

Inscription Canyon Ranch Sanitary District Treatment Plant Expansion Project Contract Documents

July, 2019

Treatment Plant Location: 14000 Grey Bears Trail, Prescott, AZ



Prepared For:
ICR Sanitary District
PO Box 215
Chino Valley, AZ 86305

Prepared by:
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SECTION I – INVITATION TO BID

INVITATION TO BID ICR SANITARY DISTRICT TREATMENT PLANT EXPANSION TO 90,000 GALLONS PER DAY

The ICR Sanitary District (ICRSD) is seeking bids for the construction of the Improvements to the Wastewater Treatment Plant as part of the Expansion Project. Work includes all labor, materials, equipment and incidentals required for the construction of proposed improvements.

The following companies are invited to bid on this project:

TO BE DETERMINED

Any questions regarding the contract documents should be directed to the District Manager, ICR Sanitary District.

Bids will be received by the District until August 15, 2019. Bids may be received via email or delivered to the USPS Post Office in Chino Valley. The following conditions apply:

Emailed Bids:

These must include the complete bid form and other required documents in PDF version, in a single PDF file that included all the required bid submittal documents. Bids must be received by Robert Busch, District Manager, via email before 4:00 PM, Thursday, August 15, 2019 at the following email address:

r.busch@icrsd.net

USPS Bids:

Bids submitted via USPS must be received by the Chino Valley Post Office prior to delivery of the mail to the Districts Post Office Box 215, Chino Valley, AZ 86323 on Thursday, August 15, 2019. It is the Bidders responsibility to submit their bids with sufficient time to insure it is received by the Board at their PO Box on the 15th.

The ICR Sanitary District reserves the right to reject any or all bids and waive any irregularities or informalities. The ICR Sanitary District also reserves the right to award based on any combination of base bid and/or bid alternates it deems appropriate.

SECTION II – INSTRUCTIONS TO BIDDERS

1. DEFINITIONS & STANDARD DOCUMENTS

Terms used in the Instructions to Bidders, which are defined in the Construction Contract, have the meanings assigned to them in the Specifications. The term “Bidder” means one who submits a bid directly to the Owner, as distinct from a sub-bidder, who submits a bid to the Bidder. The term “Successful Bidder” means the most qualified, responsible, responsive Bidder to whom the Owner (on the basis of the Owner’s evaluation as hereinafter provided) makes an award. The term “Bidding Documents” includes the Advertisement or Invitation to Bid, Instructions to Bidders, the Bid Form, and the proposed Contract Documents (plans and technical specifications), including all Addends issued prior to receipt of Bids.

Construction of this project shall be in accordance with the plans and specifications and the requirements of the latest edition of the following separate documents, except as modified and supplemented by these Contract Documents:

Arizona Department of Environmental Quality Engineering Bulletins and State Statutes including, but not limited to:

- #8 *Disinfection of Water Systems*
- #10 *Guidelines for the Construction of Water Systems*
- #11 *Minimum Requirements for Design, Submission of Plans and Specifications of Sewage Works*
- #12 *Guidelines for Installation of Septic Tank Systems*

U.S. Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD)

American Water Works Association Standards (AWWA), most recent edition.

Construction Specifications Institute (CSI) Specifications as referenced

2. QUALIFICATIONS OF BIDDER

Each Bid must contain evidence of the Bidders qualifications to do business in the State of Arizona, experience on projects of similar size and type of construction, and references with contact names and phone numbers.

As evidence of his competency to perform the Work, the Bidder shall complete and submit with his Bid the Bidder’s Qualification Statement, which is bound in these Contract Documents. Low Bidders may be asked to furnish additional data to demonstrate competency.

3. EXAMINATION OF CONTRACT DOCUMENTS AND INSPECTION OF WORK SITE

Documents, drawings and specifications are available to Bidders electronically at <https://www.icrsd.net>. Paper copies of any or all of these documents may be made available at a cost to the bidder by contacting: Bob Busch, District Manager, phone: 928-713-0548.

Permit: Aquifer Protection Permit P-103119, per December of 2002, a “significant amendment” to the APP was issued by Arizona Department of Environmental Quality to increase the permitted flow from 46,000 GPD using modified Extended Aeration Process (Santec). This Phase-2 will increase capacity of WWTP to 90,000 GPD to accommodate near-term future growth.

Contractor may need secondary permitting.

It is the responsibility of each Bidder, before submitting a Bid, to (a) examine the Contract Documents thoroughly, (b) visit the site to become familiar with the local conditions that may affect the cost, progress, performance or furnishing of the Work, (c) consider Federal, State and local laws, regulations and ordinances that may affect cost, progress performance or furnishing of the Work, (d) study and carefully correlate Bidder’s observations with the Contract Documents, (e) notify the Owner, or Owner’s Representative, of all conflicts, errors or discrepancies in the Contract Documents, (f) check and double check all computations before final submission prior to Bid opening.

Reference is made to the Supplemental General conditions and/or Technical Specifications/Special Provisions for identification of:

Those drawings of physical conditions in or relating to existing surface and subsurface conditions (except underground facilities) which are at, or contiguous to, the site which have been utilized by the Engineer/Architect in preparation of the Contract Documents. The Bidder may rely upon the accuracy of the technical data contained in such drawings, but not on the completeness thereof for the purposes of bidding or constructions.

Information and data reflected in the Contract Documents with respect to underground facilities at, or contiguous to, the site is based upon information and data furnished to Owner and Engineer/Architect by owners of such underground facilities or others, and Owner does not assume responsibility for the accuracy or completeness thereof unless it is expressly provided.

Before submitting a Bid, each Bidder will, at Bidder's own expense, make or obtain any additional examination, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface and underground facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work, and which Bidder deems necessary to determine its Bid for performing and furnishing of the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

On request in advance, Owner will provide each Bidder access to the site to conduct such explorations and tests as each Bidder deems necessary for the submission of a Bid. Bidder shall fill all holes, clean up and restore the site to its former condition upon completion of such explorations.

The lands upon which the Work is to be performed are to be considered rights-of-way and easements for access thereto. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by the Contractor. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by the Owner unless otherwise provided in the Contract Documents.

The submission of a Bid will constitute incontrovertible representation by the Bidder that bidder has complied with every requirement of this section, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents and such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

4. INTERPRETATIONS & ADDENDA OF CONTRACT

All questions about the meaning or intent of the Contract Documents are to be directed to the ICRSD MANAGER. Interpretations or clarifications considered necessary in response to such questions will be forwarded to the design Engineer/Architect for clarification and an addendum may be prepared and mailed or delivered to all parties recorded as having received Bidding Documents. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

Addenda may also be issued to modify the Bidding Documents as deemed advisable by Owner or Engineer/Architect.

A pre bid conference may be invoked at the option of the Owner to establish a formal question and answer forum, which may also lead to issuance of Addenda.

5. CONTRACT TIME

The work shall be completed not more than **Seventy-Five (75) calendar days** after issuance of "Notice to Proceed", by which the Work is to be substantially completed, and also completed and ready for final payment (the Contract Time) are set forth in the Bid Form and the Agreement.

6. LIQUIDATED DAMAGES

Provisions for liquidated damages, if any, are set forth in the Agreement (refer to par 4.3 of the Agreement).

7. SUBSTITUTE or "OR- EQUAL" ITEMS

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or equal" items. Whenever it is indicated in the Drawings or specified in the Specification that a substitute or "or equal" item of material or equipment may be furnished or used by Contractor if acceptable to ICRSD MANAGER, application for such acceptance will not be considered by ICRSD MANAGER until after the Effective Date of the Agreement.

8. SUBCONTRACTORS

It is not permissible to subcontract more than 49% of the total bid price of this project. Subcontractor list (page 18) must be filled out and submitted as part of the Bid package.

9. BID FORM

The Bid form is included with the Bidding Documents. The Bid Form shall not be removed from the Contract Documents.

All blanks on the Bid Form must be completed in ink or by typewriter. Failure to fill in all blanks properly may disqualify your Bid.

Bids by a corporation must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the Secretary or an Assistant Secretary. The Corporate address and state of incorporation must be shown below the signature.

All names must be typed or printed below the signature.

The bid shall contain an acknowledgement of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).

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

10. SUBMISSION OF BIDS

Bids shall be submitted; at the time and place indicated in the Advertisement or Invitation to bid and shall be enclosed in a opaque sealed envelope, marked with Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted) and name and address of the Bidder and accompanied by the Performance Bond (form attached) and the required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelop with the notation "BID ENCLOSED" on the face of it.

11. MODIFICATIONS and WITHDRAWAL OF BIDS

Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

If, within twenty-four hours after Bids are opened, any Bidder files a duly signed, written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid and the Bid security will be returned. Thereafter, that Bidder will be disqualified from further bidding on the work to be provided under the Contract Documents. Failure to send written notice of material and substantial mistakes within twenty-four hours will leave the Bidder at full risk liable at law for performance of contract, if contract is awarded, or for liquidated damages in lieu of performance, or for forfeiture of Bid Security, at the Owner option in an amount not less than 10% of the Bid.

12. BID OPENING

Bids will be opened and (unless obviously non responsive) read aloud publicly. An abstract of the amounts of the base Bids and major alternates (if any) will be made available to Bidders after the opening of Bids. Any Bids received after the time indicated in the Invitation to Bid shall be returned unopened to the Bidder.

13. BIDS TO REMAIN SUBJECT TO ACCEPTANCE

All bids will remain subject to acceptance for forty-five days after the day of the Bid Opening, but Owner may, in its sole discretion, release any Bid and return the Bid Security prior to that date.

14. AWARD OF CONTRACT

Owner reserves the right to reject any and all Bids, to waive any and all informalities not involving price, time or changes in the work and to negotiate contract terms with the Successful Bidder, and the right to disregard all nonconforming, non-responsive, unbalanced or conditional Bids. Also, Owner reserves the right to reject the Bid of any Bidder if the Owner believes that it would not be in the best interest of the project to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet

any other pertinent standard or criteria established by Owner. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

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

Owner may consider the qualification and experience of subcontractors, suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of subcontractors, suppliers, and other persons and organizations must be submitted as provided in the Supplementary Conditions. Owner also may consider the operating costs, maintenance requirements, performance data and guarantee of major item of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

Owner may conduct such investigation as Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualification and financial ability of Bidders, proposed subcontractors, suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.

If the Contract is to be awarded, it will be awarded to the lowest responsive, responsible Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interests of the project and the Owner.

Owner reserves the right to award the Contract based on any combination of the base bid and bid alternates it deems appropriate.

15. PERFORMANCE BOND

This project requires the successful Bidder to execute a performance bond in the amount of the bid. See the form to be executed at the end of this document.

16. SIGNING OF AGREEMENT

When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within (15) fifteen days thereafter Contractor shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within (10) ten days thereafter, Owner shall deliver one fully signed counterpart to Contractor. Each counterpart is to be accompanied by a complete set of the approved Drawing with appropriate identification.

SECTION III – BID FORM

PROJECT IDENTIFICATION: ICR Sanitary District Plant Expansion to 90,000 Gallons per Day

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter an Agreement with OWNER in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid, and in accordance with the other terms and conditions of the Contract Documents.
2. Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders. This Bid will remain subject to acceptance for forty-five days after the day of Bid Opening. BIDDER will sign and submit the Agreement and other documents required by the Bidding requirements within fifteen days after the date of OWNER's Notice of Award.
3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:
 - (a) BIDDER has examined copies of all Bidding Documents and of the following Addenda (receipt of all which is hereby acknowledge):
 - (b) BIDDER has familiarized itself with the nature and extent of the Contract Documents, work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.
 - (c) BIDDER has studied carefully all reports and drawings of subsurface conditions and drawings of physical conditions, which are identified in the Technical Specifications.
 - (d) BIDDER has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests and studies (in addition to or to the supplement referred to in (c) above) which pertain to the subsurface or physical conditions at the site or otherwise may affect the cost, progress, performance or furnishing of the Work as BIDDER considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of the Supplementary General Conditions; and no additional examinations, investigations, explorations, tests, reports or similar information or data are or will be required by BIDDER for such purposes.
 - (e) BIDDER has reviewed and checked all information and data shown or indicated the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities. No additional examinations, investigations, explorations, tests, reports or similar information or data with respect to said Underground Facilities are or will be required by BIDDER in order to perform and furnish the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions to the Contract Documents.
 - (f) BIDDER has correlated the results of all such observation, examination, investigation, explorations, test, reports and studies with the terms and conditions of the Contract Documents.
 - (g) BIDDER has given ICRSD written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by ICRSD is acceptable to BIDDER
 - (h) This Bid is genuine and not made in the interest of or on behalf of any undisclosed firm or corporations and is not submitted in conformity with any Agreement or rules of any group, association,

organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to obtain for itself any advantage over any other Bidder of over OWNER.

(i) BIDDER understands, has read and accepts full responsibility and liability for the provisions of this Section II, Instructions to Bidders.

4. BIDDER will complete the Work for the following price(s):

ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	SUB TOTAL
1	Mobilization	LS	1		
2	Permits and SWPPP	LS	1		
3	Potholing	LS	1		
4	Aeration 1 & 2 Piping	LF	100		
5	Anoxic #1 - Air/Process Piping	LF	130		
6	Clarifier #2 - Air/Process Piping	LF	370		
7	Sludge Holding Tank – Air/Process Piping	LF	120		
8	Blower Building – Air Piping	LF	180		
9	Electrical – Panel, Relays, Wires, Exhaust Fan	LS	1		
10	Dewatering Pad – Grading, Concrete & Piping	LS	1		
11	Storage Rental Equipment and Sanitation	LS	1		
12	Bypass of Sewer Flow	LS	1		
13	Testing of Equipment and Sewer Line	LS	1		

Total Bid – Lump Sum _____

Bid Total _____

Dollars (Written Words) _____

Signature of Company Official

Title

Company Name

Phone Number

Address

Fax Number

City, State

Zip Code

5. BIDDER agrees the Work will be substantially completed not more than **Seventy-Five (75)** calendar days from the Notice to Proceed. BIDDER accepts the provisions of the Agreement as to liquidate damages in the event of failure to complete the Work on time.

6. The following documents are attached to and made a condition of the Bid:

- (a) Arizona State Contractor's License Classification
- (b) Bidder's Qualification Statement
- (c) Proposed Subcontractors
- (d) Proposed Project Schedule

7. Communications concerning this Bid shall be addressed to:

ICR Sanitary District
ATTN: District Manager
PO Box 215
Chino Valley, AZ 86305

The address of Bidder indicated below:

SUBMITTED on _____ ,

ARIZONA STATE CONTRACTOR'S LICENSE CLASSIFICATION

Issued: _____ No. _____

If BIDDER is:

An Individual

By: _____ (Seal)
(Individual)

Doing Business As _____

Business Address _____

Phone Number _____

A Partnership

By: _____ (Seal)
(Firm Name)

(General Partner)

Business Address: _____

Phone Number _____

A Corporation

By: _____
(Corporation Name)

(State of Incorporation)

By: _____
(Name of Person Authorized to Sign)

(Title)

Corporate Seal

Attest: _____
(Secretary)

Business Address: _____

Phone Number _____

A Joint Venture

By: _____
(Name)

(Address)

By: _____
(Name)

(Address)

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

BIDDER'S QUALIFICATION STATEMENT

SUBMITTED TO:

Robert Busch, District Manager
r.busch@icrsd.net
PO Box 215
Chino Valley, AZ 86323

SUBMITTED BY:

Name

(Print or Type Name of Bidder)
(A Corporation/A Partnership/An Individual/A Joint Venture)
(Bidder to strike out inapplicable terms)

Signature: _____ Title: _____

Arizona Privilege License No: _____

Similar Projects the Bidder has completed or in Progress:

Date	Contract	Project	Project	Contact
Start/Complete	Amount	Name	Description	and Phone
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____

PROPOSED SUBCONTRACTORS

The following information gives the name, business address, and portion of work (description of work to be done) for each subcontractor that will be used in the work if the bidder is awarded the contract. No subcontractor doing work in excess of one half of one percent of the total amount of the bid and who is not listed shall be used without the written approval of the ICRSD. (Additional supporting data may be attached to this page. Each page shall be numbered and headed "Proposed Subcontractors" and shall be signed.)

