing the sizing and anticipated runtime of all Uninterruptible Power Supply systems provided (with spare capacity as specified).

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Control panels shall be Underwriters' Laboratories labeled by the panel manufacturer. Control panel manufacturers not capable of applying the U.L. label to their products are unacceptable.
- B. All human interface equipment/devices (indicator lights, selector switches, pushbuttons, time switches, displays, keypads, and other similar items used for control, adjustments or monitoring) shall be mounted on the non-energized side of enclosure door(s) in such a way as to be accessible without exposing the user to energized parts.
- C. All

### **2.2 RATINGS**

- A. All Control Panels shall have short circuit current ratings at least equal to the lesser of the following, unless noted otherwise on plans:



1. The short circuit current rating of the electrical distribution equipment that feeds the Control Panel.
  2. 150% of the available fault current at the Control Panel as determined by a Short Circuit Current study prepared by a licensed professional electrical engineer.
- B. All equipment/devices installed within control panels shall be rated to operate in ambient temperatures of 50 degrees C (122 degrees F) or higher.

### 2.3 ENCLOSURES

- A. All enclosures (with any required accessories or auxiliary items) shall fit within the space shown on the Plans. Any costs associated with furnishing equipment which exceeds the available space shall be borne by the Contractor.
- B. Enclosures (with any required accessories or auxiliary items) shall be suitable for the environment where installed.
- C. Enclosure materials shall be as follows unless noted otherwise:
1. Control Stations:
    - a. Where located in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.): NEMA 4X of non-metallic construction (with non-metallic hardware) compatible with the associated chemical(s).
    - b. Where located in other wet, process or outdoor areas: NEMA 4X of type 304 stainless steel construction (with stainless steel hardware).
    - c. Where located in dry, non-process, indoor areas (such as electrical rooms): NEMA 1 of die cast zinc/aluminum construction.
  2. Control Panels:
    - a. Where located in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.): NEMA 4X of non-metallic construction (with non-metallic hardware) compatible with the associated chemical(s).
    - b. Where located in other wet, process or outdoor areas: NEMA 4X of type 304 stainless steel construction (with stainless steel hardware).
    - c. Where located in dry, non-process, indoor areas (such as electrical rooms): NEMA 1 or 12.
- D. Control Panel Enclosure Construction:
1. Non-metallic control panel enclosure material, where specified, shall be reinforced polyester resin or equivalent, with a minimum thickness of 3/16 inch for all surfaces except those requiring reinforcement. Panels shall be precision molded to form a one piece unit with all corners rounded. Exterior surfaces shall be gel-coated to provide a corrosion-resistant maintenance-free satin finish which shall never need painting. Color pigments shall be molded into the resin. Color shall be grey.
  2. Metallic control panel enclosures, where specified, shall be fabricated using a minimum of 14 gauge steel for wall or frame mounted enclosures and a minimum of 12 gauge for freestanding enclosures. Continuously weld all exterior seams and grind smooth. Reinforce sheet steel with steel angles where necessary support equipment and ensure rigidity and preclude resonant vibrations.
  3. Use pan-type construction for doors.

4. Door widths shall not exceed 36-inches.
  5. Mount doors with full length, heavy duty piano hinge with hinge pins.
  6. Provide gasket completely around each door opening.
  7. Mount and secure all internal components to removable back plate assembly.
  8. For NEMA 1 or 12 enclosures, provide handle-operated key-lockable three point stainless steel latching system for each door.
  9. For NEMA 4X enclosures, provide provisions for padlocking all doors and provide clamps on three (3) sides of each door.
- E. Control panel enclosures (and associated backpanels and other similar accessories) shall be manufactured by Hoffman Engineering Co., or Saginaw Control & Engineering.

#### 2.4 CONTROL PANEL ACCESSORIES:

- A. Panel ventilation systems shall be provided if so required by the application to maintain temperatures within the acceptable ranges of the interior equipment. In no case (regardless of temperature ratings of internal equipment) shall maximum temperatures within control panels be allowed to exceed 50 degrees C (122 degrees F). Panel Air Conditioners or Heat Exchangers (to satisfy the specified thermal calculation requirements) are generally NOT acceptable unless specifically stated otherwise in these specifications, and shall not be provided for panels without specific written direction from the engineer PRIOR to submission of panel shop drawings. Panels shall be oversized, provided with standoffs/shields, and/or ventilated as required to meet the contract requirements. Thermostats shall be provided to control cooling without need of manual operation. Thermostat setpoints shall be as per recommendations of the equipment suppliers. See above for thermal calculation requirements. Cooling units shall be as manufactured by Hoffman Engineering Co., Rittal or approved equal and shall be thermostatically controlled.
- B. Space heaters shall be provided for condensation and temperature control. Thermostats AND hygrometers (or combination hygrometers) shall be provided to control heating requirements (based on temperature and relative humidity within enclosure) without need of manual operation. Setpoints shall be as per recommendations of the equipment suppliers. See above for thermal calculation requirements. Space heaters and associated control devices shall be as manufactured by Hoffman Engineering Co., Rittal, Stego or approved equal.
- C. NEMA 4X control panels shall be provided with vapor-phase corrosion inhibitor(s) (chemical combinations that vaporize and condense on all surfaces in the enclosed area, to protect metal surfaces/devices within the enclosed area from corrosion). Corrosion inhibitor shall be Hoffman #AHCI series (sized as required by the enclosure volume to be protected) or equal.
- D. For outdoor panels, stainless steel solar shields for front, top and each side of panel, supported to associated panel face with standoffs as required (to allow free air flow between solar shield and panel enclosure), shall be provided where required to limit solar loading on panel to allow use of a ventilated panel design rather than an air-conditioned panel design.

- E. Provide a sun shield over all LCD displays in exterior-mounted panels. Sun shield shall be collapsible to fully protect LCD display from UV light when not in use, shall provide side and top shielding when in use, shall be constructed of stainless steel and shall be installed such as to maintain NEMA 4X ratings of enclosures.
- F. Provide a clear polycarbonate gasketed hinged door or window to encompass all indicators, controllers, recorders, etc. mounted on NEMA 4 and 4X enclosures.
- G. Provide interior mounting panels and shelves constructed of minimum 12 gauge steel with white enamel finish. Provide metal print pocket with white enamel finish on inside of door.
- H. Provide interior LED light kit, mounted at top of interior of panel, and switched to turn "ON" when door is opened for the following control panels:
  - 1. Control panels with outer dimensions greater than 20" wide or 30" high.
  - 2. Control panels containing PLCs or other similar programmable devices.
- I. Control panels containing VFDs or Reduced Voltage Soft Starters shall include a door mounted digital keypad for adjusting the starter parameters and viewing process values and viewing the motor and starter statuses without opening the enclosure deadfront door.

## 2.5 CONTROL COMPONENTS

- A. General:
  - 1. All pushbuttons, pilot lights, selector switches and other control devices shall be separate, standard size (full 30mm) and shape, heavy duty oil-tight units.
    - a. Devices in extremely corrosive areas (chlorine rooms, fluoride rooms, etc.) shall be of non-metallic construction.
    - b. Devices in other areas shall be of chrome-plated construction.
  - 2. All components and devices so that connection can be easily made and so there is ample room for servicing each item.
  - 3. Door-mounted indicators, recorders, totalizers and controllers shall be located between 48" and 72" above finished floor level.
  - 4. Door-mounted indicator lights, selector switches and pushbuttons shall be located between 36" and 80" above finished floor level.
  - 5. All devices and components shall be adequately supported to prevent movement. Mounting strips shall be used to mount relays, timers and other devices suitable for this type of mounting.
- B. Pilot Lights:
  - 1. All pilot lights to be cluster LED type & push to test.
- C. Pushbuttons:
  - 1. All STOP operators within control stations located at equipment shall be provided with lockout provisions and a minimum of two (2) sets of contact blocks.
  - 2. Emergency shutoff pushbutton devices shall be as follows unless noted otherwise:
    - a. 2 1/4" diameter, mushroom-style, maintained contact push buttons

- b. With a minimum of one (1) normally open dry contact and three normally closed dry contacts.
- c. Connections made such that pushing “in” the button will shutoff the associated equipment.
- d. Provided with a red engraved nameplate with ½” lettering to read “Emergency Shutoff”.

D. Relays:

1. Control relays shall have the following characteristics, unless noted otherwise:
  - a. General purpose, plug-in type.
  - b. Minimum mechanical life of 10 million operations.
  - c. Coil voltage as indicated or required by application.
  - d. Single-break contacts rated 12 amperes, resistive at 240 volts.
  - e. Contacts as shown on wiring diagrams plus a minimum of one (1) spare N.O. contact and one (1) spare N.C. contact. At a minimum, each individual relay shall have 3PDT contacts. Where required, multiple control relays shall be provided (to provide the required quantities of contacts) for each “relay” function shown on plans/diagrams.
  - f. Furnished with RC transient suppressor to suppress coil-generated transients to 200% of peak voltage.
  - g. LED on/off indicator light and manual operator.
  - h. Industry standard wiring and pin terminal arrangements.
  - i. Equal to Square D 8501KP series with matching plug-in socket.
2. Interposing/isolation relays used to isolate discrete output field wiring (and where required for voltage translation for other discrete signals) to/from PLC inputs/outputs shall be terminal-block style. Terminal-block style relays shall have the following characteristics, unless noted otherwise:
  - a. Minimum mechanical life of 10 million operations.
  - b. Single-break contacts rated 6 amperes, resistive at 120 volts.
  - c. One (1) N.O. contact per relay.
  - d. Furnished with integral transient protection.
  - e. LED on/off indicator light.
  - f. DIN-rail mounted.
  - g. Equal to Square D type Zelio RSL.
3. Timer relays shall be electronic, adjustable plug-in devices meeting the following characteristics, unless noted otherwise:
  - a. General purpose, plug-in type.
  - b. Minimum mechanical life of 10 million operations.
  - c. Single-break contacts rated 10 amperes, resistive at 240 volts.
  - d. Contacts as shown on wiring diagrams plus a minimum of one (1) spare N.O. contact and one (1) spare N.C. contact. At a minimum, each relay shall have DPDT contacts (2 N.O. & 2N.C.). Where required, multiple timer or control relays shall be provided (to provide the required quantities of contacts) for each “relay” function shown on plans/diagrams.
  - e. Rotary-thumbwheel adjustments for time value, timing range and function.
  - f. Time value adjustments from .05 seconds to 999 hours
  - g. Selectable Timing Functions, including the following:
    - 1) On Delay

- 2) Interval
- 3) Off Delay
- 4) One Shot
- 5) Repeat Cycle-Off
- 6) Repeat Cycle-On
- 7) On/Off Delay
- 8) One Shot Falling Edge
- 9) Watchdog
- 10) Trigger On Delay
- h. Accuracy shall be  $\pm 2\%$  and repeatability shall be  $\pm 0.1\%$ .
- i. Furnished with integral transient protection.
- j. LED indicator light(s) for “timing” and “on/off status”
- k. Held in place with hold-down spring
- l. Equal to Square D type JCK with matching plug-in socket.

## 2.6 DC POWER SUPPLIES

- A. DC Power supplies shall be provided where specified elsewhere, or as required by design of system. Power supplies shall be industrial type, AC-to-DC switching, output voltage as required, 120vac input, size as required for the initial application plus 50% spare capacity.
- B. Redundant power supplies with diode isolation shall be provided so that the loss of one power supply does not affect system operation. The back-up supply systems shall be designed so that either the primary or the back-up supply can be removed, repaired, and returned to service without disrupting the system operation.
- C. Power supply output shall be protected by secondary overcurrent protection device(s).
- D. The power distribution from multiloop supplies shall be selectively fused so that a fault in one instrument loop will be isolated from the other loops being fed from the same supply.
- E. Each power supply shall meet the following requirements.
  1. Regulation, line: 0.4% for input from 105 to 132vac.
  2. Regulation, load: 0.8%
  3. Ripple/Noise: 15mV RMS / 200 mV peak to peak
  4. Operating temperature range: 0 deg C - 60 deg C
  5. Overvoltage protection
  6. Overload Protection
  7. Output shall remain within regulation limits for a least 16ms after loss of AC power at full load.
  8. Output status indicator.
  9. UL listing
- F. Power supplies shall be manufactured by Puls, Sola, Phoenix Contact or equal.

## 2.7 UNINTERRUPTIBLE POWER SUPPLIES

- A. Uninterruptible power supplies (UPSs) shall be provided where specified elsewhere, or as required by design of system. Power supplies shall be industrial type, size as required for the initial application plus 50% spare capacity unless noted otherwise.

- B. Battery runtime shall be as specified elsewhere. If no other specification for battery runtime is specified, battery runtime shall be 12.5 minutes at full load.
- C. UPSs shall be double-conversion, on-line type.
- D. UPSs shall be rated for operation in -20 degrees C to 55 degrees C ambient temperatures.
- E. UPS batteries shall be hot-swappable and 12-year rated when installed in 25 degrees C environment and 4-year rated when installed in 50 degrees C environment.
- F. UPSs shall include dry contacts for the following alarm points:
  - 1. Loss of Input Power Alarm
  - 2. Low Battery Alarm
- G. UPSs shall be manufactured by Falcon UPS or approved equal.

## 2.8 DISCONNECTS

- A. A main disconnect switch or circuit breaker shall be supplied integral to all control panels. The main disconnect or circuit breaker shall be accessible/operable without exposing the operator to energized sections of the control panel(s), and shall be lockable in the open/off position.
- B. Individual circuit breakers shall be provided integral to the manufactured control panel for each separate power circuit originating within the control panel.
- C. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated (or can be adjusted to is 1200A or higher, breakers shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.
- D. Manufacturers:
  - 1. Square 'D' or Cutler Hammer.

## 2.9 COMBINATION STARTERS

- A. All combination starters shall utilize a unit disconnect. Magnetic starters shall be furnished in all combination starter units unless specifically shown otherwise. All starters shall utilize full NEMA/EEMAC rated contactors (size 1 minimum).
- B. Starters shall be provided with a three-pole, external (door mounted) manual reset, solid state overload relay. Solid state overload relay shall have switch-selectable trip class and shall provide protection from:
  - 1. Overload.
  - 2. Phase Unbalance.
  - 3. Phase Loss.
  - 4. Ground Fault (Class II detection).
- C. Unless specifically shown otherwise, each combination starter or each group of starters shall be furnished with a control circuit transformer including two primary protection

fuses and one secondary fuse (in the non-ground secondary conductor). The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads (including motor space heaters and other similar loads where specified). The transformer rating shall be fully visible from the front when the unit door is opened. Unless otherwise indicated, control voltage shall be 120V AC. Control power shall be provided by individual unit control power transformers.