Name	Business Address	Description of Work	% Project Cost
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	% of Cost by Subcontractors
	% of Cost by Prime Contractor

Signature of Bidder

Address of Bidder

SECTION IV

AGREEMENT FOR CONSTRUCTION SERVICES

This Agreement for Services (“Agreement”) is entered into as of _____, 201__ between the **INSCRIPTION CANYON RANCH SANITARY DISTRICT** (hereinafter **“ICRSD”**) and _____, (hereinafter **“Contractor”**). ICRSD and Contractor may be referred to singularly as a “Party” and collectively as the “Parties.”

1. PROJECT: The Project of this Agreement is: _____

_____ (“Work”).

2. ARCHITECT/ENGINEER: The Architect/Engineer for this Project is: _____
_____.

3. INCORPORATED DOCUMENTS: ICRSD and the Contractor mutually agree that the following documents are incorporated into and made a part of this Agreement by reference, and form the Contract Documents:

- 1. General Conditions of the Contract
- 2. Supplemental General Conditions, if any
- 3. Drawings Dated: _____
- 4. Specifications Dated: _____
- 5. Addenda (listed below)
- 6. Unit Prices (Attached as Exhibit ____)
- 7. Payment and Performance Bonds (Attached as Exhibit ____)
- 8. ICR Sanitary District Insurance Requirements: Exhibit “A”
- 9. Other Exhibits: _____

The Addenda incorporated into the Contract Documents, if any, are as follows:

- Number: __ Date: _____ Pages: _____
- Number: __ Date: _____ Pages: _____

4. DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4.1 The Date of Commencement of the Work shall be _____ or otherwise will be the date fixed in a notice to proceed issued by ICRSD.

4.2 The Contractor shall achieve Substantial Completion of the entire Work not later than _____, 201__ or, if not otherwise specified, Seventy-Five (75) calendar days from Date of Commencement subject to adjustments of the Contract Time as provided for herein. Substantial Completion means the state in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the District can lawfully occupy or use the Work for its intended use.

4.3 The Contractor agrees that the damages that will be suffered by ICRSD as a result of untimely completion are difficult to estimate or otherwise ascertain with certainty. Therefore, Contractor agrees to pay to ICRSD as liquidated damages, and not as a penalty or forfeiture, the amount specified in MAG Section 108, based on the Original Contract Amount **per day** for each calendar day that Substantial Completion is delayed after the date specified in Section 4.2, subject to any extensions approved as required in the Contract Documents.

4.4 Further, the Contractor agrees that the damages that will be suffered by ICRSD as a result of untimely completion of punch list items/deficiencies noted at time of Substantial Completion are difficult to estimate or otherwise ascertain with certainty. Therefore, the Contractor agrees to pay to ICRSD as liquidated damages, and not as a penalty or forfeiture, the amount specified in MAG Section 108, based on the Original Contract Amount **per day** for each calendar day that the completion of punch list items is delayed after the date of Substantial Completion.

5. CONTRACT TIME:

5.1 Time is of the essence of the Contract Documents on the part of the Contractor. If Contractor is delayed at any time in the progress of the Work by the following causes, then the time within which Contractor is required to complete the Work (the "Contract Time") shall be reasonably extended by a Change Order: an act or neglect of ICRSD, ICRSD's employees, or separate contractors employed by ICRSD; changes in the Work ordered by ICRSD; fire or unavoidable casualties; delay directed by ICRSD in writing; or other causes which ICRSD and Contractor agree justify delay.

5.2 Notwithstanding anything to the contrary:

- (a) Any claim by Contractor seeking additional time must be reported to ICRSD in writing within ten (10) days after the occurrence of the event giving rise to such claim.
- (b) Contractor shall only be entitled to additional time if the delay:
 - (i) is not caused, or could not have been avoided, by Contractor;
 - (ii) could not be limited or avoided by Contractor's timely notice to ICRSD of the cause for the delay and
 - (iii) has no concurrent or contributing cause for which Contractor would not be entitled to an extension of the Contract Time.
- (c) Contractor shall not be entitled to additional time for any act or neglect of ICRSD, ICRSD's employees or separate contractors employed by ICRSD unless Contractor had provided ICRSD with notice of such act or neglect within ten (10) days following the action.

5.3 If any of events described in this Section entitle contractor to an extension of the Contract Time, the sole remedy of Contractor shall be such extension of the Contract Time. Contractor shall not be entitled to any adjustment of the Contract Sum, except as otherwise provided for in this paragraph. If and to the extent that the Contract Time is extended on account of acts of ICRSD only, the Contract Sum shall be increased by Contractor's reasonable and verified additional costs of performing the Work to the extent directly and solely attributable to extensions of the Contract Time on account of the of acts of ICRSD.

6. CONTRACT SUM:

6.1 ICRSD shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be _____ (\$ _____), subject to additions and deductions as provided in the Contract Documents.

6.2 The Contract Sum is inclusive of following allowances and/or ICRSD's contingencies:

6.3 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by ICRSD:

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____

7. PAYMENTS:

Payments shall be made pursuant to the terms set forth in the Contract Documents. Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time under the laws of Arizona.

8. TERMINATION:

ICRSD may terminate this Agreement at any time pursuant to the provisions of A.R.S. §38-511.

9. INSURANCE:

Insurance certificates shall be provided as required by the District in “ICR Sanitary District Insurance Requirements, attached hereto as Exhibit “A”. The District shall be named as an additional insured on all insurance.

10. GOVERNING LAW, REMEDIES AND ATTORNEY’S FEES:

This Agreement shall be construed under the laws of Arizona. Any claim or dispute relating to this Agreement may be pursued through the appropriate local jurisdiction of Yavapai County, Arizona. Rights and privileges granted herein are cumulative and any action on one shall not constitute an election or waiver of any other right or privilege. The court in any contested action that pertains to this Agreement shall award reasonable attorneys’ fees and court costs to the successful party. A “contested action” and “successful party” shall be interpreted in accordance with Arizona Revised Statutes Section 12-341.01 (as said section may be amended or renumbered in the future).

11. WAIVER:

Failure of either Party in one or more instances to insist upon the performance of any of the terms, conditions or covenants of this Agreement, or to exercise any right or privilege conferred in this Agreement, or the waiver of any breach of any term, condition or covenant herein, shall not be construed as thereafter waiving any such term, condition, covenant, right or privilege, and the same shall continue and remain in full force and effect as if no such forbearance or waiver had occurred.

12. SEVERABILITY:

If a court construes any term, condition or covenant of this Agreement to be unenforceable or invalid, the remainder of this Agreement shall remain in force.

13. INTERPRETATION:

Whenever the context requires, all words used in the singular are construed to have been used in the plural, and vice versa, and each gender will include any other gender. Headings in this Agreement are for reference only and shall not be construed to be part of the Agreement.

14. NOTICES:

All communications under this Agreement shall be in writing and will be deemed given to the Parties at the following addresses when: (i) delivered personally; (ii) sent via facsimile or email with confirmation; (iii) mailed by certified mail with return receipt requested; or, (iv) delivered by an express courier with confirmation. If provided by personal delivery, receipt will be deemed effective upon delivery. If sent via certified or registered mail, receipt will be deemed effective three (3) calendar days after being deposited in the United States mail. If sent via overnight courier, email or facsimile, receipt will be deemed effective two (2) calendar days after the sending thereof.

DISTRICT:
ICR Sanitary District
P.O. Box 215
Chino Valley, AZ 86323

CONTRACTOR:

15. CONTRACTOR REPRESENTATIONS:

If Contractor is a business entity, it represents that:

- (a) it is duly organized, validly existing and in good standing under the laws of the state of its organization;
- (b) it is authorized and in good standing to conduct business in the State of Arizona;
- (c) it has all necessary power and has received all necessary approvals to execute and perform its obligations in this Agreement; and
- (d) the individual executing this Agreement on behalf of Contractor is authorized to do so.

By signing below, Contractor certifies that he or she is not an employee of the District. This includes individuals that are not: (a) currently working due to the District's break/holiday for students and employees; (b) a substitute employee for the District; or (c) a business owned or operated by a District employee.

16. SURVIVAL:

Termination or expiration of this Agreement will not affect the Parties' rights or obligations that, by their nature and context, are intended to survive termination or expiration.

17. ELECTRONIC DELIVERY:

Execution and delivery of this Agreement by exchange of email or fax copy containing the signature of a Party will constitute a valid and binding execution and delivery of this Agreement by such Party.

18. COUNTERPARTS OF AGREEMENT:

This Agreement may be executed in counterparts, all of which together shall be considered the whole agreement. Copies of signatures shall be deemed original.

19. LIMITATIONS:

Terms and conditions of this Agreement will only be binding on ICRSD to the extent permitted by the Constitution and laws of the State of Arizona.

20. MISCELLANEOUS

This Agreement, together with any Exhibit(s) or Attachment(s), constitutes the entire agreement between the Parties with respect to the subject matter hereof, and supersedes all prior contracts, agreements, representations and understandings made by the Parties relating to such subject matter. This Agreement may not be amended or otherwise modified except by the written agreement of both Parties.

21. ADVICE OF COUNSEL:

Both Parties acknowledge that they sought their own independent legal review of this Agreement by their own counsel. If not, the Party is relying on its own intelligence and expertise in understanding this Agreement.

22. NON-DISCRIMINATION:

The Parties warrants that they will comply with any state and federal laws, rules and regulations which mandate that all persons, regardless of race, color, creed, religion, sex, genetic information, age, national origin, disability, familial status or political affiliation, shall have equal access to employment opportunities, including but not limited to the Americans with Disabilities Act. The Parties shall take affirmative action to ensure that they will not participate either directly or indirectly in the discrimination prohibited by or pursuant to Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Section 109 of the Housing and Community Development Act of 1974, the Age Discrimination Act of 1975, Genetic Information Nondiscrimination Act of 2008.

23. ASSIGNMENT:

Neither Party may assign this Agreement or its rights and duties hereunder, or any interest herein, without prior written consent of the other Party.

24. LEGAL ARIZONA WORKERS' ACT

In compliance with A.R.S. §41-4401, Contractor hereby warrants that it will, at all times during the term of this Agreement, comply with all federal immigration laws applicable to Contractor's employment of its employees, and with the E-Verify requirements of A.R.S. § 23-214 (A) (together the "State and Federal Immigration Laws"). Contractor shall further ensure that each subcontractor who performs any work for Contractor under this Agreement likewise complies with the State and Federal Immigration Laws.

Contractor agrees and warrants that ICRSD shall have the right at any time to inspect the books and records of Contractor and any subcontractor in order to verify such party's compliance with the State and Federal Immigration Laws. Contractor agrees that any act by Contractor or a subcontractor of Contractor that results in the impediment or denial of access of the books and records of Contractor or its subcontractor shall be a default and material breach of this Agreement on the part of Contractor.

Nothing herein shall make Contractor or any subcontractor of Contractor an agent or employee of ICRSD. Nothing herein shall act to establish privity of contract between ICRSD and any subcontractor of Contractor.

Any breach of Contractor's or any of Contractor's subcontractor's warranty of compliance with the State and Federal Immigration Laws, or of any other provision of this Section, shall be deemed to be a material breach of this Agreement subjecting Contractor to penalties up to and including suspension or termination of this Agreement. If the breach is by a subcontractor of Contractor, and the subcontract is suspended or terminated as a result, Contractor shall be required to take such steps as may be necessary to either self-perform the services that would have been provided under the subcontract or retain a replacement subcontractor, subject to ICRSD's approval, as soon as possible so as not to delay the providing of Services. Any additional costs attributable directly or indirectly to remedial action under this Section shall be the responsibility of Contractor.

Contractor shall advise each of Contractor's subcontractor of ICRSD's rights and the subcontractor's obligations under this Section by including a provision in its contract with each subcontractor in the following form:

“SUBCONTRACTOR hereby warrants that it will at all times during the term of this contract comply with all federal immigration laws applicable to SUBCONTRACTOR's employees, and with the requirements of A.R.S. § 23-214 (A). SUBCONTRACTOR further agrees that ICRSD may inspect the SUBCONTRACTOR'S books and records to ensure that SUBCONTRACTOR is in compliance with these requirements. Any breach of this Section by SUBCONTRACTOR will be deemed to be a material breach of this contract subjecting SUBCONTRACTOR to penalties up to and including suspension or termination of this contract.”

25. NO THIRD PARTY BENEFICIARY: This Agreement will be for the benefit of the ICRSD and CONTRACTOR only, and shall not be construed as having been entered into for the benefit of any third party.

26. NON-APPROPRIATION: ICRSD's obligations under this Agreement shall be subject to the right of non-appropriation. In the event the Governing Body of ICRSD fails to appropriate sufficient funds for the funding of this Agreement, the Agreement shall terminate at the end of the fiscal year for which the Governing Body did in fact allocate sufficient funds for the performance of this Agreement. An event of non-appropriation shall not be considered an event of default under this Agreement.

27. MEDIATION/ARBITRATION: The Parties mutually agree that in the event of any disputes, claims, questions, or disagreements arising out of or relating to this Agreement, or the breach of this Agreement, they shall first attempt in good faith to resolve the same through mediation before a mutually acceptable mediator. If the Parties cannot agree on a mutually acceptable mediator, either Party may petition the appropriate Court for the appointment of a mediator.

If the Parties cannot resolve their disputes, claims, questions of disagreements through mediation within 60 days, the Parties agree to thereafter submit same to binding arbitration in accordance with the Commercial Arbitration Rules of the American Arbitration Association in effect on the date of this Agreement, and judgment upon the award rendered by the arbitrators may be entered in any court having jurisdiction thereof. Any remedy that would be available from a court of law or equity shall be available to the arbitrator(s). The arbitration hearing and all proceedings in connection herewith shall take place in Prescott, Arizona. Either Party shall commence the arbitration hearing within ninety (90) days of the filing of the demand for arbitration, and the award shall be rendered within thirty (30) days of the conclusion of such hearing. The award shall be in writing, binding on both Parties, non-appealable and immediately enforceable in a court of law or equity. The arbitrator's cost shall be borne equally by the Parties and each Party shall bear its own costs and attorney's fees.

28. FEES AND COSTS: The successful or prevailing party shall be entitled to recover Fees and Costs incurred in all Proceedings arising out of this Agreement. "Fees and Costs" means reasonable collection charges from a collection agency, reasonable attorneys' fees, arbitration fees, expert witness fees, administrative fees, taxable costs, non-taxable costs, and other related expenses. "Proceedings" means all legal actions or similar proceedings, including negotiation, settlement, arbitration, discovery, appeals, bankruptcy, receivership, and collecting any award or judgment.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement personally or by their duly authorized officer or representative.

INSCRIPTION CANYON RANCH SANITARY DISTRICT,
a political subdivision of the State of Arizona

By: _____

Name: _____

Its: _____

CONTRACTOR: _____

By: _____

Name: _____

Its: _____

EXHIBIT A

ICR SANITARY DISTRICT INSURANCE REQUIREMENTS

Contractor shall not commence work until all required insurance coverage has been obtained and such insurance has been reviewed and accepted by the District. Certificates of Insurances on the current ACORD form shall be issued to the District showing all required insurance coverage and naming the District as an additional insured party.

Insurance Required Limit Required

Automobile Liability

Insurance covering Any Auto \$1,000,000 Combined Single Limit

Comprehensive (Commercial)

General Liability

Insurance including Products, Completed Operations, Independent Contractors, Broad Form Property Damage, Pollution and Blanket Contractual Liability coverage. Any XCU exclusions to be removed when underground work is performed.

\$1,000,000 Occurrence

\$2,000,000 Aggregate

\$1,000,000 Personal Injury

\$ 500,000 Fire Damage

\$ 5,000 Medical Payments

Per Project Aggregate (CG 70 49)

Evidence of coverage must be shown on certificates of insurance.

Workers Compensation insurance with limits to comply with the requirements of the Arizona Workers' Compensation Act.

Employers Liability insurance Statutory Limits

\$1,000,000

Professional Liability Insurance

\$1,000,000

Umbrella or Excess Liability insurance

(excess of primary General Liability, Automobile Liability and WC Coverage B)

\$1,000,000 Limit

Property Insurance shall be required for all contracts when property of the ICRSD is at risk or in the care, custody and control of the Contractor. All Risk Builders Risk insurance shall be required for all construction contracts requiring a payment bond. All Property insurance shall include coverage against the perils of Windstorm, Flood and Earthquake. Installation Floater may be substituted when contract involves installation only.)

Contract Limit or Replacement Cost Value of Scope of Work whichever is greater.

Permission to Occupy granted Deductible: 1% of Contract or Replacement.

Cost Value (whichever is greater) subject to a \$50,000 maximum unless otherwise approved by the ICRSD.

Insurance Conditions:

All insurance coverage shall be issued on an Occurrence basis by companies acceptable to District and licensed to do business in the State of Arizona by the Arizona Department of Insurance. Such companies shall have a Best's Key rating of at least "A- X".

All certificates must include:

1. A 60 day notice of cancellation of any non-renewal, cancellation or material change to any of the policies.

2. "Additional Insured" on the Property, General Liability, Automobile Liability and Umbrella (Excess) Liability policies naming the District;

3. A "Waiver of Subrogation" clause in favor of the District will be attached to the Workers Compensation, General Liability, Automobile Liability, Umbrella Liability and the Property insurance policies. In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the District as Additional Insured, and (b) showing waivers of subrogation in favor of the District:

All insurance must be maintained for three (3) years following substantial completion with Certificates of Insurance provided.

Contractor shall be responsible for payment of all deductibles; the District shall approve the deductibles selected. If any policy has aggregate limits, a statement of claims against the aggregate limits is required.

The District reserves the right to review the insurance requirements during the effective period of any contract to make reasonable adjustments to insurance coverage and limits when deemed reasonably prudent by District based upon changes in statutory laws, court decisions or potential increase in exposure to loss.

SECTION V – SUPPLEMENTARY GENERAL CONDITIONS

A. DRAWINGS & SPECIFICATIONS

The intent of the drawings and specifications is that the Contractor shall furnish all labor, materials, tools, equipment, taxes, supervision, insurance and transportation necessary for the proper execution of the project.

In case of conflict between the drawings and specifications, the specifications shall govern. Figure dimensions on drawings shall govern over scale dimensions, and detailed drawings shall govern over general drawings.

Any discrepancies found between the drawings and specifications and site conditions or any inconsistencies or ambiguities in the drawings or specifications shall be immediately reported to the ICRSD of Chino Valley, in writing. Work done by the Contractor before notification after discovery of such discrepancies, inconsistencies, or ambiguities shall be done at the Contractor's risk. The decisions made by the ICRSD regarding discrepancy resolution shall be binding.

In the event of conflict between one Contract Document and any of the other Contract Documents, the Document highest in precedence shall control and supersede the Document, which is contrary to it. The order of precedence of relevant Contract Documentation is as follows:

1. Federal and State law and regulations
2. Addenda
3. Formal Agreement
4. Bid Proposal
5. Invitation to Bid
6. Instruction to Bidders
7. Specifications
8. Drawings
9. Supplementary General Conditions

B. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

The Contractor may be furnished additional instructions and detail drawings by the District Manager or his representative, as necessary, to carry out the work required by the contract documents.

C. CONTRACT REQUIREMENTS

All grants, covenants, provisions, and claims, rights, powers, privileges and liabilities obtained in the contract documents shall be read and held as made by and with, and granted to and imposed upon, the Contractor and the ICRSD and their respective heirs, executors, administrators, successors and assigns.

The contract shall not be assigned in whole or voluntarily or involuntarily in part without the written consent of the ICRSD which consent may be withheld in the Association's sole discretion and assignment without consent shall be void. Involuntary assignment of the contract as caused by the Contractor being adjudged bankrupt or assignment of the contract for the benefit of Contractor's creditors shall be grounds for dismissal.

The contract may be amended only by the mutual consent of the ICRSD and the Contractor in writing.

D. CONTRACTOR

The Contractor will supervise and direct the work. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The contractor will employ and maintain at the work site a qualified superintendent. The superintendent shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be as binding as if given to the Contractor. The superintendent shall be present on the site at all times as required to perform adequate supervision and coordination of the work.

In the event the Contractor is a joint venture of two or more contractors, all grants, covenants, provisions, and claims, fights, power, privileges and liabilities of the contract shall be construed and held to be several as well as joint. Any notice, order, direct request or any communication required to be or that may be given by the ICRSD to the Contractor under this contract, shall be deemed well and sufficiently given to all such joint venture contractors. Any notice, request or other communication given by anyone of such persons to the ICRSD under this contract shall be deemed to have given by all persons being the Contractor.

The Contractor will indemnify and hold harmless the ICRSD and their agents and employees from and against all claims, damages and losses and expense attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefore.

In any and all claims against the ICRSD, or any of their agents or employees, by any employee of the contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the contractor or subcontractor under workmen's compensation acts, disability benefit acts or other employee benefits.

E. CONTRACTOR RELATIONS

The ICRSD, acting through the Association's Representative, shall have the authority to act as the sole judge of the work and materials with respect to both quantity and quality as set forth in the contract. It is expressly stipulated that the plans, specifications and other contract documents set forth the requirements as to the nature of the completed work and do not purport to control the method of performing work except in those instances where the nature of the completed work is dependent on the method of performance.

The Association's Representative has the authority to act on behalf of the ICRSD on all matters related to the conduct of the work under this contract.

The Association's Representative has the authority to accept or reject change orders.

Should the contractor disagree with the Representative's decision with respect to the contract, the Contractor may request that the ICRSD review the Representative's decision and make a determination.

The Association's Representative is the District Engineer. The District Engineer or his/her appointed representative may do the Inspection of the project.

The Contractor shall notify the ICRSD in writing of the name of his superintendent who will act as the

Contractor's Representative and shall have the authority to act in all matters relating to this contract. The superintendent shall have full authority to carry out all the provisions of the contract and to supply materials, equipment, tools and labor.

Subcontractors will not be recognized as having a direct relationship to the ICRSD. All persons engaged in the work including employees of subcontractors and suppliers will be considered employees of the Contractor and their work shall be subject to the provisions of the contract. References in the project plans to actions required of subcontractor, manufacturers, suppliers, or any person other than the contractor or the ICRSD, shall be interpreted as requiring the contractor to cause the Subcontractor, manufacturer, supplier or other persons to perform the specified action.

The Contractor shall at all times be responsible for the adequacy, efficiency and sufficiency of subcontractors, manufacturers, suppliers and their employees.

The Contractor shall at all times be responsible for the adequacy, efficiency and sufficiency of his employees. All workers must have sufficient knowledge, skill and experience to perform properly the work assigned to them.

The Contractor alone shall at all times be responsible for the safety of his and his subcontractor's employees. The contractor shall maintain the project site and perform the work in a manner that meets the ICRSD's responsibility under statutory and common law for the provision of a safe place to work.

The Contractor shall at all times conduct his work so as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work and to insure the protection of persons and property. No road or street shall be closed to the public except with the permission of the ICRSD or Yavapai County Public Works. Fire Hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by the Contractor to insure the use of sidewalks, private, and public driveways and proper functioning of all gutters, sewer inlets, drainage ditches and culverts, irrigation ditches and natural water courses.

Any notice, order, direction, request or other communication given by Association's representative to the Contractor shall be deemed to be well and sufficiently given to the Contractor if left at any office used by the contractor or delivered to any of his officers, clerks or servants or posted at the site of the work or mailed to any post office addressed to the Contractor at the address given in the contract document or mailed to the Contractor's last known place of business. If mailed by first- class mail, any form of communication shall be deemed to have been given to and received by the Contractor a day after the day of mailing.

Any plan or method of work suggested by the ICRSD to the Contractor but not specified or required, if adopted or followed by the Contractor in whole or in part, shall be used at the risk and responsibility of the Contractor.

The Contractor agrees to permit entry to the work site to the ICRSD or other contractors performing work on behalf of the ICRSD. The Contractor shall afford to the ICRSD, other subcontractors and their employees, all reasonable facilities and cooperation and shall arrange his work and dispose of his materials in such a manner as to not interfere with the activities of the ICRSD or others upon the site of the work. The Contractor shall report promptly any injury or damage that may be sustained by other contractors or employees of the ICRSD. The Contractor shall join his work to that of others and perform his work in proper sequence in relation to that of others.

The ICRSD shall keep the Contractor informed of the planned activities of other contractors and

themselves.

Any difference or conflict arising between the Contractor and any other contractor employed by the ICRSD or between the Contractor and the workers of the ICRSD with regard to their work shall be submitted to the District Engineer for his/her decision in the matter. If the work of the Contractor is affected or delayed because of any act or omission of any other contractor or of the ICRSD, the Contractor may submit for the Association's consideration, a documented request for a change order.

Neither the Contractor nor the ICRSD shall make any alteration or variation in or addition to or deviation or omission from the terms of this contract without written consent of the other party.

F. SUBCONTRACTING

The Contractor may utilize the services of specialty subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty subcontractors.

The Contractor shall not award work to subcontractor (s) in excess of forty-nine percent (49%) of the contract price, without prior written approval of the ICRSD.

The Contractor shall be fully responsible to the ICRSD for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of such persons directly employed by him.

The ICRSD Representative's shall approve the pay estimate. Payment shall be delivered to the Contractor at reasonable times convenient to the ICRSD.

The Contractor agrees to retain all records for at least three (3) years after the project completion. The Contractor agrees to allow the ICRSD and the Office of the Inspector General or their designated representatives, to have access to all records for review, monitoring and audit, during their normal working hours.

If the contract is not substantially completed within the specified time then liquidated damages of \$100.00 per day will incur.

The completion of this contract will be upon approval and acceptance by the ICRSD of all Work under the Contract of the ICRSD.

The Contract will be completed in full within the specified time limits, unless a time extension is approved by the ICRSD.

The attached plans and specifications are a part of this contract.

G. COMPLIANCE WITH FEDERAL AND STATE LAWS

The CONTRACTOR understands and acknowledges the applicability to it of the American with Disabilities Act, the Immigration Reform and Control Act of 1986 and the Drug Free Workplace Act of 1989. The following is only applicable to construction contracts: The CONTRACTOR must also comply with A.R.S. § 34-301, "Employment of Aliens on Public Works Prohibited," and A.R.S. §34-302, as amended, "Residence Requirements for Employees."

Under the provisions of A.R.S. §41-4401, CONTRACTOR hereby warrants to the ICRSD that the

CONTRACTOR and each of its SUBCONTRACTORS (“SUBCONTRACTORS”) will comply with, and are contractually obligated to comply with, all Federal Immigration laws and regulations that relate to their employees and A.R.S. §23-214(A) (hereinafter “CONTRACTOR Immigration Warranty”).

A breach of the CONTRACTOR Immigration Warranty shall constitute a material breach of this Contract and shall subject the CONTRACTOR to penalties up to and including termination of this Contract at the sole discretion of the ICRSD.

The ICRSD retains the legal right to inspect the papers of any CONTRACTOR or SUBCONTRACTORS employee who works on this Contract to ensure that the CONTRACTOR or SUBCONTRACTOR is complying with the CONTRACTOR Immigration Warranty. CONTRACTOR agrees to assist the ICRSD in regard to any such inspections.

The ICRSD may, at its sole discretion, conduct random verification of the employment records of the CONTRACTOR and any of SUBCONTRACTORS to ensure compliance with CONTRACTOR’S Immigration Warranty. CONTRACTOR agrees to assist the ICRSD in regard to any random verifications performed.

Neither the CONTRACTOR nor any of SUBCONTRACTOR shall be deemed to have materially breached the CONTRACTOR Immigration Warranty if the CONTRACTOR or SUBCONTRACTOR establishes that it has complied with the employment verification provisions prescribed by sections 274A and 274B of the Federal Immigration and Nationality Act and the E-Verify requirements prescribed by A.R.S. §23-214, Subsection A.

The provisions of this Article must be included in any contract the CONTRACTOR enters into with any and all of its SUBCONTRACTORS who provide services under this Contract or any subcontract. “Services” are defined as furnishing labor, time or effort in the State of Arizona by a CONTRACTOR or SUBCONTRACTOR. Services include construction or maintenance of any structure, building or transportation facility or improvement to real property.

SECTION VI – PERFORMANCE BOND

PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS THAT:

Name of CONTRACTOR

Address of CONTRACTOR

a _____, hereinafter called PRINCIPAL and
(Corporation), (Partnership) or (Individual)

Name of SURETY

Address of SURETY

hereinafter called SURETY, are held and firmly bound unto

Name of OWNER

Address of OWNER

hereinafter called OWNER, in the total aggregate penal sum of _____ Dollars

(\$_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that, whereas the PRINCIPAL entered into a certain contract with the OWNER, DATED THE _____ day of _____, 20____, a copy of which is hereto attached and made a part of the construction contract for _____

(Insert Contract Name)

NOW, THEREFORE, if the PRINCIPAL shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said CONTRACT during the original term thereof, and any extensions thereof which may be granted by the OWNER with or without notice to the SURETY and during the one year guaranty period; and if the PRINCIPAL shall satisfy all claims and demand incurred under such contract; and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so; and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default; then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, that the said SURETY, for value received hereby stipulates and agrees that no change, extension or time, alteration or addition to the terms of the CONTRACT or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its

obligation on this BOND; and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the CONTRACT or to the WORK or to the SPECIFICATIONS.

PROVIDED FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto; upon amendment to the CONTRACT not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the CONTRACT as amended. The term "AMENDMENT"; wherever used in this BOND and whether referring to this BOND, the CONTRACT or the LOAN DOCUMENTS shall include any alteration, addition, extension or modification of any character whatsoever.

PROVIDED FURTHER, that no final settlement between the OWNER and the PRINCIPAL shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied. The OWNER is the only beneficiary hereunder.

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of which shall be deemed an original, this _____ day of _____, 20____.

PRINCIPAL'S ATTEST:

PRINCIPAL

By: _____

(SEAL)

Address: _____

Witness as to PRINCIPAL

Address

SURETY'S ATTEST:

By: _____

(SEAL)

Address: _____

Witness as to SURETY

Address

PLEASE NOTE:

1. Date of BOND must not be prior to date of CONTRACT.
2. If CONTRACTOR is partnership, all partners should execute BOND.
3. Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the project is located.
4. Use of this form as an instrument of SURETY for this project is not mandatory. Use of other forms normally deemed acceptable in the State wherein the project is located may be allowed.

SECTION VII – TECHNICAL SPECIFICATIONS

INSCRIPTION CANYON RANCH SANITARY DISTRICT WWTP IMPROVEMENTS AND UPGRADES 2019

SPECIAL PROVISIONS

July 2019

INSCRIPTION CANYON RANCH SANITARY DISTRICT
YAVAPAI COUNTY, ARIZONA

Prepared by:

Civiltec Engineering

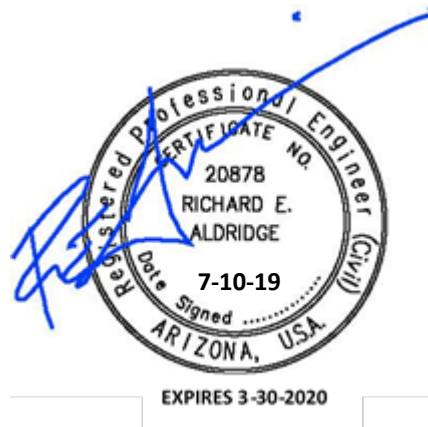
2054 N. Willow Creek Road,

Prescott, AZ 86301

928-771-2376

email: raldrige@civiltec.com

Civiltec Project Number 2018732.00



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SPECIAL PROVISIONS
MODIFICATIONS TO THE MAG SPECIFICATIONS

PART 000 INTRODUCTION

The work embraced herein shall be done in accordance with the requirements of the following:

Arizona Department of Environmental Quality Engineering Bulletins and State Statutes including, but not limited to:

- #8 *Disinfection of Water Systems*
- #10 *Guidelines for the Construction of Water Systems*
- #11 *Minimum Requirements for Design, Submission of Plans and Specifications of Sewage Works*
- #12 *Guidelines for Installation of Septic Tank Systems*

U.S. Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD)

American Water Works Association Standards (AWWA), most recent edition.