- D. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.
- E. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.
- F. NEMA/EEMAC Size 1-4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of the starter cubical without entering the vertical wireway.
- G. Each starter shall be equipped with a minimum of the following control devices:
  - 1. Door-mounted reset button.
  - 2. Two (2) field-reversible (N.O./N.C.) auxiliary contacts
  - 3. For reversing and two-speed starters: Four (4) field-reversible (N.O./N.C.) auxiliary contacts
  - 4. Additional control devices as indicated on plans.
- H. Control Wiring Terminal Blocks
  - 1. Terminal blocks shall generally be:
    - a. Feed-thru, screw-in type
    - b. DIN rail mounted
    - c. Furnished with the stationary portion of the block secured to the unit bottom plate
    - d. Furnished with unit-mounted control terminal blocks for each field wire.
    - e. Rated for the voltage and current of the proposed application per UL/NEC standards.
    - f. Sized (by supplier) for the associated wire gauges/types/quantities.
    - g. Phoenix Contact UT-4 series, Weidmuller WDU-4 series (or equivalent) unless required otherwise by application.
- I. Nameplates
  - 1. Each unit shall be properly labeled with an engraved phenolic nameplate with a white background and black letters.
  - 2. Each pilot device shall be properly labeled with a legend plate or an engraved phenolic nameplate.
- J. Manufacturers:
  - 1. Square 'D' or Cutler Hammer.

## 2.10 WIRING

- A. Refer to Section 16120 for all wiring types/applications.

- B. All wiring shall be identified on each end with hot stamped, shrink tube type, or self-laminating vinyl permanent wire markers to correspond with numbering shown on wiring diagrams.
- C. All connections shall be made on terminals with no splices.
- D. All wiring runs shall be along horizontal or vertical routes to present a neat appearance. Angled runs will not be acceptable. Group or bundle parallel runs of wire in plastic wire duct where practical.
- E. All wiring runs shall be securely fastened to the panel or wire duct by means of plastic wire ties. Adequately support and restrain all wire runs to prevent sagging or movement.
- F. AC power wiring and instrumentation/analog wiring shall be run separate.
- G. Color code all internal wiring (not field wiring) as follows:
  - 1. Line and load circuits: Black (B)
  - 2. AC control wiring: Red (R)
  - 3. Externally-Powered control wiring: Yellow (Y)
  - 4. Neutral wiring: White (W)
  - 5. Low voltage DC(+)pos: Blue (BL)
  - 6. Low voltage DC(-)neg: Blue/White Tracer (BL/W)
  - 7. Grounding: Green (G)
- H. Terminal strips shall be provided for all input and output wiring. No more than two (2) wires shall be connected to one (1) terminal block.

## 2.11 ELECTRICAL SURGE AND TRANSIENT PROTECTION

- A. General
  - 1. Function: Protect the system against damage due to electrical surges.
- B. Application: As a minimum, provide surge and transient protection (with proper grounding) at the following locations as described below:
  - 1. Power Input High Frequency Noise Filtering:
    - a. 120VAC Control panels with integral UPSs, PLCs, or other electronic/microprocessor equipment that is susceptible to failure or improper operation due to high frequency/harmonic input transients shall be provided with series-connected high-frequency noise filters on the line input (downstream of any panel main disconnects/breakers). Filters shall be as manufactured by Edco/Emerson/Islatrol or equal (exact type(s) as required by application).
  - 2. Power Input Surge Protection:
    - a. Provide surge protection device at any connection of 120VAC power to panels containing programmable logic controllers, remote I/O equipment, UPS's, transmitters, radios, VFDs, Reduced Voltage Soft Starters or other electronic equipment. Device shall:
      - 1) Be mounted internal to the associated panel, with dedicated overcurrent protection.
      - 2) Be of two-part (base and SPD), DIN-rail mountable construction.



- 3) Have 15kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform).
  - 4) Have maximum continuous operating voltage (MCOV) rating as required by the associated circuit voltage.
  - 5) Visually indicate operational status.
  - 6) Be Dehn DEHNguard series or equal by MTL Technologies, or may be combined with the High Frequency Noise Filtering device required above.
- b. Provide surge protection device at any connection of multi-pole AC power to panels containing programmable logic controllers, remote I/O equipment, UPS's, transmitters, radios, VFDs, Reduced Voltage Soft Starters or other electronic equipment. Device shall:
- 1) Be mounted internal to the associated panel, with dedicated overcurrent protection.
  - 2) Provide protection for all phases.
  - 3) Have 40kA (per phase) peak surge current rating.
  - 4) Have maximum continuous operating voltage (MCOV) rating as required by the associated circuit voltage.
  - 5) Visually indicate operational status.
  - 6) Be Square D SDSA or HWA series or equal.
3. Analog I/O Panel Terminations Surge Protection:
- a. Provide surge protection device at the PLC (or similar) panel connection of each analog I/O signal. Device shall:
- 1) Be mounted internal to the associated panel.
  - 2) Be of two-part (base and SPD), DIN-rail mountable construction.
  - 3) Have the following nominal discharge current ratings:
    - a) D1 Lightning impulse current (10/350  $\mu$ s) per line: 1 kA
    - b) C2 Total nominal discharge current (8/20  $\mu$ s): 20 kA
    - c) C2 Nominal discharge current (8/20  $\mu$ s) per line: 10 kA
  - 4) Have maximum continuous operating voltage (MCOV) rating as required by the associated signal.
  - 5) Manufacturer and Model:
    - a) DEHN BSP M4 BE 24 (926 324) with 920300 base.
    - b) Phoenix Contact 2801263 with included base.
    - c) Weidmuller 1093400000 with 8951710000 base.
4. Discrete I/O Panel Terminations Surge Protection:
- a. Provide isolation relay at the PLC (or similar) panel connection of each discrete output signal (within the associated panel). See above for isolation relay requirements.
5. Low Voltage Power Supply Load Side Surge Protection:
- a. Provide surge protection device at the PLC (or similar) panel on the load side of each low voltage power supply that has low voltage connections extending external to the panel. Device shall:
- 1) Be mounted internal to the associated panel.
  - 2) Be of two-part (base and SPD), DIN-rail mountable construction.
  - 3) Have 10kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform).
  - 4) Have maximum continuous operating voltage (MCOV) rating as required by the associated utilization voltage.

- 5) Be as manufactured by Dehn, MTL Technologies, or Phoenix Contact.
  6. Network Panel Terminations Surge Protection:
    - a. Provide surge protection device at the PLC (or similar) panel connection of each network cable. Device shall:
      - 1) Be mounted internal to the associated panel.
      - 2) Be of DIN-rail mountable construction.
      - 3) Have 1kA total nominal discharge current per line (based on 8/20 $\mu$ s waveform).
      - 4) Be designed specifically for the associated network connection type (Ethernet, RS485, RS232, etc.).
      - 5) Be MTL Zonebarrier series or equal.
  7. Antenna Cable Terminations Surge Protection:
    - a. Provide surge protection device at the connection of antenna cable to the radio panel. Device shall:
      - 1) Be mounted internal to the associated panel.
      - 2) Provide coarse protection via replaceable gas-filled surge voltage arrester
      - 3) Be Phoenix Contact CN-LAMBDA series or equal.
- C. Installation and grounding of suppressor: As directed by manufacturer. Provide coordination and inspection of grounding.

## **PART 3 EXECUTION**

### **3.1 DELIVERY, STORAGE & HANDLING**

- A. Provide Site and warehouse storage facilities for all equipment.
- B. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers, and related equipment as recommended by the capsule manufacturer.
- C. Prior to installation, store items in dry indoor locations. Provide heating in storage areas for items subject to corrosion under damp conditions.
- D. Cover panels and other elements that are exposed to dusty construction environments.

### **3.2 INSTALLATION**

- A. Provide enclosure mounting supports as required for floor, frame or wall mounting. All supports in exterior, wet or process areas shall be stainless steel unless noted otherwise. All floor-mounted panels or other similar distribution equipment shall be mounted on 6" concrete housekeeping pads unless specifically shown otherwise.
- B. All enclosures used outside shall be solid bottom unless otherwise specified. All cable and piping openings shall be sealed watertight. Cable and piping shall enter the enclosure as shown on drawings or specified herein.
- C. All equipment and components shall be solidly grounded to the control panel. One grounded terminal unit shall be provided in each control panel for connection to plant

ground system. Grounding digital and analog components shall be performed in accordance with the instrument supplier's installation recommendations. Signal ground shall be solidly connected to the ground system so as to prevent ground loops

### 3.3 PAINTING

- A. For enclosures other than NEMA 4X stainless steel or fiberglass:
  - 1. Completely clean all surfaces so that they are free of corrosive residue. Then, phosphatize all surfaces for corrosion protection.
  - 2. Prime with two (2) coats and finish with one coat of factory finish textured polyurethane. Paint shall be Sherwin-Williams Polane "T" or approved equal.
  - 3. Color to be selected during shop drawing review phase.

### 3.4 IDENTIFICATION & DOCUMENTATION

- A. Refer to specification section 16075 for additional requirements.
- B. Control panel power supply source, type, voltage, number or circuit ratings shall be identified inside control panels and on drawings.
- C. All interior devices and components shall be identified with thermal transfer labels with black letters on white background. Labels shall be placed on the subpanel and not the component. Marking system shall be a Brother "PTouch II" or equal. Lettering shall be 1/4" high.
- D. All front panel mounted devices such as push buttons shall be identified by the use of engraved bakelite nameplates or legend plates. Nameplates shall be 1/8" thick, white with black core.
- E. Where a panel includes a PLC or other network-connected device that is intended to be connected to another system (such as a plant SCADA system) via a network connection, the panel supplier shall provide an Interface Control Document (ICD) to the other system supplier (such as the SCADA Integrator). This document shall itemize the following for each networked parameter that is capable of being monitored or controlled by the other system:
  - 1. Parameter Name/Function (ex: Pump No. 1 On/Off Status)
  - 2. Parameter Type (discrete or analog, input or output)
  - 3. Parameter register ID/location
- F. Where a panel includes a touchscreen or other programmable HMI display and is to be monitored by another system (such as a plant SCADA system), the panel supplier shall provide copies of the HMI display code and screenshots of all proposed HMI screens to the other system supplier (such as the SCADA Integrator) for their use in duplicating the associated HMI.
- G. A job-specific, custom wiring diagram for each control panel (not including control stations without relays) shall be provided to the contractor prior to installation for making the appropriate electrical connections. The wiring diagram shall clearly show all control components connected to the panel (whether the components are mounted internal or external to the enclosure). All wires and terminal blocks shall be clearly labeled. A

laminated copy of the final wiring diagram for each unit shall be installed inside the door of the associated panel, and submitted to the owner with the as-built documentation.

### 3.5 OWNER TRAINING

- A. Fully train the owner in the proper operation of all control panels/equipment, describing and demonstrating full operation, including function of each door-mounted device.

### 3.6 SPARE EQUIPMENT

- A. Provide the following spare equipment:
  - 1. Fuses: 10% (minimum of 3) of each size and type utilized, mounted within a pocket within the associated control panel.
  - 2. Where control panel contains programmable controller (or similar equipment):  
Flash drive containing copies of all final programs utilized within the control panel, with provisions/cable assemblies as required to connect the flash drive provided to the controller to download the programs. Flash drive shall be attached to retractable cord (long enough to reach the associated port) attached to the inside of the panel door.

END OF SECTION 16480

## SECTION 16511

### LIGHTING MATERIALS AND METHODS

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Lighting Fixtures
- B. Drivers

##### 1.2 SUBMITTALS

- A. Complete submittals shall be provided identifying all lighting fixture types and options, all lamp types (where applicable) and compliance with all contract requirements. The absence of clear submittal information specifically listing exceptions/deviations from detailed contract requirements will be understood to indicate that the contractor/supplier intends to meet all contract requirements. Refer to specification section 16050 for additional requirements.

#### PART 2 PRODUCTS

##### 2.1 GENERAL

- A. Lighting fixtures shall be furnished as shown on plans and specified herein. It shall specifically be the responsibility of Contractor to verify exact types ceilings, walls, etc. and recessing depth of all recessed fixtures and furnish the specific mounting trims and accessories of the specified and/or accepted fixture specifically for the ceiling, wall etc. in which each fixture is to be installed.
- B. Base bid manufacturers are listed on the lighting fixture schedule. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards, efficiency, maximum wattages and photometric distributions set by the specified product.
- C. All lighting fixtures shall be so designed and shall have drivers and other similar items so installed as to function without interruptions or failures when operating in the environment in which they are proposed to be installed. Special attention shall be given to environments with potentially high ambient temperatures such as attic spaces, exterior soffits, confined interior soffits, coves, unconditioned spaces, etc. and shall be addressed by providing fixtures with suitable high ambient temperature ratings, remote mounting of drivers/ballasts, providing approved ventilation, etc. as directed by fixture manufacturer and approved by engineer, at contractor's expense.
- D. All fixtures installed such as to create penetrations through fire rated ceiling or wall assemblies shall be labeled as suitable for that purpose or installed with covers, tenting or other means as required to maintain the fire rating of the assembly.

##### 2.2 LED LUMINAIRES

- A. For the purpose of these specifications, LED Luminaires shall be defined as the entire LED fixture assembly including LED array, drivers, housing, electronics, etc. that compose the lighting fixture.
- B. Furnish and install LED Luminaire of proper size, type, efficacy, delivered lumen output, color temperature, distribution pattern, operational life, and CRI as shown on drawings.
- C. LED Luminaires shall be tested in accordance with LM-79 and LM-80 standards.
- D. LED drivers shall comply with NEMA 410 standards for inrush current, etc.
- E. Exterior, pole mounted LED Luminaires shall be provided with an easily-serviceable, UL recognized surge protection device that meets a minimum 10kA Category C Low operation (IECC C62.41.2-2002). Device shall be wired in front of light engine(s) and driver(s) and shall fail "open" such as to prevent fixture operation after a surge protection failure.
- F. LED Luminaires shall have a guarantee-warranty of at least five years unless specifically noted otherwise on contract documents.
- G. LED Luminaire assembly shall comply with ambient temperature requirements specified in General section above.

### 2.3 STEMS/PENDANTS

- A. Hangers shall be approved ball aligner type swivel, 30 degrees from vertical with swivel below canopy.
- B. Stems/Pendants shall be rigid conduit unless specified otherwise on plans. Proposed stem/pendant types shall be submitted for review prior to shipment of light fixtures from factory.
- C. Stems/Pendants shall be provided as required to prevent swaying of fixtures due to HVAC system airflow or other similar occurrences.
- D. Shall be painted the same color as the fixture trim unless noted otherwise.

### 2.4 MANUFACTURER

- A. Fixtures and stems shall be manufactured as shown in fixture schedule or approved equals.
- B. Drivers shall be as manufactured by Philips/Advance, GE, Lutron, Magnatec, Motorola, EldoLED or approved equal.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF LIGHTING FIXTURES

- A. Support:

1. Support of all lighting fixtures shall be responsibility of electrical contractor. All lighting fixture supports shall be installed in accordance with lighting fixture supplier's recommendations.
- B. Coordination:
1. Contractor shall coordinate all dimensions & locations of light fixtures prior to rough-in to ensure proper fit and coordination with other trades.
  2. Contractor shall verify exact ceiling types being installed and shall adjust fixture trim types accordingly (prior to submitting light fixture shop drawings).

END OF SECTION 16511

## SECTION 16850

### ELECTRICAL HEAT TRACING SYSTEMS

#### PART 1 GENERAL

##### 1.1 SCOPE

- A. This specification covers the requirements of materials and support services for heat-tracing systems. Heat tracing systems (including insulation and all accessories) shall be provided on all piping installed exposed in exterior locations or where otherwise indicated on plans unless noted otherwise.

##### 1.2 CODES, APPROVALS, AND STANDARDS

- A. The electric heat-tracing system shall conform to this specification. It shall be designed, manufactured, and tested in accordance with the applicable requirements of the latest edition of the following codes and standards.
  - 1. ANSI American National Standards Institute
  - 2. CEC Canadian Electrical Code
  - 3. CSA CSA International
  - 4. FM FM Approvals
  - 5. IEC International Electro-Mechanical Commission
  - 6. IEEE Institute Of Electrical and Electronics Engineers
  - 7. ITS Intertek Testing Services (Intertek ETL SEMKO)
  - 8. NEC U.S. National Electrical Code (NFPA 70)
  - 9. NEMA National Electrical Manufacturers Association
  - 10. NESC National Electrical Safety Code
  - 11. UL Underwriters' Laboratories, Inc.

#### PART 2 PRODUCTS

##### 2.1 ACCEPTABLE MANUFACTURERS

- A. Heat Tracing:
  - 1. Raychem/Tyco Thermal Controls.
  - 2. Thermon.
  - 3. Nelson Heat Tracing.
  - 4. Chromalox.
- B. Insulation:
  - 1. Armstrong World Industries, Inc.
  - 2. Babcock & Wilcox; Insulation Products Division
  - 3. CertainTeed Corporation
  - 4. Knauf Fiber Glass GmbH
  - 5. Manville Products Corp.
  - 6. Owens-Corning Fiber Glass Corp.
  - 7. Pittsburg Corning Corp.
  - 8. Rubatex Corp.

##### 2.2 SELF-REGULATING HEATING CABLES



- A. All heat-tracing applications with continuous exposure (maintain) temperatures from 150°F (65°C) to 250°F (121°C) or intermittent exposure temperatures from 185°F (85°C) to 420°F (215°C) shall use self-regulating cables.
  - 1. Self-regulating heating cable shall vary its power output relative to the temperature of the surface of the pipe or the vessel. The cable shall be designed such that it can be crossed over itself and cut to length in the field.
  - 2. Self-regulating heating cable shall be designed for a useful life of 20 years or more with “power on” continuously, based on the following useful life criteria:
    - a. Retention of at least 75 percent of nominal rated power after 20 years of operation at the maximum published continuous exposure (maintain) temperature.
    - b. Retention of at least 90 percent of nominal rated power after 1000 hours of operation at the maximum published intermittent exposure temperature. The testing shall conform to UL 746B, IEC 216-1 Part 1.
  - 3. A warranty against manufacturing defects for a period of 10 years shall be available.
  - 4. All cables shall be capable of passing a 2.5 kV dielectric test for one minute (ASTM 2633) after undergoing a 0.5 kg-m impact (BS 6351, Part 1, 8.1.10).

2.3 FREEZE-PROTECTION SYSTEMS

- A. The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. Cables shall have a temperature identification number (T-rating) of T6 (185°F or 85°C) without use of thermostats.
- B. The heating cable shall have a tinned copper braid with a resistance less than the heating cable bus wire resistance as determined in type test (ASTM, B193, Sec. 5). The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket.
- C. In order to provide rapid heat-up, to conserve energy, and to prevent overheating of fluids and plastic pipe, the heating cable shall have the following minimum self-regulating indices:
  - 1. Table K.1 Minimum Self-Regulating Indices

Heating cable	S.R. index (W/°F)	S.R. Index (W/°C)
3 W/ft	0.038	0.068
5 W/ft	0.060	0.108
8 W/ft	0.074	0.133
10 W/ft	0.100	0.180
- D. The self-regulating index is the rate of change of power output in watts per degree Fahrenheit or watts per degree Celsius, as measured between the temperatures of 50°F (10°C) and 100°F (38°C) and confirmed by the type test and published data sheets.
  - 1. In order to ensure that the self-regulating heating cable does not increase power output when accidentally exposed to high temperatures, resulting in thermal runaway and self- ignition, the cable shall produce less than 0.5 watts per foot (1.64 watts per meter) when energized and heated to 350°F (177°C) for 30 minutes. After this test, if the cable is reenergized, it must not have an increasing power output leading to thermal runaway.

2. In order to confirm 3.1B, the self-regulating heating cable shall retain at least 90 percent of its original power output after having been cycled 300 times between 50°F (10°C) and 210°F (99°C), allowing at least six minutes of dwell time at each temperature.
3. The heating cable shall be Raychem® BTV-CT or BTV-CR self-regulating heater, with continuous exposure (maintain) capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C), as manufactured by Tyco Thermal Controls.

## 2.4 SYSTEMS FOR DIVISION 1 HAZARDOUS LOCATIONS

- A. The following requirements shall apply in addition to the criteria specified above:
  1. The self-regulating heating cable shall be specifically FM Approved or CSA Certified for use in Division 1 locations.
  2. A ground-fault protection device set at 30 mA, with a nominal 100 ms response time, shall be used to protect each circuit.
  3. The temperature identification number (T-rating) of the cable used shall comply with FM and CSA requirements as applicable.
  4. Connection methods used with the cable shall be compatible and approved as a part of the system manufactured and supplied by the heating cable vendor for use in the Division 1 location.
  5. For plastic pipe and vessel applications, the heating cable shall be Raychem HBTV-CT or Raychem BTV-CT self-regulating heaters, with continuous exposure capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C), as manufactured by Tyco Thermal Controls.
  6. The heating cable shall be Raychem HQTV-CT or Raychem QTVR-CT self-regulating heaters, for continuous and intermittent exposure capability up to 225°F (110°C), as manufactured by Tyco Thermal Controls.
- B. Terminations for nonhazardous And hazardous class 1, div 2 locations
  1. All connection components used to terminate heating cables, including power connectors, splices, tees, and connectors shall be approved for the respective area classification and approved as a system with the particular type of heating cable in use. Under no circumstances shall terminations be used which are manufactured by a vendor other than the cable manufacturer.
  2. In order to keep connections dry and corrosion resistant, components shall be constructed of nonmetallic, electrostatic, charge-resistant, glass-filled, engineered polymer enclosure rated NEMA 4X. The component stand shall allow for up to four inches (100 mm) of thermal insulation.
  3. Terminals shall be spring clamp wire connection type to provide reliable connection, maintenance-free operation, and ease of reentry.
  4. Heating cable terminations shall use cold-applied materials and shall not require the use of a heat gun, torch, or hot work permit for installation.
  5. Components shall be rated to a minimum installation temperature of -40°F (-40°C), minimum usage temperature of -75°F (-60°C), and maximum pipe temperature of 500°F (260°C).
  6. The component system shall be Raychem JBM-100-L-A connection kit complete with integral LED power indicating light to serve as complete power, splice, or

tee connection for up to three Raychem BTV, QTVR, or XTV industrial parallel heating cables as manufactured by Tyco Thermal Controls.

## 2.5 THERMOSTATS AND CONTACTORS

- A. Freeze protection systems shall operate using self-regulating control or with the DigiTrace AMC-1A or DigiTrace AMC-F5 thermostat and the DigiTrace E104-100A or DigiTrace E304-40A contactor in nonhazardous locations, and DigiTrace AMC-1H thermostat with DigiTrace E307-40A contactor in hazardous locations, as supplied by Tyco Thermal Controls.
- B. Where heat tracing is applied to emergency showers and/or emergency eye wash systems (or other systems where the heated piping system provides water that may be applied to persons in emergency or non-emergency situations), the sensor (that determines whether the heat tracing system is ON or OFF) shall be placed on the associated pipe or tank wall rather than in ambient air (such as to prevent the heat tracing system from overheating the associated liquid).

## 2.6 END SEAL

- A. An above-insulation, lighted end seal kit shall be provided for each heat trace circuit termination as per the manufacturer's installation details. The kit shall be E-100-LBTV2 as supplied by Tyco Thermal Controls.

## 2.7 INSULATION

- A. All components of the insulation, including covering, mastics and adhesives shall have a flame-spread rating of not over 25, and a smoke development rating of not over 50. Ratings shall be as established by tests in accordance with ASTM E 84 and Federal Specification standards. The integrated insulation assemblies shall also conform to the above specifications. Insulation shall be applied in strict accordance with the manufacturer's instructions.
- B. Description:
  - 1. This type of insulation shall be employed for process, cold-and hot water, steam, and condensate piping and equipment with surface temperatures up to 850 degrees F. Pipe insulation and jacketing shall be applied to piping where shown, and shall include fittings, flanges, and valves. Pipe insulation shall be molded-type pipe covering, made of fibrous glass with a minimum k-factor of 0.23 at 75 degrees F mean temperature. Unless otherwise specified the insulation thickness shall be 1" minimum.
  - 2. The insulation shall be oversized for installation over electric heating cable. Insulation shall have a factory-applied white fire-retardant vapor-barrier jacket of kraft paper and aluminum foil laminated together and reinforced with fiberglass yarn. Fittings and valves shall be covered with the same material as the pipe, cut in segments to fit snugly without open spaces, held in place with copper wire or cement, and then covered with the same jacketing material as the pipe. Insulated fittings adjacent to vapor-barrier insulation shall be sealed with an acceptable vapor-barrier cement before installation of the finish jacket. Pipe insulation and vapor-barrier shall be continuous through hangers and supports. Insulation shall be coordinated with the pipe hangers and supports and where insulation

protection shields are provided the top half section of pipe insulation at support locations shall be of the same specified density, and the bottom half insulation segments provided between the pipe and the insulation protection shields shall have a density of not less than 6 lb/cu ft. All insulation shall be covered with smooth aluminum weatherproof metal or plastic preformed jacketing with a factory attached moisture barrier. The jacket for the fittings shall consist of precision-formed smooth-sided sections and shall be sized to cover and protect the insulated fitting. Each section shall be manufactured from aluminum or PVC, and all joints shall be sealed with silicon mastic or solvent welding, to provide a continuous, air and weathertight joint. Strapping shall be 1/2-inch wide, Type 3003 aluminum or stainless steel.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Heat tracing shall be provided along full length of all exposed piping or vessels located outside of buildings or in other areas designated on plans (such as by insulated piping in areas subject to cold temperature). Insulation shall be provided over all heat traced pipes.
- B. The vendor shall provide a detailed design utilizing standard heat-tracing design software, such as Tyco Thermal Controls TraceCalc® Pro design software or equal. At minimum, the design must provide the following:
  - 1. Circuit identification number
  - 2. Maintain temperature
  - 3. Line size and insulation
  - 4. Heat loss for pipe, valves, and supports
  - 5. Amount and type of heating cable required
  - 6. Spiral requirements
  - 7. Heating cable service voltage
  - 8. Heating cable power output at the maintain temperature
  - 9. Minimum and maximum maintain temperature vs. minimum and maximum ambient temperatures
  - 10. Circuit breaker and transformer sizing
- C. A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.
- D. Install additional heating tape at bolted flanges, valves, pipe supports, and other fittings and fixtures as recommended by supplier, but not less than the following:
  - 1. Bolted flanges (per pair): Two times pipe diameter
  - 2. Valves: Four times valve length
  - 3. Pipe hanger or support penetrating insulation: Three times pipe diameter
- E. The entire system shall be installed in compliance with the manufacturer's recommendations for a fully-functional, code-compliant system.
- F. All insulation shall be installed by a qualified insulation contractor in strict accordance with the manufacturer's recommendations and the requirements of these specifications.

G. All piping insulation shall be installed following required testing and approval of piping.

### 3.2 IDENTIFICATION

A. Heat tracing systems shall be labeled at the field connection of power to the heat tracing equipment per the requirements for Utilization Equipment within Specification Section 16075.

B. Heat traced piping, vessels, etc. shall be identified with appropriate caution signs or markings at intervals not exceeding 20 feet on center per NEC requirements.

### 3.3 TESTING

A. Factory inspections and tests for self-regulating, power limiting, series constant wattage and constant wattage (MI) heater cables shall include but are not limited to the following:

1. Testing shall be done per the latest IEEE Std. 515 test section and applicable manufacturer's standards.
2. In the field, all heater cables shall be meggered. The following separate field megger readings shall be taken on each self-regulating and each M.I. heater cable:
  - a. Heater cable shall be meggered when received at jobsite before installation.
  - b. Heater cable shall be meggered after installation, but before insulation is applied.
  - c. Heater cable shall be meggered after insulation has been installed.
3. All three of the above field megger readings shall be greater than 20 megohms. Otherwise, the heater cable is not acceptable and shall be replaced.
4. Field megger tests shall be recorded for each heater cable, and certified reports shall be submitted to the user.

END OF SECTION 16850

## SECTION 16900

### SCADA SYSTEM

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. See appendix for the proposal from the pre-selected SCADA Integrator further documenting the scope of services/equipment/etc. to be provided by the SCADA Integrator. The specification below is meant to supplement that separate proposal, and to generally describe the required SCADA work for the contractor.
- B. Work included: Modify/expand the existing SCADA System with appurtenant equipment and accessories as indicated, specified, and as necessary for a complete and proper operating system.
  - 1. Work includes, but not necessarily limited to, the following:
    - a. Modifications to existing programmable logic controllers (PLCs), and other appurtenances as indicated and specified herein and as required by the process flow and instrumentation diagrams and descriptions.
    - b. All engineering, hardware and software development, installation, startup, calibration services and supervision necessary.
    - c. Testing and operational demonstrations as specified.
    - d. Training programs as specified.
    - e. Preparation of manuals.
    - f. Programming of screens, alarms, historian, trending, etc. for the SCADA Computer system.
- C. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Specifications, Special Provisions, and all other related Sections.
  - 2. Refer to Specification Section 16480 for additional control panel requirements.
  - 3. Refer to Specification Section 16905 for instrumentation requirements.
  - 4. Refer to plans for point lists and additional device requirements.