Construction Specifications Institute (CSI) Specifications as referenced

Modifications to the Maricopa Association of Governments Specifications (MAG) and other referenced specifications are made in these Special Provisions and take precedence over the MAG and other referenced specifications as follows: Where there is no conflict between the MAG and other specifications and these Special Provisions, the Special Provisions are to be construed as being additions to the MAG and other Specifications. In cases of conflict between the MAG and other Specifications and these Special Provisions, the Special Provisions are to be construed as supplanting only the conflicting portions of the MAG Specifications.

PART 100 GENERAL CONDITIONS

SECTION 101 ABBREVIATIONS AND DEFINITIONS

101.2 DEFINITIONS AND TERMS:

The work is to be performed for the INSCRIPTION CANYON RANCH SANITARY DISTRICT, located in Yavapai County, Arizona. All references in the specifications to the ICRSD Board or County officials, ICRSD Board Councils, or Board of Supervisors, shall be interpreted as if suitably modified so as to be appropriate to an INSCRIPTION CANYON RANCH SANITARY DISTRICT project.

102.3 INTERPRETATION OF QUANTITIES IN PROPOSAL:

See Section 109 for additional information concerning interpretation of quantities, measurement of quantities, and payment for work complete.

102.4 EXAMINATION OF PLANS, SPECIAL PROVISIONS, AND SITE OF WORK:

Before submitting a Bid, each Bidder will, at its own expense, make or obtain any additional examinations, investigations, explorations, tests, and studies, and obtain any additional information and data which pertain to the physical condition (surface, subsurface, and underground facilities) at or contiguous to the site or elsewhere which may affect the cost, progress, performance, or furnishing of the work, and any and all difficulties or restrictions relating to the performance of the work, and which Bidder deems necessary to determine its Bid for performing and furnishing the work in accordance with the time, price, and other terms and conditions of the contract documents. Estimates have been included for the Base Bid excavation and embankment quantities as a convenience to the Contractor for the purpose of payment for this item. The Contractor shall bid an appropriate unit price to provide adequate compensation for his independent estimate of the earthwork quantities.

Bidders are hereby advised that a geotechnical report has not been prepared for this project. The responsibility for evaluating the site for purposes of preparing Bids rests entirely with each Bidder, as it deems appropriate.

SECTION 104 SCOPE OF WORK

104.1.1 GENERAL:

Project Locations: 14000 Grey Bears Trail, Prescott, AZ

The project consists of a Base Bid with no Additive Alternates. The bid documents include construction plans and specifications for bidding improvements to an existing wastewater treatment plant.

All construction elements, as identified in the Bid Schedule, shown on the plans, or described in the Special Provisions, are to include all costs associated with earthwork, trenching, subgrade construction, valves, fittings, tapping sleeves, appurtenances, utility boxes, bedding, pavement replacement, hauling, placing, disposing of, start up, testing, certifying, or any other associated work and materials required for a complete in place and operable item of construction.

Measurement and Payment:

Where no specific measurement or payment information is provided, the Bid Schedule shall be the basis of measurement and payment for the listed items including all costs associated with taxes, bonds, profit, overhead, incidental work, etc., required for a complete in place and operational installation. All work elements not specifically itemized in the bid schedule that are required for the construction as shown on the plans or described in the Specifications and these Special Provisions and referenced standards, are to be considered incidental to the project bid amount.

The Contractor shall furnish all labor, materials, equipment, transportation, utilities, testing, services and facilities required to perform all work for the construction of the project within the time specified.

Base Bid with No Bid Additive Alternates:

The project Base Bid generally consists of the construction of improvements to the existing wastewater treatment plant.

Work generally includes, but is not limited to site grading, the construction of a new concrete dewatering pad with Titan Tube dewatering bags (2 each), new clarifier (District Furnished), sludge airlift pump, diffusers, conversion of Aeration Basins #3 and #4 to Anoxic Tanks, new blowers, new sludge line, new airline, drain line copper water line, polymer dosing line, flow meter, new secondary effluent line and electrical improvements and additions.

Special Schedule Requirements:

The existing facilities will remain in service during construction. Special coordination by the Contractor in harmony with the ICRSD Board and system operators will be an integral part of the project.

The site shall be maintained in a secure condition by the Contractor during construction. Permanent perimeter fencing shall be installed early in the construction to secure the facilities.

SECTION 105 CONTROL OF WORK

105.2 PLANS AND SHOP DRAWINGS:

Shop drawings and manufacturer's specification sheets are required for all components. Submit 6 sets of all data at one time, bound and indexed in an orderly manner. Include manufacturer's specifications, literature, performance data and dimensions, making all markings with ink in color other than red. Verify that equipment submitted will fit equipment spaces before submitting. Procure shop drawings (e.g. wiring diagrams, etc.) from other trades involved and comply as required for complete installation.

105.8 CONSTRUCTION STAKES, LINES AND GRADES

Revise as follows: This section shall be suitably revised so that all references to the Engineer providing the construction control staking is hereby revised to require the Contractor to provide all necessary construction control staking.

105.12 MAINTENANCE DURING CONSTRUCTION

Adequate drainage of the construction area shall be provided at all times. Construction drains shall be provided as needed to enable water to drain from the construction area rapidly and without damaging work in progress. To further promote good drainage of the site, drainage channels, culverts, and

structures, shall be constructed from downstream to upstream in such a way that, during construction, they do not impede the flow of water from the construction area.

Damage to any portion of the work caused by the contractor's failure to provide adequate drainage of the construction area, or to order the work so as to minimize the possible extent of such damage, shall be repaired at the Contractor's expense. No extension of time shall be granted on account of the time required to make such repairs.

All constructed slopes, open areas, etc., not requiring pavement or other surfacing and not specifically called out on the plans shall be hydroseeded by the Contractor at the completion of the project. The cost of which shall be included in the SWPPP bid item.

105-15 ACCEPTANCE

In addition to any other acceptance criteria for the project, the Contractor must supply the District with 8 sets of a project Operations and Maintenance Manual for the improvements, prepared by and sealed by a registered engineering in the State of Arizona. The O&M manual must meet minimum requirements of the Arizona Department of Environmental Quality and these Technical Specifications and Special Provisions.

NEW SECTION 105.16 – RECORD DRAWING PREPARATION AND COORDINATION

The Contractor will be required to provide record drawings of the completed construction.

During the construction phase and prior to any backfilling or covering, the Contractor's surveyor will field survey the work for the purpose of as-built plan preparation. Surveying shall be performed and certified by a Registered Land Surveyor in good standing with the Arizona State Board of Technical Registration. The Contractor shall supply all horizontal and vertical as-built data in ASCII format, including a northing, easting, elevation, and description of all work completed under this contract

Prior to backfilling or covering any work, the Contractor shall notify the District 48-hours in advance in writing for the item of work. The minimum 48-hours' notice time shall not include weekends or holidays. The notification shall be via e-mail to both the District and Engineer.

The Contractor shall not backfill or cover an item of work until verification has been completed by the District. If an item of work is determined by the District to be backfilled or covered prior to being recorded by the Contractor, the Contractor at the direction of the District shall uncover the item of work at no additional cost to the District.

The Contractor shall maintain a redlined copy of the project plans including changes made in construction of the project. The redline copy shall be updated on a weekly basis in preparation for the weekly field meeting. The Contractor shall provide the District with a copy of the Record Drawings in both hard copy and PDF drawings sealed by an Arizona Registered Land Surveyor upon completion of the project. The digital record drawings shall also be furnished to the District.

Weekly field meetings with the Contractor, Engineer, and District shall occur to review information for conformance with the contract documents. The Contractor shall provide the Engineer with a schedule of work items to be constructed in the upcoming 30-day period, including approximate dates of installation prior to backfilling or covering. The Contractor shall maintain a set of field redlines and note any changes in the work. Missing, erroneous, or deficient redlined data must be corrected by the Contractor at no additional cost to the District.

No separate measurement or payment for this work will be made.

SECTION 106 CONTROL OF MATERIALS

106.2 SAMPLES AND TESTING OF MATERIALS:

QUALITY CONTROL AND TESTING

The Contractor shall perform process control sampling, testing and inspection during all phases of the work and shall perform the process control sampling, testing and inspection at a rate sufficient to assure that the work conforms to the contract requirements, and utilizing the Test Guide Tables, which are a part of this contract, as a minimum for all testing. The Contractor shall provide the Owner's Engineer a certification stating that all of the testing equipment to be used is properly calibrated and will meet the specifications applicable for the specified test procedures. The Contractor's Engineer shall certify the results of all tests performed and provide copies of the test results to the Owner's Engineer.

The Contractor shall utilize the following Test Guide Tables as a minimum sampling and testing requirement where no other standards are referenced. Where more restrictive testing requirements are noted on the plans or in the governing Bid Documents and Specifications, the more restrictive requirements shall supersede those in the following tables.

EQUIPMENT TESTING:

Testing and operation of the specified equipment and controls shall be per the manufacturers requirements if more restrictive testing is not specified in the equipment and electrical sections of these Special Provisions.

TABLE 1 TEST GUIDE FOR SOILS

STANDARD SPEC SECTION	MATERIAL NAME/TYPES	TYPE OF TEST REQUIRED	SAMPLING POINT	MINIMUM TESTING FREQUENCY
MAG 211, 601 Type III ADOT 203,501	Soil Backfill or Trench Bedding, Shading & Backfill	Proctor Density	In-Place	One per soil type
		Compaction	In-Place	One each (bedding, shading & backfill) per 300' per lift, minimum one per structure or pipe per <u>lift</u>
MAG 301.3 (A) ADOT 203	Subgrade	Proctor Density	Roadway	One per soil type
		Compaction	Roadway	One per 300'
		Gradation, PlastilCRSD Board Index	Roadway	One per 500' or change in material
ADOT 203	Natural Ground for EM<5'	Proctor Density	In-Place	One per soil type
		Compaction	In-Place	One per 500'
MAG 211 ADOT 203	Embankment	Proctor Density	In-Place	One per soil type
	Embankment for Metal Pile Location Only	Compaction	In-Place	One per 300' lift
		pH and Resistivity	In-Place or Source	One per source
MAG 301.3 (A) ADOT 203	Soil for Shoulder Build-up	Gradation, PlastilCRSD Board Index, Soluble Salts, pH	In-Place or Source	One per soil type
		Compaction		One per 500' or as directed by the Owner's Engineer
MAG 211 <u>ADOT 203</u>	Borrow within 3' of finish subgrade <u>elevation</u>	Gradation, PlastilCRSD Board Index	In-Place	One per 500'

TABLE 2 TEST GUIDE FOR AGGREGATES

SPEC SECTION, MATERIAL NAME/TYPE	TYPE OF TEST REQUIRED	SAMPLING POINT	MINIMUM TESTING FREQUENCY
Structure Backfill or Backfill MAG 206 MAG 601 Type III ADOT 203, 501	Proctor Density	Stockpile	One per source
	Compaction	In-Place	One every 500 CY, minimum one per lift
	Gradation, PlastilCRSD Board Index	On Job Site	One per 1000 CY per source
Aggregate Base MAG 310.1 702 ADOT 303	Abrasion	Source	One per source
	Proctor Density	Crusher Belt or Stockpile	At start of production, then as material changes
	Compaction	Roadway	One per lift per 300'
	Crushed Faces	Stockpile	One per 2500 CY
	Gradation, PlastilCRSD Board Index	Windrow	One per 1000 CY, one per shift minimum
Blotter Material MAG 701 ADOT 404,412	Gradation	Final Stockpile	One per stockpile
Cover Material MAG 716 ADOT 404	Gradation	Final Stockpile	One per 200 Ton
	Crushed Faces, Flakiness Index, Bulk Specific Gravity	Final Stockpile	One per source
	Abrasion #, % Carbonate	Source	One per source
	Moisture Content, Unit Weight	Trucks at Scale	One per 200 Ton
Mineral Aggregate for AC MAG 701,710	Specific Gravity, Abrasion #	Stockpile	One per source
	Crushed Faces, Sand Equivalent	Stockpile or Cold Feed	One per each 2 days of asphaltic concrete production, minimum of 2 per project
	Gradation	Cold Feed or Bins	One per 500 Ton of asphaltic concrete production, minimum one per shift
Filter Material for Perforated Pipe, MAG 701 ADOT 501	Gradation	Source of Stockpile	One per 300 CY per source

TABLE 2 TEST GUIDE FOR AGGREGATES (CONTINUED)

SPEC SECTION, MATERIAL NAME/TYPE	TYPE OF TEST REQUIRED	SAMPLING POINT	MINIMUM TESTING FREQUENCY
Plating Material for Pipe Ends, MAG 701, 703 ADOT 501	Gradation, Plastic Index, Proctor Density	Source or Stockpile	One per source
	Compaction	In-Place	One every 50 CY
Bedding Material for Pipe MAG 601.4 Type III	Gradation, PlastiCRSD Board Index, pH, Resistivity	Source or Stockpile	One per 300 CY per source
	Proctor Density	Source or Stockpile	One per source
	Compaction	In-Place	One every 50 CY

TABLE 3 TEST GUIDE FOR BITUMINOUS MATERIAL

SPEC SECTION, MATERIAL NAME/TYPE	TYPE OF TEST REQUIRED	SAMPLING POINT	MINIMUM TESTING FREQUENCY
AC, FC, RC MAG 711 ADOT 406, 407, 408, 409, 411, 416, 1005	Per Standard Spec MAG 711-1, ADOT 1005-1, 1005-1A, 1005-5	Circulation Line Recommended	Certificate of Compliance required and duplicate sample per 1/2 shift
For Tack MAG 712, 713 ADOT 404	MAG 712-1,713-1 ADOT 1005-1,1005- 1A, 1005-5		Certificate of Compliance required
Liquid Asphalt, Type MC MAG 712 ADOT 1005	Per AASHTO M 82 and Standard Spec, MAG 712-1, ADOT 1005-5	Distributor Recommended	Certificate of Compliance required and duplicate sample per delivery shift
For RM, Prime MAG 320, 710, 712 ADOT 404, 405			
Emulsified Asphalt, Type RS-1, CRS-1, RS- 2, CRS-2, SS-1, CSS-1, MAG 713 ADOT 1005	Per Standard Spec MAG 713-1, ADOT 1005-5, 1005-2	Distributor Recommended	Certificate of Compliance required and duplicate sample per delivery unit
For Chip Seal, Tack, MAG 713, ADOT 404			
Emulsified Asphalt Special Type Diluted SS-1 or CSS-1, MAG 713, ADOT 1005	Residue MAG 713-1 Applicable ADOT	Distributor Recommended	Certificate of Compliance required and duplicate sample per delivery unit
For Tack MAG 712, 713 ADOT 404	Residue MAG 712-1, 713-1, Applicable ADOT		

TABLE 4 TEST GUIDE FOR PORTLAND CEMENT CONCRETE

SPEC SECTION, MATERIAL NAME/TYPE	TYPE OF TEST REQUIRED	SAMPLING POINT	MINIMUM TESTING REQUIRED
Portland Cement Structural Concrete, MAG 725 Class S B ADOT 601, 1006	Comprehensive Strength, Slump, Temperature	At Discharge	One set per consecutive 50 CY or fraction thereof per day, or per structure. For less than 20 CY, at the discretion of the Owner's Engineer*
	Entrained Air	At Discharge	Sample for air content every 50 CY when elevation is above 3000 feet, or per structure
Shotcrete, MAG 525, ADOT 912	Comprehensive strength	Test Panels	Sample 3 cores as per Owner's Engineer
	Slump	At Discharge	One per 20 CY

* One set for every truck for small pours. If a sample cannot be taken, the batch ticket from the truck must be obtained by the Contractor and furnished to the testing lab and project engineer. The ticket must include the compressive strength of the concrete batch and note any additives.

A "set" is a minimum of 4 concrete cylinder samples.

TABLE 5 TEST GUIDE FOR BITUMINOUS MIXTURES			
SPEC SECTION, MATERIAL NAME/TYPE	TYPE OF TEST REQUIRED	SAMPLING POINT	MINIMUM TESTING FREQUENCY
ASPHALT CONCRETE PAVEMENT, WG 321, 710 ADOT 406, 409	Extraction	Roadway	2 per day
	Marshall (75 blow)	Roadway	2 per day
	Tensile Strength Ratio (Immersion Compression Test may be substituted as approved by the Owner)	Roadway	1 per 2000 tons min. 1 per project
	Cores Lifts >or= 1-1/2"	Roadway	1 per 500 centerline feet minimum
	Rice Density	Roadway	1 per day
	Density	Roadway	1 per 300 lane feet minimum
	Strip Test	Roadway	1 per day

Additional testing requirements may be included elsewhere in these Special Provisions for other items of construction such as the Reservoir, Electrical and Instrumentation or other specialty items.