##### 1.2 QUALITY ASSURANCE

- A. The qualifications and experience of key project personnel shall be acceptable to the Engineer. The System Integrator shall employ competent service personnel to service and troubleshoot the control and instrumentation systems and shall have at least 15 years of experience with similar work. References shall be provided upon request by the Engineer. The System Integrator shall maintain their own UL508 panel shop. The System Integrator pre-approved for this project is:
  - 1. Control Systems Inc (“CSI”) – Pelham, AL (contact: Mr. Drew Waltz, [andrewwaltz@controlsystemsinc.net](mailto:andrewwaltz@controlsystemsinc.net), 205-679-4000)
- B. The system integration duties shall be provided by a company qualified, experienced, and regularly engaged in designing, setting up, programming, and integrating complex process loop controls and instrumentation for process control and monitoring applications. Only qualified system integrators will be allowed to submit proposals for this project. In order to be considered qualified, integrator shall have completed a

minimum of five (5) projects of similar type/scope and equal or greater magnitude and complexity within the last ten (10) years. Sub-contractors without qualifications will be rejected. Previous projects used to meet this experience requirement must have included similar (or greater) scopes of work for each of the following areas:

1. Process loop controls for the proposed processes
2. HMI graphics
3. Instrumentation
4. Control Panel/PLC panel construction

C. The System Integrator or it's personnel engaged in this project shall have and shall maintain, at a minimum, the first three (3) certificates of ISA 62443 (for cybersecurity of industrial automation and control systems).

D. Contractor:

1. Shall be fully and solely responsible for the work of the systems supplier and solely responsible to the Owner for having supplied to the Owner the complete integrated SCADA system.
2. To provide personal superintendence and direction of the work, maintaining and supplying complete supervision over and coordination between all subcontractors employed by him and the Instrumentation and Control System Integrator.
3. To be responsible for defining the limits of his subcontractor's work.
4. To be responsible for setting of instruments (including alarms, etc. as provided under other sections).

E. Operation and Maintenance Manuals

1. Operating instructions shall incorporate a functional description of the entire system, including the system schematics which reflect "as-built" modifications.
2. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.
3. As part of the operation and maintenance manuals, provide one hard copy of the program used to program the programmable logic controller.

### 1.3 WARRANTY

A. Systems supplier shall furnish a hardware and software warranty for the system starting at substantial completion and ending one year from this date.

### 1.4 REFERENCES

- A. Instrument Society of America (ISA) PR7. 1, Pneumatic Control Circuit Pressure Test, Tentative Recommendation Practice.
- B. Instrument Society of America (ISA) S5.4, Instrument Loop Diagrams, standard.
- C. National Electrical Manufacturers Association (NEMA) Publication, General Standards for Industrial and Control Systems, ICS 1 and Industrial Controls and Systems ICS2.

### 1.5 SUBMITTALS

A. General/System submittal requirements:

1. Provide submittal (quantity as required by contract) of:

- a. Component manufacturing data sheets indicating pertinent data and identifying each component (including all components within PLC/control panel enclosures, instruments, computer systems, surge protection devices, antennae, radios, sun/rain shields, etc.) by tag number and nomenclature as indicated on drawings and in specifications.
  - b. Component drawing showing dimensions, mounting, and external connection details,
  - c. SCADA Network Diagram showing all major network equipment (including all PLCs, RTUs, Ethernet Switches, Computer System components, network cabling networked I/O, etc.).
  - d. List of all spare parts. All manufacturers recommended spare parts shall be provided in addition to required spare parts.
  - e. Shop test plan and results.
  - f. Propagation study results.
2. Identify any specification section where exceptions are being taken or an "or equal" piece of hardware is being proposed.
  3. A Bill of Materials shall be included with catalog information on all components.
  4. Information shall be included on any proprietary logic component sufficient to demonstrate its ability to perform the required functions.
- B. Panel submittal requirements:
1. A job-specific, custom wiring diagram
    - a. The wiring diagram shall clearly show all components (whether the components are mounted internal or external to the control panel enclosure).
    - b. All wires and terminal blocks shall be clearly labeled.
    - c. Diagram shall be in accordance with NEMA/ICS standards.
  2. Size, type and rating of all system components.
  3. Unit frontal elevation and dimension drawings.
  4. Internal component layout diagrams.
  5. Manufacturer's product data sheets for all components.
- C. Instrumentation/Field Device submittal requirements:
1. Manufacturer's product data sheets
  2. Job-specific model numbers for each instrument/field device
  3. Job-specific ranges/setpoints/etc. proposed for each instrument/field device
- D. Calculation submittal requirements:
1. Thermal calculations showing amount of air conditioning and heating required for each control panel, per ambient requirements listed below and operating temperature limitations of all equipment/devices within each control panel.
    - a. Thermal calculations used for sizing cooling systems for each control panel located in exterior or non-conditioned spaces shall assume:
      - 1) Ambient exterior air temperature ranges of -5 degrees F to 105 degrees F.
      - 2) Full solar contact where applicable.
      - 3) No wind.
      - 4) Heat loss from interior equipment (electronics, etc.) per equipment supplier's information.



- b. Thermal calculations used for sizing heating systems for each control panel shall assume:
  - 1) Ambient exterior air temperature ranges of -5 degrees F to 105 degrees F.
  - 2) No heat loss by interior components of control panel.
  - 3) No solar gain on exterior of control panel.
  - 4) Doubling of heating wattage required to account for wind where control panels are located outdoors.
  - 5) Minimum temperature difference (due to heating) of 10 degrees F to prevent condensation, regardless of equipment temperature limitations.
- 2. Load calculations showing the sizing of all power supplies provided (with spare capacity as specified).
- 3. Load calculations showing the sizing and anticipated runtime of all Uninterruptible Power Supply systems provided (with spare capacity as specified).

#### 1.6 DELIVERY, STORAGE AND HANDLING:

- A. Packing and Labeling:
  - 1. Prior to shipment, each component shall be tagged to identify its' location, tag number, and system function. Identification shall be prominently displayed on the outside of the package.
  - 2. Firmly attach permanent, final labeling (as specified elsewhere) to all equipment, panels, instruments/field devices, etc. prior to installation.
- B. Delivery:
  - 1. Following completion of shop assembly, factory test, and approval of all equipment by the Engineer, the panels, cabinets, and consoles and equipment shall be shipped. Provide protection for equipment from handling and the environment.
- C. Receiving:
  - 1. The contractor is responsible for receiving and proper storage of equipment delivered to the job site.
  - 2. All received items shall be protected from the elements and where required stored in a low humidity environment.
  - 3. Protect materials and equipment against damage in storage and during construction.

## **PART 2 PRODUCTS**

### 2.1 GENERAL:

- A. Refer to Specification Section 16480 (Manufactured Control Panels) for all control panel enclosure, control component, controller, surge protection device, etc. requirements.
- B. Specifications below identify general intent and major system components only. System Integrator shall be responsible providing all system accessories, interconnections,

installation, etc. and verifying compatibility of all system components as required to provide a fully-functional/coordinated system.

## 2.2 SCADA COMPUTER SYSTEMS & SCADA SOFTWARE

- A. Modify existing computer systems, software, programming, etc. as required to accommodate the new I/O specified on point lists on plans.

## 2.3 MODIFICATIONS TO SCADA PLC PANEL SHALL INCLUDE:

- A. General construction/materials/devices per Specification Section 16480 (Manufactured Control Panels) AND in accordance with owner's existing SCADA standards for this facility. Reuse existing PLCs, power supplies, etc. where possible.
- B. Input/Output modules:
  - 1. Provide I/O modules on associated controller backplane as required by point lists provided on plans.
  - 2. Discrete inputs & outputs to/from motor starters (or other panels with 120VAC controls/CPTs) shall generally be rated for 120VAC unless noted or required otherwise (to coordinate with typical 120VAC CPTs at motor starters). Discrete inputs & outputs to/from equipment only rated for 24V discrete signals shall be rated for 24V. PLC supplier shall coordinate all I/O voltage rating requirements with associated remote panels/starters/equipment/devices prior to submitting panel shop drawings. Provide isolation relaying/etc. as required to use same voltage classes for discrete inputs and outputs to each piece of equipment such as to allow a common conduit/raceway system to be used .
  - 3. Provide network/communication I/O modules (for Ethernet, Profibus, DeviceNet, etc. connections) as required by point lists provided on plans. All networked points listed are representative only. Prior to preparation of submittals, System Integrator shall collect register lists identifying all available networked points for the associated systems from the system supplier(s) and shall review the lists with the owner and engineer for determination of final points to be monitored/controlled. System Integrator shall provide programming/HMI for all networked points chosen by the owner/engineer for these systems. Where new network connections to existing equipment/devices is required, the System Integrator shall include all costs in bid as required for coordinating with the existing equipment supplier, providing network hardware/gateways/routers/etc. within new SCADA PLC cabinets AND within existing equipment cabinets as required (with engineer's approval in submittal phase), and for providing all integrating all applicable parameters into the SCADA system.
- C. Verify that existing UPS, power supplies, thermal controls, etc. within existing PLC panels are sufficient for the proposed improvements/additions. Replace or supplement existing systems as required.
- D. Panel surge protection, auxiliary components, etc. shall be provided for new I/O as required, per Specification Section 16480.

## 2.4 WIRING

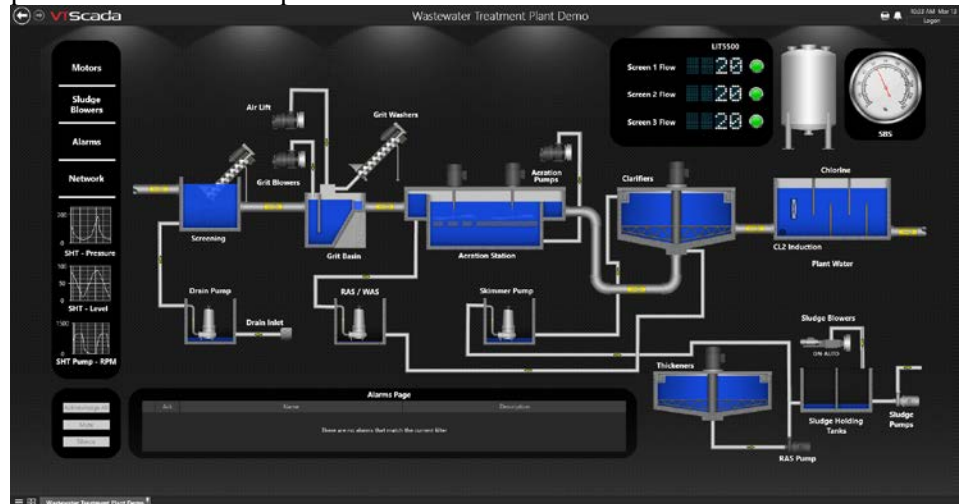
- A. Refer to Specification Sections 16116, 16120 and 16480 for requirements.

## PART 3 EXECUTION

### 3.1 GENERAL

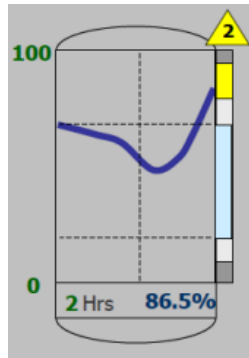
- A. Maintain existing SCADA graphics/process controls/etc. unless they become obsolete as a part of this project. Integrator shall confirm/determine all requirements with owner prior to submitting proposal.
- B. SCADA System shall:
  - 1. Measure and monitor discrete and continuous process and process equipment variables (see SCADA Point List on contract plans).
  - 2. Effectively present the process and process equipment variables to the operators allowing them to accurately monitor the status of the processes. Screens/screen shots shall generally be detailed 2 dimensional (with shaded piping, and project-specific side/elevation views of major processes/tanks/equipment).
  - 3. Provide a means for the operators to effectively control the treatment processes, both automatically and manually.
  - 4. Provide historical data acquisition, storage, retrieval, processing, and report generation.
- C. The SCADA software shall be developed to include graphics for the proposed project scope. Human-Machine Interface (HMI) software as specified shall be supplied and fully configured by the System Integrator. Reports, graphics displays, real-time trends, function blocks, PID loop control, historical trends, security, alarming, etc. shall be developed by the System Integrator through a collaborative effort between the Engineer, Owner, Contractor and Equipment Suppliers.
- D. The system shall include all provisions as necessary to provide alarm notification to off-site personnel. The system shall be configured to provide customizable alarm information via text-to-voice phone calls, SMS text messages, emails or pagers as directed/approved by the facility owner. The alarming system shall cascade alarms through a user-editable list of contacts, allowing each user to acknowledge the alarm (and to stop further notifications to other contacts).
- E. In general, the operator interface to the system shall be via a hierarchy of graphics screens with “poke points” which will allow operators to navigate the plant facility by facility by simply “clicking” on the poke points with a mouse pointing device. All HMI conventions/graphics shall meet owner’s standards/conventions. Integrator shall fully review proposed screen conventions with owner prior to submitting screen submittals.
  - 1. A “Main Menu” shall be developed and will contain “poke points” to allow navigation to the following major subsystems:
    - a. Overall detailed 2-D graphical screen of site(s), showing major structures/processes. Screen(s) shall show shaded piping, and project-specific side/elevation representations of the various equipment/facilities. Screen(s) shall indicate major system parameters such as significant flow/level measurements, system on/off statuses, etc. in a clear manner, but shall not be used for detailed parameter displays.

- b. One (1) overall system process-flow diagrammatical representation of major process system or structure, on one screen if possible (with detailed 2-D graphics for each major structure or process). Screen(s) shall indicate major system parameters such as significant flow/level measurements, system on/off statuses, etc., but shall not be used for detailed parameter displays. Recent historical trends of major applicable analog variables should be displayed in graph form, either embedded within the associated facility/tank, or on a sidebar, per owner preferences. Below is a general/typical example of the quality of overall process-flow screen expected:



Typical Example: Overall Process Flow Screen

- c. Separate process-flow diagrammatical representations (with detailed 2-D graphics for each component) for each major process or structure. Screens shall indicate all relevant I/O statuses, and shall allow for control for the given process or structure.
- d. Pop-up style detailed component or process screens (for individual VFDs, analog instruments, PID or setpoint control systems, etc.). These types of component screens shall rely on graphical/diagrammatical displays rather than just text where possible.
- e. Real-time trend displays.
- f. Historical trend displays.
- g. Excel reporting subsystem.
- h. I/O diagnostics test displays.
- i. Current alarms.
- j. Equipment maintenance subsystem.
2. Where possible, real-time trends shall be embedded into the process-flow diagrammatical representations noted above. For example, graphical displays showing tank levels shall include an embedded trend line (within the tank image) to indicate the historical trend for the tank level. Typical/acceptable ranges and alarm ranges should be graphically indicated (by horizontal lines or colored bars as selected by owner) on the trend so that the user can quickly determine if the associated trend is within acceptable range(s). Similar embedded trending graphics shall be provided for other analog values where helpful to the plant operator. Below is a general example of this type of embedded trending:



Typical Example: Embedded Trending

3. The “Main Menu” shall contain dynamic symbols to depict the operational/communications status of each SCADA System panel/network device on the network (i.e. Normal or In Communications Failure).
4. Each new graphic display shall be designed so that an operator may “click” on “poke points” to gain access to any area of the facility (or to remote systems, where applicable) or to the Main Menu. The operator shall also be able to access the Current Alarms Display from any graphic display. Real-time and Historical Trend displays shall be made available from each plant process area via poke points.
5. All new graphics displays of plant areas shall be based upon detailed 2-D graphics as a basis for the display unless noted otherwise. For example, piping shall generally be drawn as grey-scale 2D pipes with fading (from center of pipe to outside edge of pipe), and with flow direction arrows. Motors, pumps, equipment images, etc. shall include similar detail.
6. Color conventions (for ON, OFF, OPEN, CLOSED, and various levels of alarms) used within the HMI shall be per the owner’s standards (to be determined during the construction phase of the project). Consideration should be given to simplifying the color schemes by using bolder colors for alarm conditions than for typical running/off/open/closed conditions.
7. Screen background color (black, grey, white, etc.) shall be as selected by owner. Consideration shall be given to black background color to minimize screen brightness for night operators.
8. Special graphics displays shall be developed by the System Integrator for each process control strategy. These graphics displays shall allow authorized operators to modify control parameters such as set points, operational sequences, etc. Passwords shall be utilized to determine the authorization level of operators.
9. All process alarms shall be categorized by “group” with each group representing a specific area of the plant or distribution system.
10. Security of the system shall be accomplished via allowing access to various parts and features of the system via entry of User names and passwords.
11. Graphics screens shall be developed for each major item of process equipment for which equipment runtime or equipment maintenance data is being collected. These graphics screens shall contain all data relative to the piece of equipment including runtime today, runtime since last serviced, total runtime between maintenance intervals. All runtime data shall be maintained by the various programmable logic controllers; not by the HMI software package.

12. All historical process data, such as average flows, hourly minimums and maximums, etc., shall be maintained by the various programmable logic controllers; not by the HMI software package.

### 3.2 TESTING

#### A. General

1. All elements of the hardware and software shall be tested to demonstrate that the total system satisfies all of the requirements of this specification.
2. As a minimum the testing shall include the following:
  - a. Operational Readiness Test (ORT)
  - b. Functional Acceptance Test (FAT)
3. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and upon the system's or subsection's producing the correct result (effect), the specific test requirement will have been satisfied.

#### B. Operational Readiness Test (ORT)

1. General: Prior to start-up, the entire installed System shall be certified (inspected, tested and documented) that it is ready for operation. These inspections and tests shall include Loop/Component Inspections and Tests and a repeat of the Factory Demonstration Tests.

#### C. Functional Acceptance Test (FAT)

1. The entire SCADA System shall be tested on-site to demonstrate that it is operational and in conformance with these specifications.
2. Tests shall demonstrate specified functions, both hardware and software, to the satisfaction of the owner.

### 3.3 TRAINING

#### A. General

1. Provide an integrated training program for the owner's personnel at the jobsite. Tailor the training program to meet the specific needs of the Owner's personnel. Include training sessions, classroom and field, for managers, engineers, operators and maintenance personnel.
2. The training shall be carried out by technically competent and experienced instructors
3. The Owner shall have the right to make and reuse video tapes of all of the onsite training sessions.
4. One eight (8) hour day shall be provided on site for owner and or engineer selected attendees.

END OF SECTION 16900

# Appendix A



SUBSURFACE EXPLORATION AND  
GEOTECHNICAL ENGINEERING EVALUATION

**Demopolis WSB - Reuse Water System**

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August 23, 2024

**PREPARED FOR**

Demopolis Water Works & Sewer Board  
103 E Capitol  
Demopolis, Alabama 36732

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**PREPARED BY**



CDG, Inc.  
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Dothan, Alabama 36301





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August 23, 2024

Demopolis Water Works & Sewer Board  
103 E Capitol  
Demopolis, Alabama 36732

Attention: Chairman John Reynolds

Reference: **Report of Subsurface Exploration and  
Geotechnical Engineering Evaluation  
Demopolis WSB – Resuse Water System  
Demopolis, Alabama  
CDG Reference Number: R0011622271**

Dear Mayor Thomas:

CDG, Inc. (CDG) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Sewer Plant Upgrade project in Demopolis, 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 10/12/23.

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  
8/23/24

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**APPENDICES**

- Appendix A – Project Location Maps
- Appendix B – Boring Location Plan
- Appendix C – Boring Logs
- Appendix D – Laboratory Test Data

## **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 Reuse Water System project:

- Site reconnaissance and soil test boring layout.
- Geologic map review.
- Mobilization of an ATV-mounted drilling rig and four (4) soil test borings in the proposed development areas. Borings were performed on July 10, 11, 22 and 23, 2024 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 25 to 35 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 (16 tests), Grain Size Analysis (4 tests), Atterberg Limits (4 tests).
- 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 DESCRIPTIONS

The proposed development is located adjacent to existing wastewater treatment structures at the Demopolis wastewater treatment plant. The existing facility is located at the end of Water Street in Demopolis, Marengo County, Alabama. The existing facility is bounded to the east and north by wooded areas, to the south by Water Street, and to the west by an existing treatment lagoon. A *Site Vicinity Map* is included in **Appendix A**.

At the time of the field work (July 9, 2024), the site was developed and vegetated with short grasses. The site was previously graded to construct the existing wastewater treatment plant structures and lagoon. A barbed wire fence was observed around the existing site. A lone, mature pine tree was observed in the proposed clarifier location. Overhead utilities were observed along the southern edge of the plant. Various utilities were observed around the existing structures.

Observations and available topographic information (*WWTP Improvements 2022*; dated May 2024) indicate that the point of highest elevation (EL 95') is located on the west side of the site adjacent to the existing lagoon. The point of lowest elevation (EL 83') occurs at the west end of the site adjacent to the existing clarifiers. Therefore, the site generally slopes from west to east away. The following pictures indicate typical site conditions at the time of the fieldwork.



North of Area for Proposed Clarifier



West of Proposed Bladder Tank and Filter Disk

The proposed improvements include a 78-foot-wide diameter, 12-foot-deep clarifier basin; a 6-foot-wide diameter bladder tank; and an approximately 700 square foot filter disk. Total and differential settlement tolerances for the structures were specified as 1 inch and ½ inch, respectively. The bladder tank and filter disk will be constructed with slabs-on-grade.

Specific structural loads were not provided at the time of report preparation. However, the maximum water height for the clarifier is proposed to be 12 feet. Therefore, we have assumed maximum ground pressures exerted by the basins will not exceed 2,000 psf. The bladder tank will have maximum ground pressures on the order of 1,000 psf, per Carmen Chose (CDG).

Based on an available grading plan (*Site Plan Grading & Clarifier No. 3 Details*; WWTP Improvements 2022; prepared by CDG; dated May 2024) we understand that earthwork in the proposed clarifier area is expected to consist of ±4 feet of fill for a final grade of 87.30'. The bottom of the clarifier will bear at 77.65', approximately 5' below the existing grade (82.7'). The bladder tank and filter disk will be constructed at or near existing grades.

## **3.0 FIELD AND LABORATORY TESTING**

### **3.1 Soil Test Borings**

The field investigation included performing four (4) 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 (digital GIS data provided by the USGS) indicates that the site is located in the Coastal Plain Geologic Province. Soils of the Coastal Plain appear to have been deposited in an ancient marine environment and the rock, where present, is relatively low-grade sedimentary (often limestone and sandstone). However, the site is underlain by more recent deposits termed alluvial, coastal and low terrace deposits.

Alluvial, coastal and low terrace deposits refer to relatively recent (Quaternary), water-deposited soil typically associated with ancient or existing rivers, streams, and other waterways. The site in Demopolis is located just south of the Black Warrior River. Therefore, the deposits at the site appear to have resulted from the meanderings and flooding of the Black Warrior River and its tributaries. The soils generally consist of fine to coarse, quartz sand with clay lenses and some gravel. Due to relatively recent deposition, alluvium and low terrace deposits may exhibit a low consistency.

Clays in the Coastal Plain Province and terrace deposits can exhibit a high plasticity. 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 encountered in the geologic formation present at the site. Springs typically develop when water becomes trapped in the porous sands overlying relatively impermeable silts and clays. They can be present continually; however, additional springs and greater flow rates are generally present during periods of high rainfall.

## **5.0 SUBSURFACE CONDITIONS**

The subsurface exploration included four (4) soil test borings in the proposed development areas. The boring locations were established in the field using hand-held GPS equipment and available site layout information (*Site Plan Improvements*; prepared by CDG; dated May 2024). 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 6 to 8 inches at the tested locations.

### **5.2 Existing Fill**

Previously placed fill was encountered at two (2) boring locations (B-3 and B-4). The fill appears to be associated with the existing development of the wastewater lagoons, wastewater treatment plant equipment, and structures on site. The existing fill was encountered immediately beneath the topsoil and consisted of silty/clayey sand and sandy clay. The fill extended to a depth of approximately 6 feet below the existing ground surface at both test locations. Standard Penetration Test (SPT) N-values in the fill ranged from 3 to 10 blows per foot (bpf) and averaged 7 bpf. Therefore, the fill exhibited a very loose to loose (non-cohesive) or stiff (cohesive) consistency.

The natural moisture contents of selected samples of the fill were 12% and 24%. A tested sample of the fill exhibited a moderate degree of plasticity with a Liquid Limit (LL) value of 29 and Plasticity Index (PI) value of 13. The tested sample contained 66.4% fine-grained (silt and clay size) particles. Based on USCS classification guidelines, the tested soil sample was classified as a sandy clay (CL).

### **5.3 Terrace Deposits**

Low Terrace Deposits associated with the meandering of the Black Warrior River were encountered underlying the topsoil or existing fill at the boring locations. The deposits extended to depths ranging from 25 to 35 feet below the existing ground surface, at which depths the borings were terminated or auger refusal was encountered.

The deposits encountered consisted of silty sand, clayey sand, sandy clay, poorly-graded sand, and poorly-graded sand with silt. The sand ranged from fine to medium-grained. SPT N-values in the deposits ranged from 8 to greater than 50 bpf. Blow counts exceeding 50 bpf were encountered in boring B-1 near the ground surface and in boring B-2 immediately above the auger refusal depth. The unconfined compressive strength ( $PP_{qu}$ ) of cohesive samples was measured using a hand-held penetrometer.  $PP_{qu}$  values ranged from 2.0 to greater than 4.0 tons per square foot (tsf). Therefore, the deposits exhibited a stiff to hard (cohesive) or loose to dense (non-cohesive) consistency. The loose deposits were present in borings B-3 and B-4 from approximately 12 to 30+ below the existing ground surface.

The natural moisture contents of selected samples of the deposits ranged from 8% to 30%. Tested samples of the deposits exhibited a moderate degree of plasticity with LL values ranging from non-plastic (NP) to 31 and PI values ranging from NP to 14. Tested samples contained between 2.9% and 66.4% fine-grained (silt and clay size) particles. Based on USCS classification guidelines, the tested deposits are classified as sandy clay (CL), poorly-graded sand with silt (SP-SM), and poorly-graded SAND (SP).

### **5.4 Groundwater**

Groundwater levels were measured in the borings at the time of drilling. Groundwater was encountered at 12 feet in borings B-1 and B-2 and at 24 feet in borings B-3 and B-4 during drilling operations. The boreholes were backfilled upon completion of drilling operations.

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**

Based on an available grading plan (*Site Plan Grading & Clarifier No. 3 Details*; WWTP Improvements 2022; prepared by CDG; dated May 2024) we understand that earthwork in the proposed clarifier area is expected to consist of ±4 feet of fill for a final grade of EL 87.30'. The bottom of the clarifier will bear at EL 77.65', approximately 5' below the existing grade (82.7'). The bladder tank and filter disk will be constructed at or near existing grades.

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 6 to 8 inches at the tested locations.

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.

Existing fill was encountered to a depth of 6 feet below the ground surface in borings B-3 and B-4. Portions of the existing fill exhibited a low consistency. Additionally, records associated with placement of the existing fill were unavailable; therefore, it is undocumented. Structures supported on undocumented and low-consistency fill 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 existing fill under the proposed filter disk and bladder tank, in their current condition, are not suitable for support of the proposed structures.**

**Where the bladder tank and filter disk are planned, subgrade preparation should include complete over-excavation of the existing fill and low-consistency soils in the proposed structure areas. Based on the available boring information, over-excavation should extend to a minimum depth of 72 inches below the original ground surface.** Over-excavation should continue a minimum of 5-feet horizontally beyond the exterior edges of the proposed structures.

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 (bladder tank and filter) or construction of overlying structures (clarifier). 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.



## **6.2 Water Control**

Groundwater was encountered at 12 feet in borings B-1 and B-2 and at 24 feet at borings B-3 and B-4 at the time of the subsurface exploration. 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 7 feet below the existing ground surface are expected to construct the clarifier and 6 feet below ground surface for the required undercut for the filter disk and bladder tank. The borings at the site encountered existing fill and terrace deposits. Auger refusal was encountered at borings B-1 at 25 feet and B-2 at 35 feet. Excavation is not expected near the depth of auger refusal. The existing fill and terrace deposits 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. Groundwater was encountered in B-1 and B-2 at 12 feet and B-3 and B-4 at 24 feet. 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  $\pm 3\%$  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 terrace deposits. Laboratory testing indicates that on-site materials are generally suitable for reuse as fill following proper moisture conditioning. However, the existing fill should be carefully screen for debris or organics if reused.

We note that tested on-site soil samples exhibited natural moisture contents ranging from 12% to 34%. Therefore, portions of the on-site soils are expected to be 15% wet to 5% 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 (up to 66.4%) 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**

The following foundation recommendations were developed based on our evaluation of the boring and laboratory-testing data and experience with similar construction. Anticipated ground pressures exerted by the basins will be on the order of 1000 psf for the bladder tank clarifier. The maximum water height for the clarifier is proposed to be 12 feet. Therefore, we have assumed maximum ground pressures exerted by the basins will not exceed 2,000 psf.

Based on the noted project information and the subsurface conditions encountered in the borings, it is our opinion that spread footings are an appropriate foundation alternative for support of the proposed structures. However, the existing fill present in the proposed development areas should be undercut and replaced with compacted and tested, structural fill as previously described. The extent of undercutting should be field verified by CDG during grading.

Following proper subgrade preparation, foundations are expected to bear on high consistency terrace deposits or newly placed, compacted and tested, structural fill. Footings bearing on the noted materials may be designed based on an allowable bearing pressure of 2,500 psf. A value of 0.35 is recommended for the coefficient of friction between the bottom of the footing and the bearing materials. Continuous and column footings should have minimum widths of 18 and 24 inches, respectively. Footings should bear a minimum of 24 inches below the lowest adjacent final subgrade elevation to provide confinement for the bearing soils.