SECTION 107 LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

107.2 PERMITS:

The Contractor is responsible for all taxes, including sales tax, required by all laws and ordinances having jurisdiction. This includes the SWPPP/NPDES permit costs, if any, and associated tasks.

107.10 CONTRACTOR'S RESPONSIBILITY FOR WORK:

The Owner will not protect or be responsible for protection of equipment, tools, materials, or work in progress in the construction area during construction.

107.11 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES:

All power poles, pedestals, guy wires and underground facilities shall be removed and/or relocated by the respective owners of the facilities. The Contractor is responsible for the notification and coordination with the utility companies to ensure that this work is accomplished in a manner consistent with the construction schedule.

The Contractor shall perform all necessary potholes and utility locating at least two weeks in advance of all underground utility work to ensure expedient completion of the work in accordance with the

project Specifications. Locating existing utility conflicts in advance of the utility relocations is an important element of the project. Failure of the Contractor to locate utility conflicts at least two weeks in advance of the construction activities will diminish his ability to make a claim for delays for utility relocations.

SECTION 108 COMMENCEMENT, PROSECUTION AND PROGRESS

108.4 CONTRACTOR'S CONSTRUCTION SCHEDULE:

The Contractor shall be required to prepare and furnish to the ICRSD Board a construction Critical Path Schedule in Microsoft Project, Primavera or similar compatible electronic format. Requests for time extensions will only be considered for those items affecting the project Critical Path.

108.7 DETERMINATION AND EXTENSION OF CONTRACT TIME:

The Contract Time shall be as follows:

- For the **BASE BID**, the Contract time will be **as specified elsewhere in the Bid Documents**.

SECTION 109 MEASUREMENTS AND PAYMENTS

109.1 MEASUREMENT OF QUANTITIES:

The CONTRACTOR shall construct the work under a single lump sum fixed price contract. Lump-sum measurements will be for the entire item, unit of work, structure, or any combination of these described, as specified and as indicated in the Bid Schedule of the Bid Form. Bid Schedule quantities shall only be used for progress payments.

109.10 PAYMENT FOR MOBILIZATION/DEMOBILIZATION: REMOVE in its entirety and REPLACE with the following:

The Agency will compensate the Contractor for a single round trip including mobilization and demobilization of the Contractor's personnel, equipment, supplies and incidentals, including establishment of offices, buildings and other facilities required for the performance of the work on the project, as well as preparatory work and operations prior to the commencement of the work on the project site.

Measurement and Payment: Mobilization will be measured for payment by the lump sum bid as a single complete unit of work. Payment for mobilization will be made as provided herein which shall be full compensation for supplying and furnishing all materials, facilities, and services and performing all the work involved as specified above. The total amount allowed for mobilization during the life of the contract shall not exceed 9 percent of the original contract amount. If the bid price exceeds this percentage the excess amount will be paid to the Contractor upon completion of the contract and 9 percent of the contract amount shall be used to determine partial payments. Partial payments under this item will be made in accordance with the following provisions:

The first payment of 1/2 of the lump sum price for mobilization may be made provided that all submissions required under this section and as otherwise noted in the contract documents are submitted by the Contractor at the preconstruction conference to the satisfaction of the Engineer and when the Engineer has determined that a significant amount of equipment and materials have been mobilized to the project site which will be used to perform portions of the project work.

The second payment of 1/2 of the lump sum price for mobilization shall be made on the first estimate following completion of 30 percent of the contract.

PART 200 EARTHWORK

SECTION 201 CLEARING AND GRUBBING

SECTION 201.1 DESCRIPTION:

Earthwork includes all clearing and grubbing and other incidental work as required to construct the improvements shown on the plans and/or included in the Special Provisions. No separate measurement or payment for Clearing and Grubbing will be made.

201.2 PRESERVATION OF PROPERTY:

The Contractor shall make every effort possible to avoid damaging existing facilities. During construction, any damage inflicted to existing facilities which are intended to remain, shall be remedied within 72 hours of being damaged unless a longer period is approved by the ICRSD Board. If a damaged facility is critical to the operation of the WWTP, it shall be repaired or replaced immediately, or the contractor shall provide a suitable workaround solution to maintain the operation of the plant.

The Contractor, at his own expense, shall be required to replace, in like kind, facilities that are intended to remain which are damaged beyond repair to the satisfaction of the Engineer.

SECTION 205 ROADWAY EXCAVATION

SECTION 205.1 DESCRIPTION:

All earthwork on this project is considered incidental to the bid item of work requiring excavation. This specifically applies to the new clarifier tank, concrete dewatering pad and other miscellaneous buried and/or above ground facilities.

No separate measurement or payment will be made for earthwork for this project.

PART 300 STREETS AND RELATED WORK

SECTION 301 SUBGRADE PREPARATION

301.1 SUBGRADE PREPARATION

Unless more restrictive preparation requirements are noted in the Special Provisions, native subgrade soils shall be stripped of vegetation and debris, scarified to a minimum depth of 8 inches, uniformly moistened or dried to within 3% of optimum moisture content and compacted to not less than 95% of the maximum density as determined by ASTM test method D698, prior to placement of fill or base course materials.

No separate measurement or payment will be made for subgrade preparation, being considered incidental to the item of work requiring subgrade preparation.

SECTION 340 CONCRETE CURB, GUTTER, SIDEWALK, DRIVEWAY, AND ALLEY ENTRANCES

340.7 ACCEPTANCE:

In accordance with Section 107.10, the Contractor is responsible for protecting the finish surface of concrete by keeping footprints, tire impressions, graffiti, names, etc., from becoming part of the finished product. This may require special scheduling of materials, delivery and/or manpower. All defaced concrete will be replaced by the Contractor at no extra cost to the Owner. Patching is not acceptable. Cracked concrete will also require replacement. The Engineer shall determine the removal and replacement limits of the damaged/defaced concrete using a neat saw cut edge or removal to the nearest joint.

SECTION 350 REMOVAL OF EXISTING IMPROVEMENTS

350.1 DESCRIPTION

Removal of existing improvements includes all site clearing and grubbing, demolition of existing facilities, existing pavements, fencing, vegetation and other incidental work as required to construct the improvements shown on the plans and/or included in the Special Provisions.

No separate measurement or payment for Clearing and Grubbing or Removal of Existing Improvements will be made.

The work under this section shall consist of the removal, salvage and reinstallation, wholly or in part, and satisfactory disposal of all structures and obstructions within the project area which interfere with the construction of the proposed improvements. Salvaging of designated materials includes backfilling the resulting cavities. Existing structures, pavement, fencing and other existing improvements which are or are to become an integral part of the existing and/or planned improvements shall remain even though not specifically noted on the plans, specifications and special provisions.

Materials removed and not designated to be salvaged or incorporated into the work shall become the property of the Contractor.

The removal of existing improvements shall be conducted in such a manner as not to injure active utilities or any portion of the existing improvements that are to remain in place.

All improvements located within the construction limits that require removal for the construction of the new improvements, whether included in the bid schedule or not, are to be removed and disposed of by the Contractor. Removal items not specifically included in the Bid Schedule are considered incidental to the construction and no separate measurement or payment will be made.

The following conditions shall apply for removal, replacement and matching of existing improvements to new construction. The cost of this work is incidental to the project bid amount:

1. Provide a minimum of 24" of transition grading from existing improvements to new construction elements to provide a smooth transition between existing grades and the new improvements.
2. Existing improvements shall be removed and replaced in kind within the 24" transition zone. This includes concrete, ABC, asphalt driveway transitions, landscape stone/brick, irrigation components, fences or any other landscape features requiring the transition.

3. Shrubs/low growth vegetation may be trimmed to provide room for necessary construction devices.
4. The Contractor will coordinate with the County for the exact limits of the removals and replacements as required at each match up location.
5. ABC shall be used for any match up required at unimproved driveways or other locations subject to vehicle or pedestrian traffic where not specifically called out for replacement on the plans. Native materials may be used at locations not subject to vehicle or pedestrian traffic.
6. Improvements within the 24" transition zone must be adjusted to final finish grade elevations.

350.3 MISCELLANEOUS REMOVAL AND OTHER WORK:

All removal items not specifically designated for stockpiling or other uses shall be deemed to be Surplus Material and disposed of in accordance with the provisions of Section 205.6 of the Specifications. Hard surface removals (asphalt, concrete, etc.) shall require a neat saw cut edge or removal to the nearest joint.

PART 400 RIGHT-OF-WAY AND TRAFFIC CONTROL

SECTION 401 TRAFFIC CONTROL

401.1 DESCRIPTION:

Traffic control shall also apply to the control of pedestrian traffic in and around the project site.

401.4 TRAFFIC CONTROL MEASURES:

In addition to vehicle traffic, sufficient and adequate devices and measures to control the pedestrian traffic in and around the job site shall be provided and erected per the Contractors approved traffic control plan. Devices may include barricades, steel traffic rated trench plates, flagging and/or warning signs, flagmen, fences, signs, pilot cars, lights, etc, as necessary. Placement and maintenance of all devices shall conform to the Manual on Uniform Traffic Control Devices (MUTCD). No separate measurement or payment shall be made for traffic control.

PART 600 WATER AND SEWER

SECTION 601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.4.4 COMPACTION DENSITIES:

Minimum trench densities shall be as identified in the plans, specifications and/or special provisions. In no case shall a trench density be less than 95% unless specifically authorized by the ICRSD Board in writing.

No water settlement will be allowed.

SECTION 610 and 615 WATERLINE AND SANITARY SEWER LINE CONSTRUCTION

610.01 & 615.01 DESCRIPTION:

All water and sewer line testing shall conform to MAG sections 610 and 615 as appropriate for the project including pressure, bacteriological, chlorination, vacuum, slopes for gravity lines and any other

requirements of the Arizona Department of Environmental Quality general construction and testing requirements.

PART 700 MATERIALS

GENERAL REQUIREMENTS:

- Aggregate Base Course material shall be per MAG Section 702.
- All concrete used on the project shall be a minimum of MAG Type AA, 4,000 psi, with an air entraining admixture (4% - 6%). This minimum strength supersedes any other requirements of the plans or any referenced details with a lesser requirement.
- All concrete incorporated into this project shall be a minimum mag Class "AA" (f'c= 4000 p.s.i.), with 4% -6% air entrainment, and shall conform to the provisions of Section 725, MAG Standards. Lower strength concrete, if noted on the referenced standard details or in the construction plans shall not be less than a Class AA, 4,000 psi minimum as noted above.
- No concrete shall be placed prior to acceptance of the base and the concrete forms by the Engineer.
- Miscellaneous concrete generally includes pipe supports, spillways, drainage features, fence posts, equipment supports, and other similar or incidental construction items.

NEW MAG PART 1000 – WWTP GENERAL CONSTRUCTION REQUIREMENTS

MAG SECTION 01 73 60 – EQUIPMENT TESTING AND PLANT STARTUP

GENERAL

Equipment testing and plant startup are required for satisfactory completion of the contract and shall be scheduled and completed within the contract time.

EQUIPMENT TESTING

Contractor Furnished Equipment

The Contractor shall provide the services of an experienced and authorized representative of the manufacturer of each item of equipment indicated in the equipment schedules who shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The Contractor shall have the manufacturer's representative revisit the Work site as often as necessary until any and all problems are corrected. The Contractor shall require that each manufacturer's representative furnish to the Engineer a written report addressed to the Owner certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts and has been operated satisfactorily under full-load conditions.

The Contractor shall be responsible for scheduling all operations testing. The Contractor shall furnish all personnel, power, water, chemicals, fuel, oil, grease and all other necessary equipment, facilities and services required for conducting the tests. The Contractor is advised that the Engineer and the Owner's operating personnel will witness operations testing and that the manufacturer's representative shall be required to instruct the Owner's operating personnel in correct operation and maintenance procedures. This instruction shall be scheduled with the Engineer and the Owner at least

ten (10) days in advance and shall be provided while the equipment is fully operational. The Contractor shall have previously furnished the technical manuals required under Section 01 33 00 Submittal Procedures.

Owner Furnished Equipment

The Contractor shall notify the Engineer when Owner furnished equipment is completely installed in accordance with the Owner furnished manufacturer's instructions and requirements of the Contract Documents and ready for operational testing. The Engineer will schedule the manufacturer's representative to visit the site of the Work and inspect, check, adjust if necessary and approve the equipment installation. If the manufacturer's representative cannot complete the testing and startup services due to the Contractor's negligence in installing the equipment, the Contractor shall be responsible for the costs of the service representatives' revisit to the site of the Work.

PLANT STARTUP

The startup of the treatment plant facilities and equipment is a coordinating operation requiring the combined technical expertise of the Contractor, suppliers, Engineer and the Owner. The Contractor shall provide the effective coordination of all parties necessary for successful plant, facilities and equipment startup.

The Contractor shall be required to startup and operate the various pieces of equipment for a continuous seven (7) day period under coordination direction of the Engineer and Owner. The start-up shall not be commenced until all required leakage tests, disinfection and equipment tests have been completed to the satisfaction of the Engineer.

All defects in materials or workmanship which appear during this test period shall be immediately corrected by the Contractor. The Contractor shall provide the services of authorized representatives of the manufacturer, in addition to those services required under equipment testing, as may be necessary, to correct faulty equipment operation. Time lost for equipment repairs, wiring corrections, control point settings or other reasons which actually interrupt the startup may, at the discretion of the Engineer, be justifiable cause for extending the startup test duration.

MAG SECTION 01 78 23 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions including any General and Supplementary Conditions apply to work of this section.

1.02 SUMMARY

- A. Furnish four sets of bound operation and maintenance manuals. Manuals shall contain descriptive drawings and data which identify equipment installed at the project and detail the procedures and parts required to maintain and repair the equipment. Copies of approved submittals shall be included for all equipment.

1.03 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS

- A. General:

1. The "Operating and Maintenance Manual" is a bound compilation of drawings and data required for each building or project. These manuals, complete with drawings and data, shall be furnished to the Purchaser.
 2. Not Used
 3. The number of binders (or "volumes") required for each individual building or project will depend on the amount of information to be catalogued.
 4. All information included shall be legible and sufficiently marked to indicate the exact size, model, type, etc., of equipment furnished and installed.
- B. Purpose: The Operating and Maintenance Manual is prepared to provide a ready reference to all important pieces of mechanical and electrical equipment installed on the project. It is also to provide the necessary operating and maintenance data for use by service personnel. It is also to provide information required for checking equipment performance or for planning of plant expansion or redesign.
- C. Quantity and Preparation (Submit through Engineer):
1. Four sets of the Operation and Maintenance Manuals shall be prepared for the project.
 - a. One set to the Engineer.
 - b. Three sets to Owner.
 2. The quantities of drawings, manufacturer's literature, or other data required for these manuals are in addition to those otherwise required for normal distribution for approval during the construction period.

PART 2 - PRODUCTS

2.01 PAGE SIZE

- A. All pages shall be standard 8-1/2 x 11 inches size or approximate multiples (preferably 17 x 11 inches) folded to 8-1/2 x 11 inch manila pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manila pocket.

2.02 DRAWINGS

- B. All drawings larger than 8-1/2 x 11 inch shall be folded and inserted in individual 8-1/2 x 11 inch manila pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manila pocket.

2.03 BINDERS

- C. Binders shall be Buckram binders with block lettering for sheet size 8-1/2 x 11 inches with 2 to 3-1/2 inch expandable metal capacity as required for the project. The number of binders, however, shall be based on not filling them beyond 4".
- D. The following information shall appear on the front cover and backbone:
 1. "Operation and Maintenance Manual".
 2. Project Name (and volume number if more than one volume).