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.

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 should be removed and replaced. 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 high consistency terrace deposits. Ground supported slabs may be designed based on a modulus of subgrade reaction of 150 pci.

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 recompact 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 to the existing fill 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 Demopolis Water Works & Sewer Board for specific application to the Reuse Water System project in Demopolis, 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.

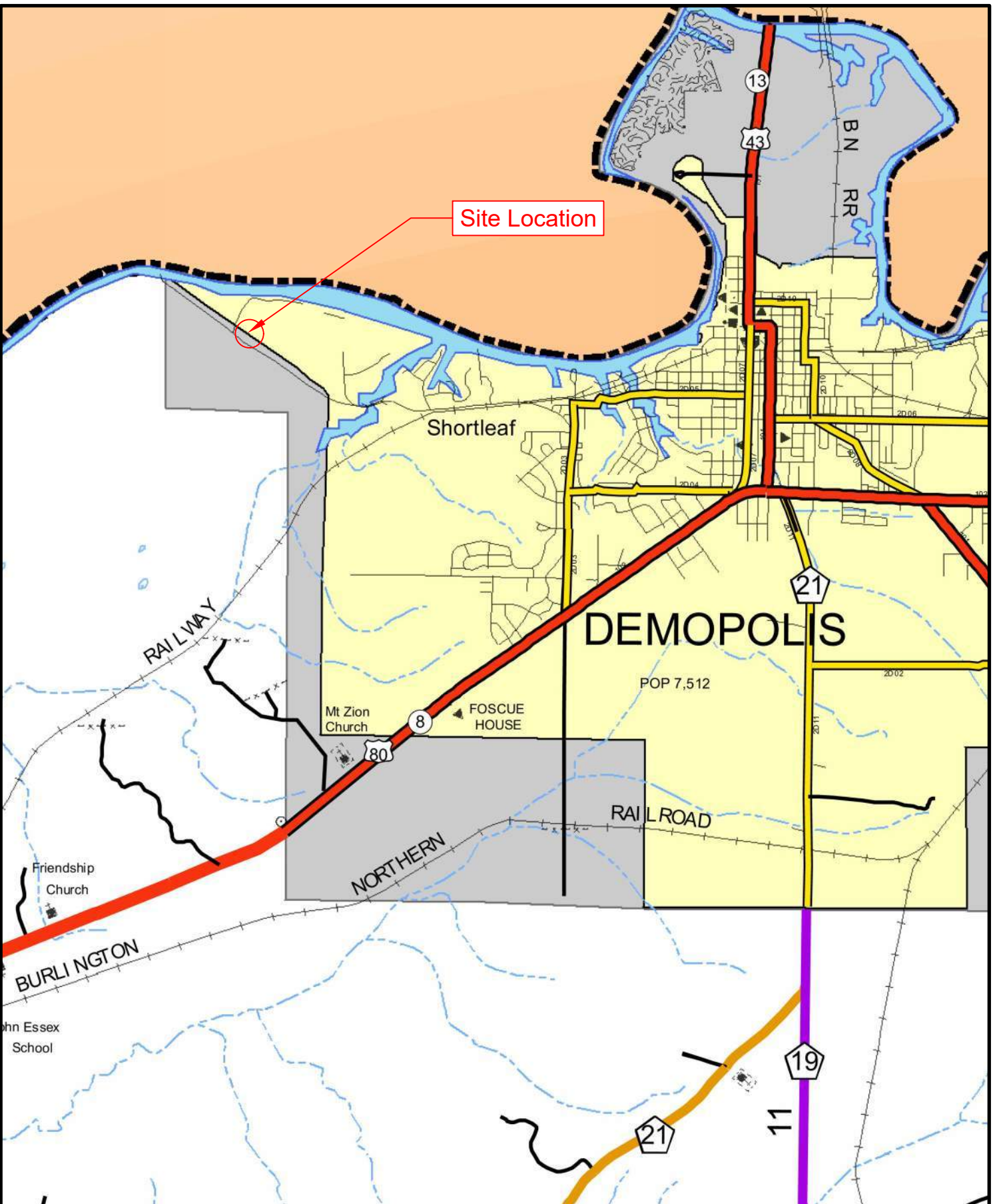
The recommendations in this report were developed based on our understanding of the proposed construction and from the limited information obtained from the subsurface exploration and laboratory testing programs. If significant changes are made in the scope of the project, CDG should be allowed to review our recommendations in light of the changes to determine if additional testing and revised conclusions are needed.



## APPENDIX A

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### **Project Maps**




**CDG**  
Engineering. Environmental. Answers.

## Site Vicinity Map

Drawn By: TL	Scale: 1" = 1 mile	Date: 8/1/2024
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Demopolis WSB - Reuse  
Water System  
Demopolis, AL  
CDG Project No. R001622272

'LJLWDO \*,6 GDWD VKRZQ ZDV SURYLGHG E\ WKH 86 \*HRORJLFD O 6KUYH

/HJHQG  
● 'RFXPHQWHG 6LQNKROH  
4DOW



\$OOXYLDO FRDVWDO DQG ORZ WHUUDFH GHSRVLWV  
+RORFHQH 4DOW

6LWH /RFXPHQWHG



4DOW

\$OOXYLDO FRDVWDO DQG ORZ WHUUDFH GHSRVLWV 9DULFRORUHG LQH  
LQ SODFHV



Engineering. Environmental. Answers.

6LWH \*HRORJ  
'RFXPHQWHG 6LQNKROH

'UDZQ %\, 7/ 6FDOH, PLOWH,

'HPRSROLV :6% 5HX  
DWHU 6VWHP  
HPRSROLV \$ODEDF  
&' 3URMHFW 1R 5





## APPENDIX B

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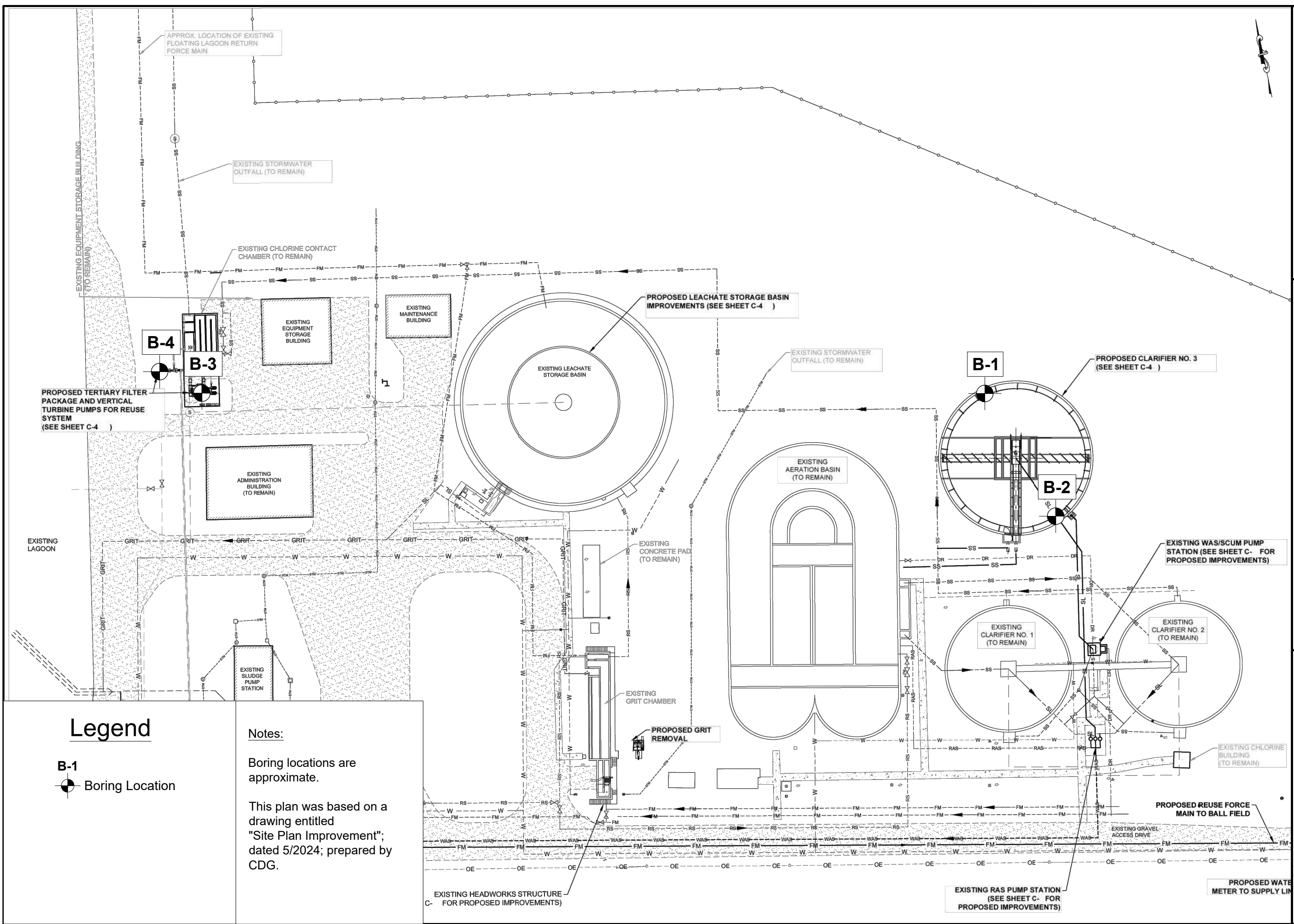
# Boring Location Plan

# Boring Location Plan


Date: 7/8/2024

Scale: 1" = 45'

Drawn By: TL



## Legend

B-1  
 Boring Location

**Notes:**  
 Boring locations are approximate.  
 This plan was based on a drawing entitled "Site Plan Improvement"; dated 5/2024; prepared by CDG.



## APPENDIX C

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### **Boring Logs**

# Boring ID: B-1



## Demopolis WSB - Reuse Water System

Project Number: R001622271	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Demopolis, Alabama	Latitude: -87.53131	Logged By: Tyler Lawrence
Date Started: 07-22-2024	Longitude: 32.30467	Hammer Efficiency: 96
Date Completed: 07-22-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec		Atterberg Limits		Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
								RQD or (%)	TCR (%)	LL (%)	PI (%)				
0		0	±8 inches of topsoil encountered at ground surface.												
0	No Data	0	<b>(Terrace Deposits)</b> Very stiff, tan and gray, fine to medium sandy CLAY		7-23-24	57								3.5	
3		-3 3	Medium dense, tan and gray, clayey fine to medium SAND		4-6-8	14									
6		-6 6	Very stiff, tan and gray, fine to medium sandy CLAY		5-8-10	18								3.25	
8.5		-8.5 8.5	Medium dense, tan, poorly-grade SAND with silt		6-8-10	18									
12.25		-12.25 12.25	...same												
15					5-9-12	21									
17.25		-17.25 17.25	Medium dense, tan, poorly-graded SAND		4-6-8	14									
22.25		-22.25 22.25	...same												
25.5		-25.5 25.5			7-10-10	20									
26															Boring backfilled upon completion.

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22 Jul 2024

# Boring ID: B-1



## Demopolis WSB - Reuse Water System

Project Number: R001622271	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Demopolis, Alabama	Latitude: -87.53131	Logged By: Tyler Lawrence
Date Started: 07-22-2024	Longitude: 32.30467	Hammer Efficiency: 96
Date Completed: 07-22-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec		Atterberg Limits		Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
								RQD or (%)	TCR (%)	LL (%)	PI (%)				

26			Boring refusal encountered at 25 feet due to blowing sands.												
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# Boring ID: B-2

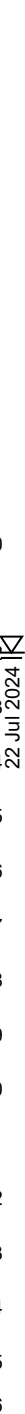


## Demopolis WSB - Reuse Water System

Project Number: R001622271	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Demopolis, Alabama	Latitude: -87.53125	Logged By: Tyler Lawrence
Date Started: 07-22-2024	Longitude: 32.30458	Hammer Efficiency: 96
Date Completed: 07-22-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec		Atterberg Limits		Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
								RQD or (%)	TCR (%)	LL (%)	PI (%)				
0		0	±8 inches of topsoil encountered at ground surface.												
0	No Data	0	(Terrace Deposits) Very stiff, brown, fine to medium sandy CLAY		9-9-11	20						30		>4.0	
3		-3 3	Medium dense, tan and gray, clayey fine to medium SAND		3-4-11	15						20			
6		-6 6	Medium dense, tan, silty fine to medium SAND with interbedded clay		8-11-13	24						10			
8.5		-8.5 8.5	Medium dense, tan, poorly-graded SAND with silt		7-7-9	16						23	8.3		Non-Plastic USCS = SP-SM
12.25		-12.25 12.25	...same												
15					5-7-8	15						24			Non-Plastic USCS = SP
17.25		-17.25 17.25	Medium dense, tan, poorly-graded SAND		4-12-17	29						20	2.9		
22.25		-22.25 22.25	...same												
25					4-7-12	19						27			

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22 Jul 2024

# Boring ID: B-2



## Demopolis WSB - Reuse Water System

Project Number: R001622271	Ground Elevation:	Method: Diedrich D-50 w/ 2¼ HSA
Project Location: Demopolis, Alabama	Latitude: -87.53125	Logged By: Tyler Lawrence
Date Started: 07-22-2024	Longitude: 32.30458	Hammer Efficiency: 96
Date Completed: 07-22-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec		Atterberg Limits		Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
								RQD or (%)	TCR (%)	LL (%)	PI (%)				
26			(continued)												
27		-27.25	...same												
28		27.25	Hard, tan and gray, fine to medium sandy CLAY		6-10-22	32						28		>4.0	
29															
30															
31															
32		-32.25													
33		32.25	...gray with chert pebbles												
34															
35		-35.5			20-46-50/4	50/4						25		>4.0	
36		35.5	Boring refusal encountered at 35 feet due to blowing sands.												Boring backfilled upon completion.
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# Boring ID: B-3



## Demopolis WSB - Reuse Water System

Project Number: R001622271	Ground Elevation:	Method: Georpobe 7822DT
Project Location: Demopolis, Alabama	Latitude: -87.30477	Logged By: Tyler Lawrence
Date Started: 07-10-2024	Longitude: 32.30476	Hammer Efficiency: 96
Date Completed: 07-10-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec		Atterberg Limits		Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
								RQD or (%)	TCR (%)	LL (%)	PI (%)				
0		0	±6 inches of topsoil encountered at ground surface.												
0	No Data	0	(Fill) Loose, tan, silty fine to medium SAND		5-3-3	6									
3		-3 3	Soft, tan, fine sandy CLAY		2-1-2	3									
6		-6 6	(Terrace Deposits) Very stiff, brown, fine to medium sandy CLAY		6-8-10	18							>4.0		
8.5		-8.5 8.5	...stiff, tan		2-5-4	9									
12.25		-12.25 12.25	Medium dense, tan, clayey fine to medium SAND		4-5-7	12									
17.25		-17.25 17.25	Loose, tan, silty fine to medium SAND		5-2-7	9									
22.25		-22.25 22.25	Loose, tan, poorly-graded SAND with silt		2-4-5	9									