3. Owner's name.
4. Engineer's name.
5. General Contractor's name.

2.04 CONTENTS AND INDEXING

- E. Manuals shall contain descriptions of the building systems in sufficient detail to adequately indicate the type of systems installed and the basic details of their operation.
- F. All purchased equipment data shall be used to designate the sections. Within each section additional indexing of component parts may be required.
- G. Operation and Maintenance Manuals shall contain to the fullest extent all possible information pertinent to the equipment. The arrangement and type of information to be filed shall be as follows:
 1. Copy of purchase order change (if any).
 2. Outline drawings, special construction details, "as built" electrical wiring and control diagrams for all major and supplementary systems.
 3. Manufacturer's test or calculated performance data and certified test curves.
 4. Installation, operating, and maintenance instructions, including a complete parts list and sectional drawing with parts identification numbers. Mark with model, size and plan number.
 5. Manufacturer's brochure marked to indicate exact equipment purchased. Brochures on component parts supplied by a manufacturer with his equipment, but not manufactured directly by him, shall also be included.
 6. The serial numbers of each item of equipment installed are to be listed with the model numbers and plan symbols.
 7. Written warranties.
 8. Include a Table of Contents. The contents shall be divided with tabbed index dividers into the following suggested parts:
 - 1) Building and System Descriptions
 - 2) Purchased Equipment Data
 - 3) Test Reports and Valve Charts
 - 4) Start-Up and Operation
 - 5) Preventative Maintenance Recommendations
 9. A copy of the approved submittals for each piece of equipment.
 10. A copy of all testing, adjusting and balancing reports.
 11. Wiring diagrams marked with model and size and plan symbol.
 12. Operating and Maintenance Manuals data for Part I shall be obtained directly from the mechanical and electrical consultants. (Allow consultant preparation cost.)

13. The index shall contain the name and address of the manufacturer and, if different, where replacement and repair parts may be obtained.

MAG SECTION 03 39 00 – CONCRETE CURING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section shall describe how the CONTRACTOR shall perform work in regard to concrete curing.

1.02 REFERENCED SECTIONS – NONE

1.03 CITED STANDARDS – NONE

1.04 NOTED RESTRICTIONS – NONE

1.05 QUALITY CONTROL

- A. Protection against loss of moisture from the surface of the concrete shall be accomplished by the following:
 1. Keeping the surface cured for a minimum period of 7 days.
 2. Keeping the surface in contact with the form.
 3. Covering with burlap or cotton mats kept continuously wet and covered with polyethylene plastic.
 4. Continuously sprinkling the exposed surfaces.
 5. Applying a curing and sealing compound as specified herein.

PART 2 - PRODUCTS

2.01 CURING AND SEALING COMPOUND

- A. Clear Curing and Sealing Compound (VOC compliant) shall comply with ASTM C309, Type 1D. The compound shall have 30 percent solids content minimum, and will not yellow under ultraviolet light after 500 hours of test and will have test data from an independent testing laboratory indicating a maximum moisture loss of 0.040 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon.
- B. Compound shall be "Super Aqua Cure VOX" or "Super Diamond Clear VOX" by The Euclid Chemical Co. or an equal approved by the OWNER or ENGINEER.
- C. No curing compounds shall be used on any surfaces to which pneumatic mortar is to be applied, or on which any other type of concrete mortar or chemical waterproofing coating is to be used. They may be used in other places, however, upon the approval of the compound and its location by the OWNER.

PART 3 - EXECUTION

3.01 PREPARATION – NONE

3.02 INSTALLATION

- A. All concrete shall be cured by the methods specified herein for a minimum of seven days.
- B. All concrete that is to be painted shall be water or plastic membrane cured. No curing compound shall be used on any concrete surface that is to receive paint or upon which any material is to be bonded. All other concrete shall be cured by water curing or sprayed curing membrane at the CONTRACTOR's option, except floors and slabs which are specified to be sealed with a concrete sealer. Floor slabs may be cured using a plastic film membrane curing.
- C. Water Curing
 - 1. All surfaces of concrete being water cured shall be kept constantly and visibly moist day and night for a period of not less than seven days and nights. Each day the forms remain in place may count as one day of water curing. No further curing credit will be allowed for forms in place after contact has once been broken between the concrete surface and the forms. Ties shall not be loosened during the period when concrete is being cured by leaving the forms in place. The top of walls shall be flooded with water at least three times per day, and the concrete surface shall be kept moist at all times during the seven-day curing period.
- D. Sprayed Membrane Curing
 - 1. The curing compound shall be applied to the concrete surface after repairing and patching, and within one hour after the forms are removed. If more than one hour elapses after the removal of the forms, membrane compound shall not be used and water curing shall be applied for the full curing period. If the surface requires repairing or painting, the concrete shall be water cured.
 - 2. Curing compound shall not be removed from the concrete in less than seven days. Curing compound may be removed by the CONTRACTOR only upon written request by the CONTRACTOR and acceptance by the OWNER, stating what measures the CONTRACTOR shall take to adequately cure the structure.
 - 3. Care shall be taken to apply curing compound in the area of the constructions joints to see that curing compound is placed within the construction joint silhouette. The curing compound placed within the construction joint silhouette shall be removed by heavy sandblasting prior to placing any new concrete. The CONTRACTOR has the option of water curing the construction joint.
 - 4. Curing compound shall be applied by a mechanical, power operated sprayer and mechanical agitator that will uniformly mix all pigment and compound. The compound shall be applied in at least two coats. Each coat shall be applied in a direction opposite to the preceding coat.
 - 5. The compound shall be applied in sufficient quantity so that the surface will have a uniform appearance and will effectively and completely conceal all natural color of the concrete at the time of the spraying. The CONTRACTOR shall continue to coat and recoat the surface until the specified coverage is achieved and until a coating film remains on the surface of the concrete. The thickness and coverage of the compound shall be such that the film can be scraped from the surface at any and all points after drying for at least 24 hours.

6. The CONTRACTOR is cautioned that the method of applying curing compound specified herein may require more compound than normally suggested by the manufacturer of the compound and also more than is customary in the trade.
7. If the CONTRACTOR desires to use a curing compound other than the specified compound, the CONTRACTOR shall coat sample areas of concrete wall with the proposed compound and also a similar adjacent area with the specified compound in the specified manner for comparison. Complete data on the proposed compound shall also be submitted for review. If the proposed sample is not equal or better, in the opinion of the OWNER, in all features, the proposed substitution will not be allowed.
8. Prior to final acceptance of the work, the CONTRACTOR shall remove, by sandblasting or other acceptable method, any curing compound on surfaces that will be exposed to view, so that only the natural color of the finished concrete will be visible uniformly over the entire surface.
9. When concrete slab placements are subject to high temperatures, wind and/or low humidity, the OWNER or the ENGINEER may require the use of the evaporation retarder to minimize plastic cracking. The compound may be required to be applied one or more times during the finishing operation.
10. At air temperatures of 90°F or above, concrete shall be kept below 90°F during placing and curing. Concrete surfaces shall be kept continuously moist by wet-curing for at least 24 hours after the concrete has been placed, and water shall be applied to formed surfaces while forms are still in place. After the period of wet-curing, a suitable heat-reflecting plastic membrane or white-pigmented curing compound or immediate membrane curing shall be used.

E. Plastic Membrane Curing

1. Polyethylene film may be used to cure slabs, and shall be sealed at joints and edges with a small sand berm. The plastic membrane shall be installed as soon as the concrete is finished and can be walked on without damage. The concrete shall be kept moist under the plastic membrane.

MAG SECTION 03 60 10 – GROUTING MORTAR

PART 1 - GENERAL

1.01 REQUIREMENT

- A. The Contractor shall furnish, place, finish and cure the following types of grouting mortars as called for herein and as shown in the Contract Documents
 1. Non-Shrink Grout: This type of grout shall be used wherever grout is shown or called for in the Contract Documents, unless another type is specifically referenced.
 2. Topping Grout: This type of grout shall be used for grouting clarifier bottoms.
 3. Epoxy Grout: This type of grout shall be used for anchor bolt or reinforcing steel embedment, repairs and resurfacing.

1.02 RELATED WORK

- A. Section 03 30 00 - Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Specifications, codes and standards is listed under Section 03 30 00 Cast-in-Place Concrete, and those additional commercial standards as follows:

CRD-C 621-85 Corps of Engineers Specification for Non-Shrink Grout

ASTM C 109 Standard Test Method for Compressive (Latest Edition) Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)

ASTM C-827-87 Standard Test Method for Early Volume Change of Cementitious Mixtures

1.04 SUBMITTALS

- A. Non-Shrink Grout: Submit manufacturers technical data including compressive strength and expansion data at plastic, flowable and fluid consistencies. Also submit manufacturers applications manual containing instructions and recommendations for mixing, handling, placement and appropriate uses for each type of non-shrink grout used in the work.
- B. Topping Grout: Provide certified mix design including proportions and gradations of all materials and compressive strength test results from at least one (1) trial batch. Tests shall be performed by a certified testing laboratory. All costs for such mix design and trial batch tests shall be borne by the Contractor.
- C. Epoxy Grout: Submit manufacturer's technical data including strengths and application manual of instructions for mixing, handling and placing.

1.05 QUALITY ASSURANCE

- A. Mix design tests for topping grout shall be performed per the standards referenced herein.
- B. During the progress of construction, the Engineer may have tests made of each type of grout used in the work to ensure compliance with the Contract Documents. These tests will be made in accordance with the standards referenced herein. The test expense during construction, except for the mix design and trial batch tests, will be borne by the Owner. The costs of additional tests including non-destructive tests and core drilling needed to verify or investigate the quality of questionable work or material shall be borne by the Contractor.
- C. Grout for testing shall be supplied by the Contractor at no cost to the Owner.
- D. If any grout fails to meet the requirements of these specifications, immediate corrective action shall be taken for all subsequent batches. Grout already in place which fails to meet these requirements is subject to removal and replacement with all costs borne by the Contractor.
- E. Construction tolerances shall be as specified in Section 03 30 00 Cast-in-Place Concrete, except as modified herein and elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.01 NON-SHRINK GROUT

- A. Non-shrink grout shall be a prepackaged, inorganic, non-gasliberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturers instructions shall be printed on each bag or other container in which the materials are packaged.
- B. Non-shrink grouts for use as herein specified shall conform to the Corps of Engineers specifications for Non-Shrink Grout, CRD-C621-85 and to these specifications. The grout shall have a 28-day compressive strength of 6,000 psi or greater.
- C. Non-shrink grouts shall be as manufactured by: Tremcrete Systems Incorporated, Woodland, California; Gifford-Hill & Company, Inc., Dallas, Texas; or approved equal.

2.02 TOPPING GROUT

- A. Cement topping grout for clarifiers or channels shall be composed of one-part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. The minimum compressive strength at 28-days shall be 4,000 psi.
- B. Cement grout materials shall be as specified in Section 03 30 00 Cast-in-Place Concrete.

2.03 EPOXY GROUT

- A. Epoxy grout shall be a pourable, non-shrink, one-hundred percent (100%) solids system. The epoxy grout system shall have three components; resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application. Manufacturer's instructions shall be printed on each container in which the materials are packaged.
- B. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F. The epoxy grout shall develop a minimum compressive strength of 5,000 psi in 24-hours and 10,000 psi in 7-days.

2.04 CURING MATERIALS

- A. Curing materials shall be as specified in Section 03 30 00 Cast-in-Place Concrete, for cement topping grout and as recommended by the manufacturer of non-shrink grouts.

PART 3 - EXECUTION

3.01 PLACING NON-SHRINK AND EPOXY GROUT

- A. All forming, mixing, surface preparation, handling, placing and consolidated of non-shrink and epoxy grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Curing shall be as specified herein.

MAG SECTION 03 62 00 – NON-SHRINK GROUTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall furnish all material, equipment, labor, services, etc., for grouting as specified in this section and the respective DRAWINGS.

1.02 REFERENCED SECTIONS – NONE

1.03 CITED STANDARDS – NONE

1.04 NOTED RESTRICTIONS

- A. In no case shall the water/cement ratio be more than that specified for the concrete being repaired. In the case of mortar being used for patching or repairing exposed concrete surfaces which are not to be painted or which will not be submerged in water, sufficient white cement shall be used to make the color of the finished patch match that of the surrounding concrete.

1.05 QUALITY CONTROL

- A. Cement mortar or grout for the repair of imperfect concrete work, filling of holes left by form bolts or ties, and the filling of voids around items through the concrete, and grout for spreading over construction joints and cold joints etc., shall consist of Portland cement and sand mixed in the same proportions used for the concrete being repaired, with only sufficient water to give the required consistency. Essentially, this would consist of the concrete mix with the coarse aggregate removed and water quantity adjusted as required.
- B. Grout to fill the void between the steel casing and the carrier pipe of jacked pipe shall have the concrete mix of Class C concrete with the coarse aggregate removed.
- C. Grout for which the mix is not otherwise specified shall be mixed in the proportions by weight of one-part cement to four parts of concrete sand.

PART 2 - PRODUCTS

2.01 NON-SHRINK GROUTING

- A. Non-shrink grout shall be made with a hydraulic cement, which when mixed with water will harden rapidly to produce a permanent high strength material suitable for exterior use.
- B. All grout utilized shall be durable, non-staining, non-shrink, non-metallic grout. The grout shall show no shrinkage in accordance with ASTM C-827 prior to initial setting and shall show no shrinkage in the hardened state under ASTM C-157; Corps of Engineers Specification CRD-C-588 and the field cylinder tests.
- C. The grout shall conform to ASTM-C-191 concerning time of initial set. All grouting operations shall be completed in accordance with the recommendations of ACI, CSI, and the grout manufacturer's published specifications for mixing and placing.

- D. All grout utilized shall be "Five Star Grouts" as manufactured by U.S. Grout Corporation, Greenwich, Connecticut; "Masterflow 713 Grout" as manufactured by Master Builders, Cleveland, Ohio; or an OWNER approved equal.
- E. Where nonmetallic grout is nonessential, grout shall be a non-shrink, non-catalyzed, metallic grout such as Embecco 636 Grout, as manufactured by Master Builders, Cleveland, Ohio or OWNER approved equal.
- F. When mixed in accordance with manufacturer's published instructions, the non-shrink grout shall be semi fluid and suitable for placing by pouring into place when mixed to a flowable consistency. The compressive strength tested in accordance with ASTM C 109 shall be not less than 3,000 psi at 1 day and not less than 6,000 psi at 28 days. Setting time tested in accordance with ASTM C 191 shall be not less than 30 minutes.

2.02 EPOXY GROUT

- A. Epoxy grout shall be made by mixing one-part epoxy with not more than two parts sand. The sand shall be clean, bagged, graded, kiln dried silica sand. The prepared grout shall wet the contact surface and provide proper adhesion or a coat of epoxy shall be applied prior to placing the epoxy grout. Manufacturer's published instructions for mixing and application shall be followed.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Bolt and tie holes shall be cleaned and roughened by heavy sandblasting and filled with dry pack mortar, well tamped into the holes. For dry pack mortar, only enough water shall be used so that the resulting mortar will crumble to the touch after being formed into a ball by hand.
- B. Concrete surfaces shall be cleaned and roughened by a heavy sandblasting and thoroughly damp before grout or mortar is placed, or, where indicated on the DRAWINGS or specified, an epoxy bonding agent shall be applied to the clean, roughened, dry surface before placing the mortar or grout.

3.02 INSTALLATION

- A. Grout for spreading over the surfaces of construction joints or cold joints shall consist of sand and cement with no more water used than allowed by the water/cement ratio specified for the concrete.
- B. Particular care shall be exercised in placing cement mortar or grout since it will be expected to furnish structural strength or an impermeable water seal or both. Cement mortar or grout that has not been placed within 30 minutes after mixing shall not be used.
- C. Epoxy grout shall be used where specified herein or where indicated on the DRAWINGS. Epoxy grout may be used to repair surface defects in concrete work.
- D. For vertical or overhead work, epoxy gel shall be used. For horizontal work, epoxy shall be used. Epoxy grout for vertical or overhead work may be used for horizontal work.

MAG SECTION 11 94 19 – POLYMER INJECTION SYSTEM

SECTION 11 94 19 – POLYMER INJECTION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Polymer Unit

1. The polymer dilution/feed unit shall be capable of automatically metering, diluting, activating and feeding a liquid polymer with water to the titan tubes located on the concrete dewatering pad.
2. The polymer dilution/feed unit shall be capable of producing polymer solution with polymer-to-water solution concentrations between 0.25%-1.0%.

1.02 SERVICE CONDITIONS

- A. Dilution Water supply pressure shall be a minimum of 65 psi.
- B. Backpressure from the point of application on the system shall be a maximum of 15 psi.
- C. Dilution Water range GPH: 1 to 16.
- D. Polymer Output, GPH: 0.01 – 1.0.
- E. Metering pump GPH: 0.5 to 5.
- F. Control Panel supply voltage shall be 120 VAC, 1 Phase, 60 Hz.

1.03 MATERIAL SPECIFICATIONS

A. Connections - Plumbing

1. Dilution water inlet, 1/2" FNPT
2. Neat polymer inlet, 5/8" FNPT
3. Solution discharge, 1/2" FNPT

B. Connections - Electrical

1. Standard, grounded male plug - 120/1/60, 6 amps max.
2. Terminal blocks for interconnecting all skid-mounted electrical devices.
3. Terminal blocks for all remote input and output signals.

C. Dimensions

1. Frame shall be approximately 10" wide x 16" deep x 23" high.

D. Materials of Construction

1. The system's frame shall be of rugged 304 stainless steel construction. No mild steel shall be used. The skid shall be constructed of 3/16" minimum 304 stainless steel. The frame shall be constructed of 3/16" angle or structural stainless steel tubing. . Control panel shall be mounted in vertical position and at 60" high. Pump suction shall not exceed 18" from the skid.

2. Piping and valves shall be mounted with rigid pipe clamps. Fasteners required to mount components to system frame shall be minimum ¼-20.
3. Mixing chamber – 304 stainless steel body with PVC top cap.

1.04 QUALITY ASSURANCE

- A. The manufacturer of alternate equipment shall submit with their bid a list of ten (10) installations, each at least five years in operation, which quantify the proposed alternate system's ability to meet the above criteria. All variations to these specifications must be listed in the manufacturer's proposed scope of supply submitted at time of bid. The drawings and specifications are based on PolyBlend. Contractor shall include in the bid and shall be responsible for the costs of any changes to accommodate other equipment, including but not limited to structural, mechanical, and electrical work.
- B. Pre-assemble and factory test system to ensure compliance with pressure and operational requirements.
- C. The approved system shall produce a completely homogenous polymer and water solution free of visible polymer agglomerations, or "fish-eyes".

1.05 WARRANTY

- A. The system shall be covered by a one (1) year limited warranty against defects in materials and workmanship. The mixing chamber shall be covered by a lifetime warranty covering the repair and replacement of any part of the mixing chamber that fails for any reason, provided unit has received reasonable use and care. The mixing chamber shall be guaranteed not to plug for the life of the system. The warranty shall not be de-rated as a result of using non-potable water.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide a quantity of one (1) Polyblend model PB16-1 polymer activation, dilution and feed system or Engineer approved equal. The "or equal" clause shall be defined as a system which has a minimum five (5) years proven track record of providing performance at least equal to the specified equipment with the types of polymers specified below, as proven by actual field trials; a design which inherently provides an equal level of reliability and quality compared to the system specified; the general design of the system as it relates to maintenance accessibility of parts and operation.

2.02 EQUIPMENT

- A. Multi-Zone Mixing Chamber
 1. A non-mechanical, hydrodynamic, blending device specifically designed to dilute and activate emulsion, dispersion and solution type polymer with viscosities up to 75,000 cps. and active contents up to 75%, shall be provided. Systems without a proven track record with all types of polymers described above will not be considered.
 2. The liquid polymer activation chamber's mixing energy shall be staged such that it provides for high, non-damaging mixing energy over the full operating range of the system which then dissipates through concentric chambers. The integral water control device, which shall also produce mixing energy by creating a pressure drop across its orifice, shall be constructed of stainless steel and brass and shall be designed to allow orifice replacement

without disassembly of any other part of the system. The system shall be designed for use with either potable or non-potable dilution water.

3. A mixing chamber drain valve with 1/2" fitting shall be provided and plumbed to the nearest floor drain. The mixing chamber shall have a maximum working pressure of 100 psi.
4. Provide a neat polymer check valve specifically designed to isolate neat polymer from dilution water. The valve shall be designed with an open, unobstructed path to the valve seat. The valve body shall be constructed of Teflon. The ball shall be stainless steel. The spring shall be covered with a PVC boot, to prevent polymer from passing through the spring. The valve shall be readily accessible from outside the reactor for cleaning and shall be easily disassembled. Conventional check valves, and or check valves that are installed inside the mixing chamber, or which require mixing chamber disassembly for servicing will not be accepted.

B. Dilution Water Control

1. The dilution water flow rate shall be monitored by a Rotameter type flow meter and provide for 0.5 to 1.0 GPM inline feed. Unions shall be provided on the inlet and outlet of the Rotameter to allow easy removal for cleaning.
 - a. Rotameter accuracy shall be less than or equal to $\pm 4\%$ of full scale flow.
 - b. Materials of Construction:
 - 1) Metering Tube: Machined Cast Acrylic
 - 2) Internal Components: 316L Stainless Steel
 - 3) Fitting: PVC
 - 4) Elastomers: Buna-N
2. Unit shall have an electric solenoid valve for on/off control of total dilution water flow.
 - a. Materials of Construction: Brass body, NBR Seal
 - b. Manufacturer: Parker Skinner Valve or equal
3. The dilution water flow rate shall be manually adjusted through a flow control valve connected directly to the mixing chamber. Valve shall be constructed of PVC body, SS needle, and brass seat. The assembly shall accommodate a flow of 16 GPH.

C. Polymer Metering Control

1. Unit shall have a neat polymer metering pump. Pump shall be a solenoid operated diaphragm pump with an adjustable stroke length and frequency. Capacity shall be 1.0 GPH.
2. Pump shall be driven by a 1/6 HP (minimum), TENV, 0-90 volt DC motor. Variable speed capability shall be provided by an SCR controller. Maximum speed of the pump shall not exceed 650 RPM.

- D. Provide a metering calibration assembly rigidly mounted to the system frame and sized to provide a one-minute drawdown at 100% pump capacity. The column shall be graduated in

increments of 0.1 gallons/10mL. Supporting the calibration column with the polymer piping is not acceptable.

E. Controls

1. A control panel affixed to the system's frame shall be provided, rated NEMA 4X and constructed of FRP. The control panel shall consist of all switches, relays, indicator lights, digital displays, and controllers as required herein. The control panel components shall be NEMA 4X. All skid-mounted electrical components interconnected to control panel shall terminate on terminal blocks. Terminal blocks shall be sized for 14 ga. wire with terminal block numbers and a legend. Wires shall be neatly run through wire race-way and numbered with adhesive type labels.
2. Polymer unit shall be capable of utilizing input and output signals to coordinate system integration with Dewatering Unit. All integral signals shall be provided for complete system functionality in tandem with such systems necessary for uninterrupted processing of solids.
3. Control Devices:
 - a. Main Power / System ON - OFF – REMOTE selector switch.
 - b. NEMA 4X, panel-mounted potentiometer for local control of pump speed.
 - c. Alarm reset push-button.
4. SCR Controller:
 - a. Input Voltage: 115/230 VAC
 - b. Output Voltage: 0-90 VDC or 0-180 VDC
 - c. HP Rating: 1/8-1 @ 90 VDC, ¼-2 @ 180 VDC
 - d. Signal Input: 4-20mA or 0-10VDC, selectable
 - e. Max Output Current: 10 Amps
 - f. Adjustable min speed, max speed, current limit, IR compensation and signal input adjust
 - g. 3% linearity through 60:1 speed range
5. Indicators:
 - a. System Running indicator, white full voltage pilot light
 - b. Low water differential pressure alarm
 - c. LCD display of pump rate
 - d. Low polymer flow alarm
6. Alarms:
 - a. Loss of Dilution Water Flow Alarm, Differential Pressure Type. Metering pump shall stop when low dilution water pressure occurs. The pump shall automatically restart when the pressure returns. A red indicator light and alarm output indicating dry contact shall be provided as part of this alarm system.

- F. The valves, equipment, materials of construction and controls specified under this section supersedes valves, equipment, materials of construction and controls specified elsewhere in the contract documents.

PART 3 - EXECUTION

3.01 MAINTENANCE

- A. Unit shall be open frame design to allow easy access to all components.
- B. Mixing chamber shall be easily disassembled and reassembled to allow access to all parts exposed to neat polymer.
- C. Polymer check valve shall be readily accessible. Check valves installed inside mixing chamber shall not be acceptable.

MAG SECTION 11 94 53 – POSITIVE DISPLACEMENT BLOWER

PART 1 - GENERAL

1.01 ITEMS TO BE FURNISHED

- A. One (1) Positive Displacement Blower
- B. Electric motor drivers
- C. All accessories required for proper operation

1.02 REQUIREMENTS

- A. The blower package shall operate unenclosed at sound level below 96 dbA measured at 1m in a free field environment. Testing shall be included with the submittal.
- B. The blower shall have a minimum L10 bearing life of 50,000 hours. All work must be shown.
- C. The positive displacement blower package shall consist of the following scope of supply and any additional materials or equipment recommended by the blower manufacturer.
 - 1. Inlet Filter
 - 2. Inlet Silencer
 - 3. Inlet Flex Joint
 - 4. Positive Displacement Blower
 - 5. TEFC, Inverter Capable, NEMA Frame Motor
 - 6. V-belt, 1.4 SF
 - 7. OSHA Approved Belt or Coupling Guard
 - 8. Elevated Steel Base
 - 9. Discharge Flex Joint
 - 10. Discharge Silencer

11. Weighted Relief Valve
12. Discharge Check Valve
13. Discharge Pressure Gage
14. Inlet Filter Restriction Indicator
15. Start-up Oil

1.03 START UP

- A. The manufacturer shall provide the services of a factory trained technician to check installation, verify proper operation and train the owner's personnel in proper maintenance procedures. Start-up services shall be a minimum of one day.

1.04 QUALITY ASSURANCE

- A. The blower package will be built by a blower package supplier who has units at 50 or more wastewater treatment plants, the same size or larger than those specified below, that have been in successful operation for fifteen or more years.
- B. All components shall be furnished by a single supplier who shall be responsible for the performance and compatibility of the system.
- C. The blower packager shall be an authorized warranty service center for the blower provided.
- D. Unit shall be Model 900-1320K as manufactured by Republic, or equal.
- E. Blower package supplier must submit an authorization letter from the blower manufacturer, of the blower proposed to be installed, to the project engineer at least 10 workings days before the bid opening for his package to qualify for use on the project. The letter shall state the packager is qualified to design and build blower packages for wastewater treatment plants plus be authorized to perform warranty work.

1.05 STANDARD WARRANTY

- A. The manufacturer will provide a warranty stating that the blower package is warranted to be in accordance with the product specifications mutually agreed upon and to be free from defects in workmanship and materials. The blower package manufacturer's product warranty will extend to all packaged products supplied by the blower package manufacturer whether or not manufactured by the blower package manufacturer. This warranty shall terminate at twelve (12) months in service with the original user or eighteen (18) months from the date of shipment, whichever occurs first.

PART 2 - PRODUCTS

2.01 BLOWER

- A. Blower unit shall be positive displacement type Model URAI Model 59 as manufactured by Roots, or equal. The impellers shall be mounted on a single shaft supported on each end by ball bearings mounted in outboard bearing housings. The blower shall be built from parts cast in patterns from which previous units have been built and tested. The blower shall be of the manufacturers' standard design.

2.02 BLOWER HOUSINGS

- A. The blower housings shall consist of vertically split cast iron intermediate sections held securely between cast iron inlet and outlet heads with high strength steel tie rods. Two-piece fabricated construction with rope packing is not acceptable.
- B. No contact shall be made between the shaft rotor and the housing, other than through the bearings. Where the blower shaft passes through the inlet and outlet heads, suitable carbon graphite ring seals shall be provided to prevent air leakage.
- C. Inlet and outlet connections shall be threaded meeting ANSI standard B1.20.1.

2.03 IMPELLERS

- A. The impellers shall be cast iron involute impellers. Impellers shall butt together directly or through one-piece metal spacers and be securely keyed to the blower shaft.
- B. Impellers shall be individually statically balanced, then assembled to the shaft and the entire rotating element shall be dynamically balanced as an assembly. Blower shall be designed to operate at a maximum vibration level of 1.25 mils in the vertical plane when measured on the bearing housing.

2.04 DIFFUSERS

- A. Diffuser sections that receive air from the impeller and guide the air to the eye of the next impeller shall be provided. Diffusing vanes shall be provided and be an integral part of the intermediate section casting.

2.05 BAFFLE RINGS

- A. Units incorporating baffle rings at the inlet and intermediate sections shall be provided with one-piece stainless steel baffle rings, securely mounted to the head and sections either directly or through one-piece stainless steel mounting brackets.

2.06 SHAFT

- A. Blower shaft shall be fully ground high-grade carbon steel of sufficient diameter to operate at a minimum of 20% below first critical speed. Shaft speed shall not exceed 3600 RPM.

2.07 BEARINGS

- A. Each blower shall be provided with two oil lubricated anti-friction ball bearings.
- B. Bearings shall be sized to provide a bearing life of minimum 10 years per AFBMA B-10 standards.

2.08 BEARING HOUSINGS

- A. Bearings shall be mounted in cast iron outboard mounted bearing housings designed to isolate the bearings from blower temperature. Bearing housings shall be designed to allow removal and replacement of the bearings without dismantling the machine or disconnecting piping.

2.09 BELT DRIVE

- A. The blower shall be connected to the motor through a suitable belt drive. The installing contractor shall check, and if necessary, adjust the belt drive alignment in accordance with manufacturer's instructions. Each belt drive shall be provided with a suitable guard in

compliance with OSHA standards. The diver must be mounted on an adjustable base to permit installing, adjusting and removing the V-belts.

2.10 BASEPLATE

- A. Each blower and motor shall be mounted on a single full-length structural steel baseplate designed for resilient mounting on suitable vibration pads supplied by the blower manufacturer. Baseplate shall not be grouted or bolted to the concrete foundation.

2.11 MOTOR

- A. Positive displacement blowers: 20 horsepower electric motors shall be variable speed, squirrel cage design in accordance with NEMA and IEEE standards. Motors shall be designed to operate at 2850 RPM on 3 phase, 60 cycle, 460-volt electrical supply. Motor shall have a 1.15 service factor and be sized to operate below motor nameplate rating at the specified capacity and design conditions. Motor enclosure shall be TEFC and shall be inverter duty rated. NEMA nominal efficiency shall be a minimum of 93% with a power factor of a minimum of 86%. Motor shall be Baldor Super-E Motor or approved equal.
- B. The capacity of drive motor must be calculated on the basis of air intake temperature of -30 degrees Centigrade (-22 degrees Fahrenheit) or less. The design must include means of controlling the rate of air delivery to prevent overheating or damage to the motor.

2.12 ACCESSORIES

- A. 2" wafer style check valve for low-pressure air service shall be provided for mounting in the blower discharge piping.
- B. 10" inlet filter/silencer shall be provided. Filter element shall be cleanable and replaceable. Filter shall be sized for the specified flow. Filter efficiency shall be minimum 90% on 10 micron particles.
- C. Surge/overload protection panel.
- D. Install VFDs on Blowers.

PART 3 - EXECUTION

3.01 TESTING

- A. Each blower shall be given a mechanical run test at the manufacturer's facility for a minimum of four hours. Blower bearing vibration and temperature shall be checked to ensure compliance with manufacturers standards.
- B. All tests shall conform to ASME Power Test Code and shall extend from surge to beyond rated design flow. ASME tests are not required for blowers built from parts cast in patterns from which previous units have been cast, built and tested.

3.02 INSTALLATION

- A. Blower shall be installed in accordance with manufacturers recommendations. The installing contractor shall provide qualified personnel to check the coupling alignment and make any necessary adjustments. All piping and accessories shall be fully supported to prevent the transmission of excessive forces to the blower connections. Blower shall be installed on suitable resilient foundation pads supplied by the blower manufacturer.

MAG SECTION 11 94 73 – BUBBLE MIXERS

SECTION 11 94 73 – BUBBLE MIXERS

PART 1 - GENERAL

1.01 SCOPE

- A. There shall be furnished:
 - 1. Quantity as shown in the Drawings.
 - 2. All accessories required for proper operation.

1.02 MANUFACTURER

- A. Acceptable manufactures are:
 - 1. Diffused Gas Technologies
 - 2. or approved equal.