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 10 Jul 2024



# Boring ID: B-3



## Demopolis WSB - Reuse Water System

Project Number: R001622271	Ground Elevation:	Method: Georpobe 7822DT
Project Location: Demopolis, Alabama	Latitude: -87.30477	Logged By: Tyler Lawrence
Date Started: 07-10-2024	Longitude: 32.30476	Hammer Efficiency: 96
Date Completed: 07-10-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec		Atterberg Limits		Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
								RQD or (%)	TCR (%)	LL (%)	PI (%)				
26			(continued)												
27		-27.25 27.25	Loose, tan, poorly-graded SAND with silt												
28			Loose, gray, poorly-graded SAND with silt												
29					2-2-6	8									
30		-30 30	Boring terminated at 30 feet.												Boring backfilled upon completion.
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# Boring ID: B-4



## Demopolis WSB - Reuse Water System

Project Number: R001622271	Ground Elevation:	Method: Georpobe 7822DT
Project Location: Demopolis, Alabama	Latitude: -87.53188	Logged By: Tyler Lawrence
Date Started: 07-10-2024	Longitude: 32.30478	Hammer Efficiency: 96
Date Completed: 07-10-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec		Atterberg Limits		Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
								RQD or (%)	TCR (%)	LL (%)	PI (%)				
0		0	±6 inches of topsoil encountered at ground surface.												
0	No Data	0	(Fill) Loose, tan, clayey fine to medium SAND		6-4-4	8						12			
3		-3 3	Stiff, tan, fine sandy CLAY		4-4-6	10				29	13	20	66.4		USCS = CL
6		-6 6	(Terrace Deposits) Very stiff, tan, fine to medium sandy CLAY		6-8-10	18						20			
8.5		-8.5 8.5	...stiff, tan		WOH-5-6	11				31	14	21	66.4	2.0	USCS = CL
12.25		-12.25 12.25	...same		WOH-4-6	10						18		2.0	
17.25		-17.25 17.25	Medium dense, tan, silty fine to medium SAND		5-5-6	11						8			
22.25		-22.25 22.25	Loose, tan, poorly-graded SAND with silt		2-4-4	8						26			

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 10 Jul 2024

# Boring ID: B-4



## Demopolis WSB - Reuse Water System

Project Number: R001622271	Ground Elevation:	Method: Georpobe 7822DT
Project Location: Demopolis, Alabama	Latitude: -87.53188	Logged By: Tyler Lawrence
Date Started: 07-10-2024	Longitude: 32.30478	Hammer Efficiency: 96
Date Completed: 07-10-2024	Coordinate System: Geographic	Hammer Type: Automatic

Depth (feet)	Piezometer	Elev. (ft) Depth (ft)	Material Description and Classification	Graphic Log	Standard Penetration Test (SPT)	N-Value	Sampler	RQD / Rec		Atterberg Limits		Moisture (%)	Fines (%)	qu (tsf)	Comments / Additional Notes
								RQD or (%)	TCR (%)	LL (%)	PI (%)				

26			(continued)												
27		-27.25	Loose, tan, poorly-graded SAND with silt												
28		27.25	...same												
29					2-3-7	10						25			
30		-30	Boring terminated at 30 feet.												Boring backfilled upon completion.
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## APPENDIX D

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# Laboratory Test Results



# Soil Classification Results

**Dothan**  
1962 West Main Street  
Dothan, AL 36301  
Phone: 334-677-9431

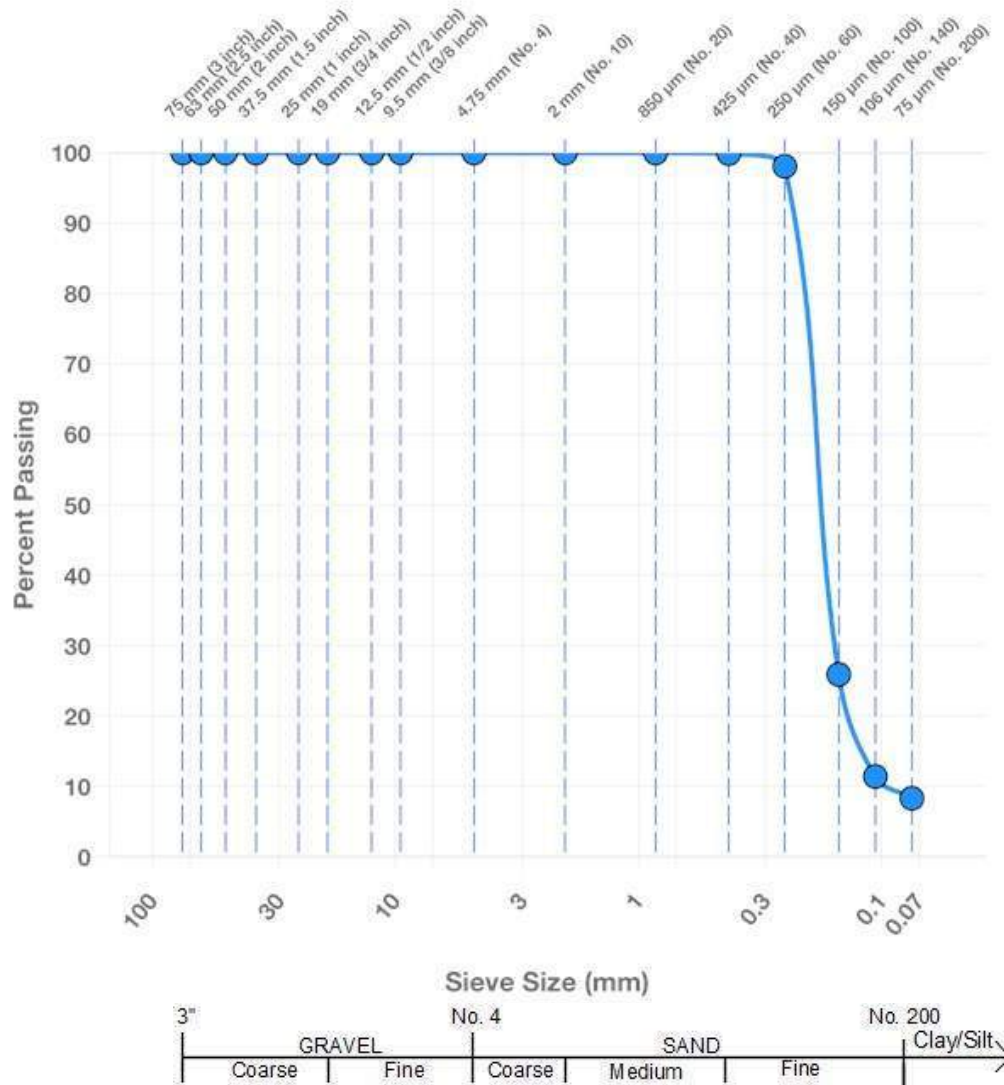
**Client:**  
Demopolis Water Works & Sewer Board  
103 East Capital Street  
Demopolis, AL 36732

**Project:**  
R001622271  
Demopolis WSB - Reuse Water System  
2101 Water Street  
Demopolis, AL 36732

Sample and Test Information	
<b>Boring No. / Sample #:</b> B-2 / 7131	
<b>Location Details:</b> B-2 @ 9-10.5	
<b>Sample Depth (ft.):</b> 9-10.5	
<b>Sample Description:</b> Tan, poorly-graded SAND with silt	
<b>Date Sampled:</b> 07/31/2024	<b>Date Tested:</b> 08/15/2024
<b>Completed By:</b> John Rhodus	<b>Date Issued:</b> 08/15/2024

Report of Atterberg Limits (ASTM D4318)	
<b>Liquid Limit (LL):</b> NP	<b>Classifications</b> <b>AASHTO :</b> A-3 <b>USCS:</b> SP-SM
<b>Plastic Limit (PL):</b> NP	
<b>Plasticity Index (PI):</b> NP	

Report of Sieve Analysis (ASTM D6913)	
<b>Percent Gravel:</b> 0.0	<b>Soak Duration:</b> 6 hours
<b>Percent Sand:</b> 91.7	
<b>Percent Clay/Silt:</b> 8.3	





# Soil Classification Results

**Dothan**  
1962 West Main Street  
Dothan, AL 36301  
Phone: 334-677-9431

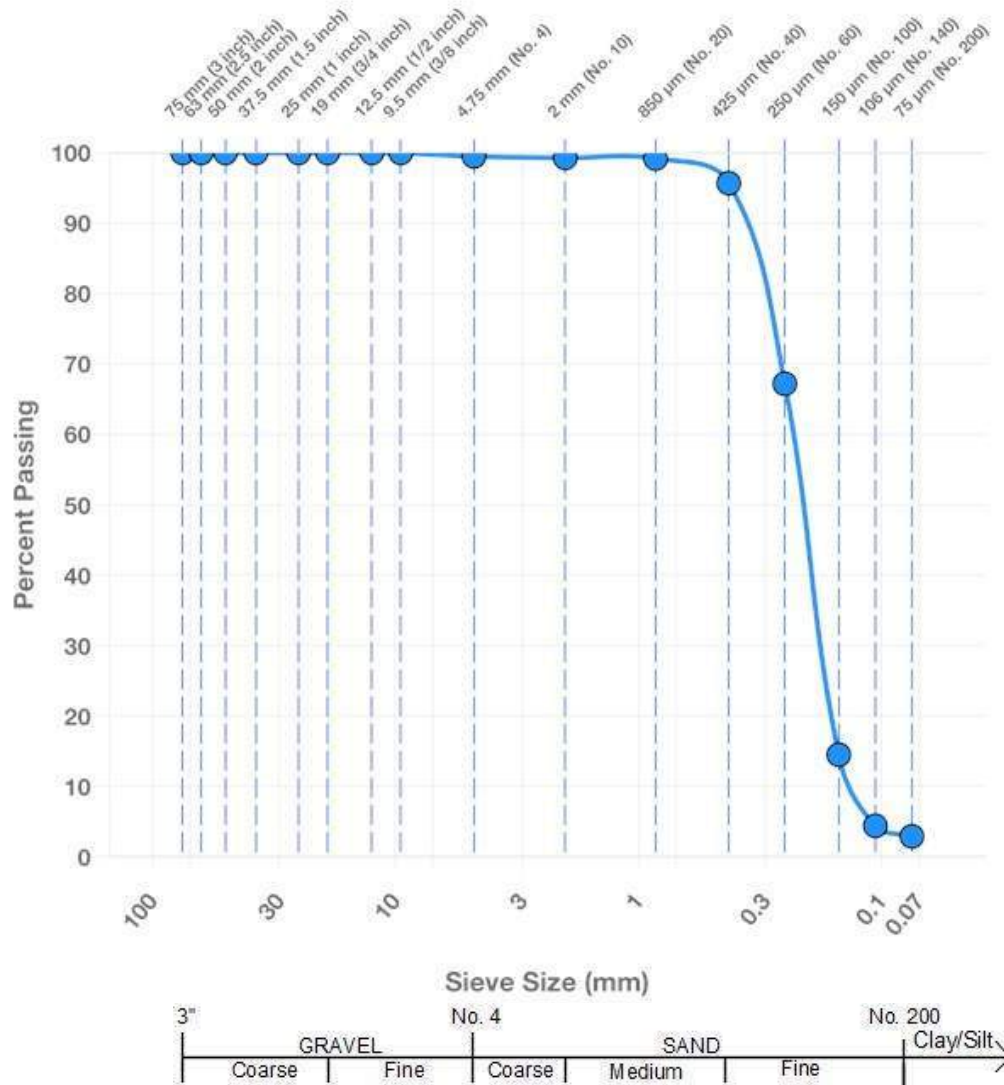
**Client:**  
Demopolis Water Works & Sewer Board  
103 East Capital Street  
Demopolis, AL 36732

**Project:**  
R001622271  
Demopolis WSB - Reuse Water System  
2101 Water Street  
Demopolis, AL 36732

Sample and Test Information	
<b>Boring No. / Sample #:</b> B-2 / 7133	
<b>Location Details:</b> B-2 @ 19-20.5	
<b>Sample Depth (ft.):</b> 19-20.5	
<b>Sample Description:</b> Tan and brown, poorly-graded SAND	
<b>Date Sampled:</b> 07/31/2024	<b>Date Tested:</b> 08/15/2024
<b>Completed By:</b> John Rhodus	<b>Date Issued:</b> 08/15/2024

Report of Atterberg Limits (ASTM D4318)	
<b>Liquid Limit (LL):</b> NP	<b>Classifications</b> <b>AASHTO :</b> A-3 <b>USCS:</b> SP
<b>Plastic Limit (PL):</b> NP	
<b>Plasticity Index (PI):</b> NP	

Report of Sieve Analysis (ASTM D6913)	
<b>Percent Gravel:</b> 0.5	<b>Soak Duration:</b> 6 hours
<b>Percent Sand:</b> 96.6	
<b>Percent Clay/Silt:</b> 2.9	





# Soil Classification Results

**Dothan**  
1962 West Main Street  
Dothan, AL 36301  
Phone: 334-677-9431

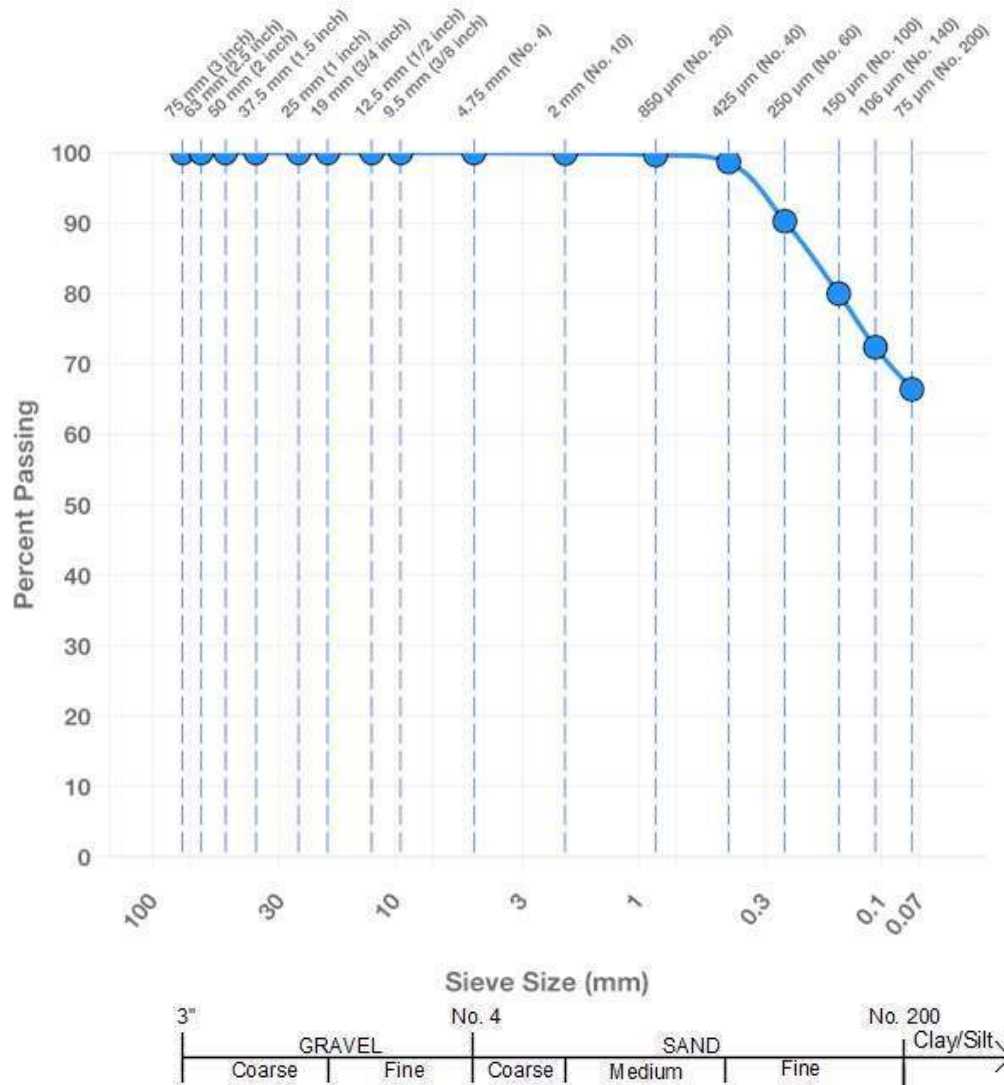
**Client:**  
Demopolis Water Works & Sewer Board  
103 East Capital Street  
Demopolis, AL 36732

**Project:**  
R001622271  
Demopolis WSB - Reuse Water System  
2101 Water Street  
Demopolis, AL 36732

Sample and Test Information	
<b>Boring No. / Sample #:</b> B-4 / 6981	
<b>Location Details:</b> B-4 @ 4-5.5	
<b>Sample Depth (ft.):</b> 4-5.5	
<b>Sample Description:</b> Tan, fine sandy CLAY	
<b>Date Sampled:</b> 07/17/2024	<b>Date Tested:</b> 08/15/2024
<b>Completed By:</b> John Rhodus	<b>Date Issued:</b> 08/15/2024

Report of Atterberg Limits (ASTM D4318)	
<b>Liquid Limit (LL):</b> 29	<b>Classifications</b> <b>AASHTO :</b> A-6 (6) <b>USCS:</b> CL
<b>Plastic Limit (PL):</b> 16	
<b>Plasticity Index (PI):</b> 13	

Report of Sieve Analysis (ASTM D6913)	
<b>Percent Gravel:</b> 0.0	<b>Soak Duration:</b> 6 hours
<b>Percent Sand:</b> 33.6	
<b>Percent Clay/Silt:</b> 66.4	





# Soil Classification Results

**Dothan**  
 1962 West Main Street  
 Dothan, AL 36301  
 Phone: 334-677-9431

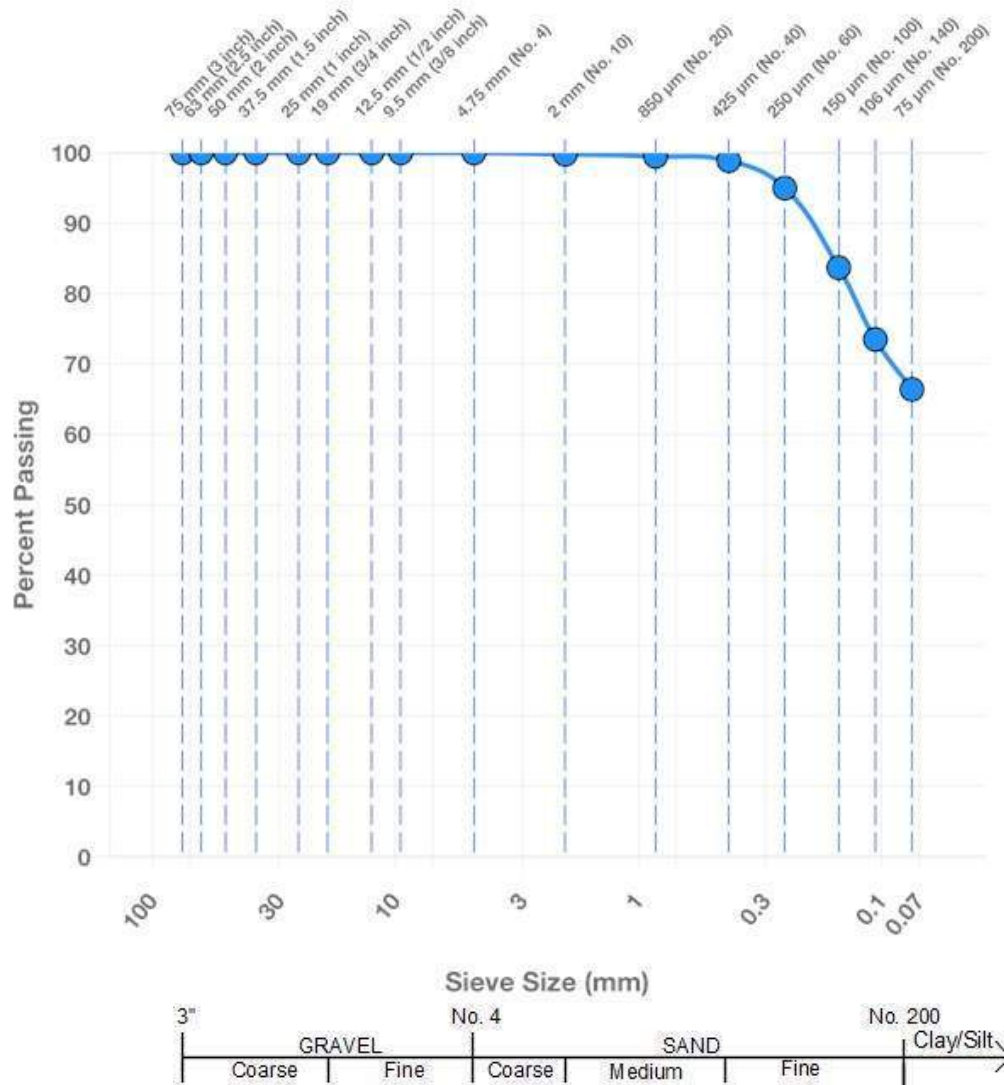
**Client:**  
 Demopolis Water Works & Sewer Board  
 103 East Capital Street  
 Demopolis, AL 36732

**Project:**  
 R001622271  
 Demopolis WSB - Reuse Water System  
 2101 Water Street  
 Demopolis, AL 36732

Sample and Test Information	
<b>Boring No. / Sample #:</b> B-4 / 6983	
<b>Location Details:</b> B-4 @ 9-10.5	
<b>Sample Depth (ft.):</b> 9-10.5	
<b>Sample Description:</b> Tan, fine sandy CLAY	
<b>Date Sampled:</b> 07/17/2024	<b>Date Tested:</b> 08/15/2024
<b>Completed By:</b> John Rhodus	<b>Date Issued:</b> 08/15/2024

Report of Atterberg Limits (ASTM D4318)	
<b>Liquid Limit (LL):</b> 31	<b>Classifications</b> <b>AASHTO :</b> A-6 (7) <b>USCS:</b> CL
<b>Plastic Limit (PL):</b> 17	
<b>Plasticity Index (PI):</b> 14	

Report of Sieve Analysis (ASTM D6913)	
<b>Percent Gravel:</b> 0.0	<b>Soak Duration:</b> 6 hours
<b>Percent Sand:</b> 33.6	
<b>Percent Clay/Silt:</b> 66.4	





# 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.**



Telephone: 301/565-2733

e-mail: [info@geoprofessional.org](mailto:info@geoprofessional.org) [www.geoprofessional.org](http://www.geoprofessional.org)



# **Appendix B**



**10 Commerce Drive  
Pelham, AL 35124**

PH: (205) 679-4000 FAX: (205) 679-4274

**QUOTATION**

Date:	October 9th, 2024	Quote #:	Q240260AJW2
To:	CDG	Phone:	
Attn:	Carmen Chosie	Fax:	
From:	Drew Waltz	Email:	<a href="mailto:carmen.Chosie@cdge.com">carmen.Chosie@cdge.com</a>
Re:	DEMOP FTV Conversion		

**DESCRIPTION:**

- Replace current Indusoft HMI system with FactoryTalk View system at WWTP and Main Office.
- Provide two new Windows PCs to run HMI
  - One in WWTP and the other in the Main Office

CSI will provide the following:

**FactoryTalk View Upgrade:**

- FactoryTalk View Licenses
- Two new PCs
- Recreate all current screens
- Fix current screens not functioning correctly
- Field startup and travel not included in this price

**FactoryTalk View .....\$32,020.15**

**Installation and Field Startup**

- Price includes four long days with an engineer
- Travel costs Included

**Installation and Field Startup (Travel Included): .....\$8,117.42**

**Total: .....\$40,137.57**



**10 Commerce Drive  
Pelham, AL 35124**

PH: (205) 679-4000 FAX: (205) 679-4274

DELIVERY: 10-12 Weeks after Receipt of Order

TERMS OF PAYMENT: Discount 1% 10 Days, Net 30 Days after Invoice Date

Price valid for 90 days from date of quote.

Thank you for the opportunity,  
Drew Waltz  
Project Manager  
Terms and Conditions:



**10 Commerce Drive  
Pelham, AL 35124**

PH: (205) 679-4000 FAX: (205) 679-4274

1. **Acceptance of Order / Termination of Order** – Acceptance of order is subject to credit approval of the Buyer. If the Buyer's Credit becomes unsatisfactory, CSI reserves the right to terminate any and all orders upon notice to the Buyer without liability to CSI.
2. **Startup Services** – Unless otherwise noted, Startup assistance or field installation is not included in this quote. If startup assistance or panel installation is required it shall be performed at CSI's standard Field Service rates. Buyer may request a current rate sheet at any time. If Startup assistance or field installation is included in the quote, it is to be performed during normal working hours unless specifically noted. If night or weekend is required but not quoted, CSI reserves the right to charge the Overtime rate for overtime services provided.
3. **Delivery / Delay in Delivery** – Delivery quoted is the best estimate at the date of the quote. If a specific delivery is required please inform us before placing order and re-quoting or additional charges may apply to guarantee this. CSI shall not be held responsible for delays due to acts of God, failure of our suppliers to ship or deliver on time, or other circumstances beyond CSI's reasonable control. Shipping from CSI shall be FOB with shipping charges added to the Buyer's Invoice.
4. **Taxes** – Prices shown do not include sales taxes or any other taxes imposed on the sale of goods. Taxes now or hereafter imposed upon sales or shipments shall be charged to the Buyer. Buyer agrees to reimburse CSI for any such tax or provide Seller with acceptable tax exemption certificate.
5. **Pricing and changes to Scope of Work** – Modifications by the Buyer to the project quoted may require a change in price. CSI reserves the right to charge for additional items or services not included in the original quote that the Buyer adds or changes after the quote has been accepted. The buyer may request a modified quote at any time a change is made to verify the price difference before proceeding with changes. Panel shall not be UL listed unless noted in quote.
6. **Warranty** – CSI's standard warranty is on all parts for 1 year from ship date. If a longer warranty period is required, it shall be negotiated and noted on the quote. This may require a change of the quote to reflect the change in price.
7. **Payment Terms** – Payment terms shall be as stated on our quote and any invoices. If a deviation from CSI's standard terms is required, CSI reserves the right to revise the quote and/or invoice to reflect such terms as well as any price differences that may occur from this change. As a condition of the sales agreement, a monthly service charge of 1.5% or the maximum permitted by law may be added to all accounts not paid by the net due date. If the Buyer fails to cure all debts in a reasonable amount of time as determined by CSI, CSI reserves the right to attempt to retrieve the balance through collections or legal action. This includes the Buyer as a company and/or the representative of the company as an individual. The Buyer, in addition to the outstanding balance, will owe any fees incurred with the actions necessary to retrieve all debts.

A Purchase order to CSI serves as an acceptance of these terms unless otherwise negotiated in writing.



**10 Commerce Drive  
Pelham, AL 35124**

PH: (205) 679-4000 FAX: (205) 679-4274

**QUOTATION**

Date:	October 10th, 2024	Quote #:	Q240262AJW2
To:	CDG	Phone:	
Attn:	Carmen Chosie	Fax:	
From:	Drew Waltz	Email:	<a href="mailto:carmen.Chosie@cdge.com">carmen.Chosie@cdge.com</a>
Re:	DEMOP WWTP Upgrades		

**DESCRIPTION:**

- Programming Upgrades at WWTP
  - RAS Valve Automation
  - Bypass Valve to Lagoon
  - Lagoon Level
  - Was/Scum Pump Control
  - Grit Removal/Washing System
  - New Clarifier Control

CSI will provide the following:

**Programming:**

- PLC programming for new equipment and systems
- HMI programming operator monitoring control of new systems

**Programming .....\$13,953.76**

**Installation and Field Startup**

- Two long weeks with an engineer
- Travel costs included

**Installation and Field Startup: .....\$17,431.06**

**Total: .....\$31,384.82**





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Pelham, AL 35124**

PH: (205) 679-4000 FAX: (205) 679-4274

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Price valid for 90 days from date of quote.

Thank you for the opportunity,  
Drew Waltz  
Project Manager



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3. **Delivery / Delay in Delivery** – Delivery quoted is the best estimate at the date of the quote. If a specific delivery is required please inform us before placing order and re-quoting or additional charges may apply to guarantee this. CSI shall not be held responsible for delays due to acts of God, failure of our suppliers to ship or deliver on time, or other circumstances beyond CSI's reasonable control. Shipping from CSI shall be FOB with shipping charges added to the Buyer's Invoice.
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5. **Pricing and changes to Scope of Work** – Modifications by the Buyer to the project quoted may require a change in price. CSI reserves the right to charge for additional items or services not included in the original quote that the Buyer adds or changes after the quote has been accepted. The buyer may request a modified quote at any time a change is made to verify the price difference before proceeding with changes. Panel shall not be UL listed unless noted in quote.
6. **Warranty** – CSI's standard warranty is on all parts for 1 year from ship date. If a longer warranty period is required, it shall be negotiated and noted on the quote. This may require a change of the quote to reflect the change in price.
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