1.03 PERFORMANCE

- A. Mixers shall adequately mix the tanks as shown in the Drawings.
- B. Air Flow
 - 1. Blowers will provide air for the mixers. It is anticipated that each mixer will require approximately 25 scfm.

PART 2 - PRODUCTS

2.01 GENERAL DESIGN

- A. The operating principle of the SS Series 1 Plenum Diffuser is a basic rectangular chamber with parallel groups of orifices of two different diameters located on both sides. The holes are defined on three horizontal planes located lengthwise on the sides of the diffuser plenum. The diffuser plenum shall be 304 L stainless steel with a cast end plate.:
- B. Mounting of the diffuser shall be 3/4" NPT male threads.
- C. Miscellaneous: The contractor shall supply all appurtenances necessary for a complete installation.

MAG SECTION 11 94 74 – FINE BUBBLE DIFFUSERS

PART 1 - GENERAL

1.01 SCOPE

- A. There shall be furnished:
 - 1. Quantity as shown in the Drawings.
 - 2. All accessories required for proper operation.

1.02 MANUFACTURER

- A. Acceptable manufactures are:
 - 1. EDI
 - 2. or approved equal.

1.03 PERFORMANCE

- A. Diffusers shall adequately aerate the tanks as shown in the Drawings.
- B. Air Flow
 - 1. Blowers will provide air for the diffusers. It is anticipated that each diffuser will require approximately 10 scfm.

PART 2 - PRODUCTS

2.01 GENERAL DESIGN

- A. The diffusers shall be 9" (230 mm) diameter fine bubble disc diffusers as manufactured by EDI Flex Air.
- B. All diffusers shall be standard ¾" male pipe thread connection that fits any pipe
- C. All diffuser shall have Triple-check valve design prevents entry of liquid/solids into air feed piping •
- D. Diffusers shall be resistant to fouling and plugging for low maintenance •
- E. Diffusers shall have a Glass-filled Polypropylene (GFPP) body for maximum chemical, temperature and UV resistance •
- F. Diffusers shall be standard EPDM membrane,
- G. Diffusers shall be Patented EZ-Seal™ for quick membrane install
- H. Miscellaneous: The contractor shall supply all appurtenances necessary for a complete installation.

MAG SECTION 17 00 00 – BYPASS OF SEWER FLOW

PART 1 - GENERAL

1.01 BYPASS SYSTEM

- A. The CONTRACTOR shall be responsible for continuity of sanitary sewer service during the execution of the work and shall provide temporary means to maintain and handle sewage flow in the existing system as required to complete the necessary construction.
- B. The bypass method shall be of adequate capacity and size to handle all flows without sewage backup. The CONTRACTOR shall be solely responsible for clean-up, repair, property damage costs and claims resulting from failure of the diversion system. The maximum expected flow rate throughout the duration of the work is 350 gpm.

- C. The CONTRACTOR shall submit to the District for approval a description of the proposed bypass methods before any bypass system is erected.
- D. Prior to full operation of the bypass system, the CONTRACTOR shall demonstrate, to the satisfaction of the District, that the bypass system is fully functional and adequate, and shall certify the same, in writing, to the District.
- E. All costs for the bypass system shall be accounted for in the CONTRACTOR's bid.

1.02 SPILL RESPONSE PLAN

- A. Prior to the start of construction, the CONTRACTOR shall develop and submit to the District, for review and approval, a written Spill Response Plan. The Spill Response Plan shall be developed to respond to any construction related sewage spill. This shall include, but is not limited to:
 - 1. The CONTRACTOR shall identify all nearby waterways, channels, catch basins and entrances to underground existing storm drains and furnishing all of the necessary materials, supplies, tools equipment, labor and other services.
 - 2. The CONTRACTOR shall make arrangements for an emergency response unit comprised of emergency response equipment and trained personnel to be immediately dispatched to the Jobsite in the event of a sewage spill.
 - 3. The CONTRACTOR shall develop and include an emergency notification procedure, which includes an emergency response roster with telephone numbers and arrangements for backup personnel and equipment and an emergency notification roster of the design District representatives. The CONTRACTOR shall designate a primary and secondary representative and include their respective phone numbers, pager numbers, and cellular phone numbers. The CONTRACTOR'S representatives shall be accessible and available at all times to respond immediately to any construction related emergency.
 - 4. In case of sewage spill, the CONTRACTOR shall act immediately without instructions from the District, to control the spill and take all appropriate steps to contain it in accordance with their Spill Response Plan. The CONTRACTOR shall immediately notify the District representatives of the spill and all actions taken. The CONTRACTOR shall, within three (3) working days from the occurrence of the spill, submit to the District a written confirmation describing the following information related to the spill: the location on a map; the nature and volume; the date and time; the duration; the cause; the type of remedial and/or preventive actions taken; and the water body impacted and results of any necessary monitoring. Requests for additional compensation for the handling of the spill shall be submitted to the District as a construction claim. The CONTRACTOR shall assure the validity, accuracy, and correctness of the claim under penalty of perjury. The District may institute further corrective actions, as deemed necessary, to fully comply with existing law, ordinance, code, order or regulation. The CONTRACTOR shall be responsible for all costs incurred for the corrective actions.
 - 5. It shall be the CONTRACTOR's responsibility to assure that all field forces, including Subcontractors, know and obey all safety and emergency procedures, including the Spill Response Plan, to be maintained and followed at the Jobsite.

MAG SECTION 26 00 00 – GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. It is the intent of this part of the Contract Documents to cover the work and materials necessary for erecting a complete electrical system, tested and ready for continuous use. The system shall be constructed in accordance with the Contract Documents, and Federal, State, and Local codes and regulations.

1.02 RELATED SECTIONS

- A. The Contractor shall coordinate the work with other trades and furnish and install the equipment in accordance with the manufacturers' requirements.
- B. The Related Work can be found in other Divisions of these specifications, such as, but not limited to:

- 1. Division 0 Procurement and Contracting Requirements
- 2. Division 1 General Requirements
- 3. Division 2 Existing Conditions
- 4. Division 3 Concrete
- 5. Division 9 Finishes
- 6. Division 11 Equipment
- 7. Division 14 Conveying Systems
- 8. Division 23 Mechanical
- 9. Division 24 Instrumentation

1.03 GENERAL PROVISIONS

- A. Minimum sizes of equipment, and electrical devices, are indicated but it is not intended to show every offset and fitting, nor every structural or mechanical difficulty that will be encountered during the installation of the work.
- B. Work indicated on the Plans is approximately to scale, but actual dimensions and detailed Plans should be followed as closely as field conditions permit. Field verification of scale dimensions on Plans is governed by field conditions. Installation of systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination.
- C. Discrepancies indicated on different Plans, between Plans and actual field conditions, or between Plans and Contract Documents shall be promptly brought to the attention of the Engineer for clarification, prior to purchasing and installing equipment.
- D. The alignment of equipment and conduit shall be adjusted to accommodate architectural changes, or to avoid work of other trades, without extra expense to the Owner.
- E. The Contractor shall furnish and install the parts and pieces necessary to the installation of equipment, in accordance with the best practice of the trade, and in conformance with the requirements of these Contract Documents.

- F. Items not specifically mentioned in these Contract Documents, or noted on the Plans, or indicated on reviewed shop drawings, but which are obviously necessary to make a complete working installation, shall be deemed to be included herein.
- G. The Contractor shall layout and install electrical work prior to placing floors and walls. Furnish and install sleeves and openings through floors and walls, required for installation of conduits. Sleeves shall be rigidly supported and suitably packed, or sealed, to prevent ingress of wet concrete. Spacers shall be installed in order to prevent conduit movement. Dimensions indicated for electrical equipment and their installation are restrictive dimensions.
- H. The Contractor shall furnish and install inserts and hangers required to support conduits and other electrical equipment. If the inserts, hangers, sleeves, or other mounting hardware are improperly placed, or installed, the Contractor shall do necessary work, at their own expense, to rectify the errors.
- I. Electrical equipment shall be capable of operating successfully at full rated load, without failure, at an ambient air temperature of 40 degrees C, and specifically rated for the altitude indicated on the Plans. Electrical equipment not rated for operation at that temperature shall be provided with air conditioning to meet the manufacturers' operating temperature.
- J. If any contradictions, contrasts, non-homogeneity, or inconsistency appears, the strictest criteria noted and the collective requirements in any and all of the project documents shall apply.
- K. The Contractor shall perform necessary saw cutting, core drilling, excavating, removal, shoring, backfilling, and other work required for the proper installation of conduits, whether inside, or outside of the buildings and structures. The Contractor shall repair and patch where demolition has taken place in a manner to match existing original structure.

1.04 REGULATIONS, CODES, AND STANDARDS

- A. Electrical work, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the latest published regulations, codes, and standards, of the following:
 - 1. National Electrical Code (NEC)
 - 2. State and local codes
 - 3. Institute of Electrical and Electronic Engineers (IEEE)
 - 4. American National Standards Institute (ANSI)
 - 5. American Society for Testing and Materials (ASTM)
 - 6. Insulated Cable Engineers Association (ICEA)
 - 7. National Electrical Manufacturers Association (NEMA) Standards
 - 8. Federal Occupational Safety and Health Act (OSHA)
 - 9. National Fire Protection Association (NFPA)
- B. When applicable, the material used in the performance of the electrical work shall be listed by the Underwriters' Laboratories, Inc. (UL) for the class of service for which they are intended.

1.05 SUBMITTALS

- A. It is the obligation of the Contractor to organize their work, so that a complete electrical, instrumentation, and control system for the facility will be provided, and will be supported by accurate shop and record drawings, and O&M manuals.
- B. The Contractor shall submit detailed shop drawings and data prepared and organized by the suppliers. The quantity of submittal sets required shall be as specified in the Contract Documents.
- C. The submittals shall be neatly grouped and organized by specification section number, and sub-section. Related information shall be highlighted, and the specific product shall be marked. All submittals shall be complete and presented in one package. Incomplete submittals will be returned without review. If a portion of the project requires a fast track schedule, that portion only may be submitted earlier under a separate cover letter. The following shall be submitted to the Engineer and returned, reviewed to the Contractor before fabrication is started.
 1. A complete list of the equipment and materials, including the manufacturer's name, product specification, descriptive data, technical literature, performance charts, catalog cuts, installation instructions, and spare part recommendations for each different item of the equipment specified. The above shall clearly show all the specified requirements as described in the Specifications including but not limited to specific U.L. and NEMA rating, technical capabilities, test result verifications, Seismic Zone rating, and acceptance letters.
 2. Drawings containing complete wiring and schematic diagrams, control diagrams, and any other details required to demonstrate that the system has been coordinated and will operate as intended. Drawings shall also show proposed layout, anchoring, support, and appurtenances of equipment, and equipment relationship to other parts of the work including clearances for maintenance and operations.
 3. Any exceptions to these specifications, with the reasons for requesting such exceptions, with calculations and drawings for redesign of related components, including detail drawings showing internal and assembly details, with installation instructions. Proposed layout showing any modifications or exceptions to related work made necessary by this work, with calculations and drawings showing such modifications or exceptions.
 4. Prior to project acceptance, The Contractor shall submit "Record Drawings" of the electrical, control, and instrumentation, along with step-by-step procedure manuals for the installation, operation start-up, and maintenance of the equipment. Each set shall include installation, operating, troubleshooting, and maintenance and overhaul instructions in complete detail. It shall also include possible breakdowns and repairs, and troubleshooting guides, as well as simplified wiring and control diagrams of the system installed. This shall provide the Owner with comprehensive information on all systems and components to enable operation, service, maintenance and repair. Exploded or other detailed views of all equipment, devices, assemblies, and accessory components shall be included, together with complete parts lists and ordering instructions.
 5. Record Drawings:
 - a. The Contractor shall maintain a marked up set of Contract Document Plans showing actual installed circuit numbers, conduit sizes, cable tray routing, number of

conductors, conductor sizes (larger than #12 AWG), and all other deviations from the design Plans.

- b. Underground conduit and concealed items shall be dimensioned on the Plans from permanent, visible, building features.
- c. The Contractor shall provide actual motor size, starter size, and overload heater size, along with all other protective equipment for all 480 V and motor circuits as part of the one-line record drawings.
- d. The Contractor shall revise all conductor identification and panel schedules to indicate as-built conditions.

PART 2 - PRODUCTS

2.01 MATERIALS AND METHODS

- A. Materials, equipment, and parts comprising any unit, or part thereof, specified or indicated on the Plans, shall be new and unused, of current manufacture, and of highest grade consistent with the state of the art. Damaged or dirty materials, equipment, and parts, are not considered to be new and unused, and will not be accepted.
- B. Field verification of scale dimensions on Plans is directed, since actual locations, distances, and levels will be governed by actual field conditions. The Contractor shall also review architectural, structural, yard, mechanical, and other Plans, and the accepted electrical and mechanical shop drawings, and shall adjust their work to conform to the conditions indicated therein.
- C. The fabricator of major components, such as distribution panelboards, switchgear, and motor control centers, shall also be the manufacturer of the major devices therein. Were possible, the major components shall be manufactured and supplied by the same fabricator.
- D. Refer to various Division sections for individual equipment manufacturers. Indicated manufacturers are subject to strict compliance with the specifications and complete project documents. The reference to a particular manufacturer does not relieve the Contractor from conforming to the specified requirements.

2.02 NAMEPLATES

- A. Where indicated elsewhere in these specifications, or on the Plans, the Contractor shall furnish and install nameplates, which shall be white laminate with black letters. The nameplates shall be fastened to the various devices with round head stainless steel screws. Each disconnecting means for service, feeder, branch, or equipment conductors shall have nameplates indicating its purpose.

2.03 EQUIPMENT ASSEMBLIES

- A. Equipment assemblies, such as Service Entrance Sections, Switchgear, Switchboards, Control and Distribution Panels, and other custom fabricated electrical enclosures shall bear a UL label as a complete assembly. The UL label on the individual components making up the assembly will not be considered sufficient to meet the present requirement. Whenever a generic UL label does not apply for the assembly, a serialized UL label shall be affixed to the assembly, and the serial number shall be submitted with the assembly record shop drawings.

- B. Custom fabricated electrical control panels, and enclosures, shall bear a serialized UL or ETL label affixed by a local inspector, and the serial number shall be submitted with the assembly record shop drawings.

2.04 SEISMIC RESTRAINT

- A. The construction area is classified by the Uniform Building Code (UBC) as Seismic Zone III. The Code requires that not only the structures, but also major electrical components be designed and installed in a manner which will preclude damage during a seismic event. All electrical equipment shall be securely anchored and seismic braced in accordance with regulations contained in the most recent adopted edition of the UBC, and the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) "Guidelines for Seismic Restraints of Electrical Systems".
- B. Units mounted and secured directly to structure shall be provided with connectors of sufficient strength to meet the restraining criteria.
- C. All electrical equipment which is securely anchored (hard mounted) to the building or structure shall have supports designed to withstand lateral and vertical "G" loadings equal to or greater than UBC requirements and SMACNA guidelines.
- D. Shop drawings are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, load/deflection data, center of gravity, standard connections, manufacturer's recommendations, and behavior problems (vibration, thermal, expansion, etc.) associated with equipment.

PART 3 - EXECUTION

3.01 UTILITY SERVICE AND EQUIPMENT

- A. The Contractor shall be responsible for contacting and coordinating the electrical utility work with the electrical utility company. The Contractor shall be responsible for furnishing and installing equipment and material required to bring electrical power service to the service location in conformance with the electrical utility requirements. The Contractor may have to provide the following for the electrical utility company's primary (from utility power line to the utility transformer) and secondary (from utility transformer to the service) electrical lines in accordance with the electrical utility company's specifications and requirements:
 1. Conduits and cables (verify quantity and sizes)
 2. Trenching, backfill, and compacting (verify trench size(s), backfill material, and compaction percentage requirements)
 3. Concrete pad(s) (for pad mounted transformer(s))
 4. Cable protection along the vertical drop at the utility company's pole (if pole mounted transformer(s))
 5. Other items required by the power utility company's specifications
 6. The Contractor shall also submit copies of service entrance shop drawings to the utility, per utility submittal requirements, prior to submittal to the Engineer. The Contractor shall obtain written approval from the power utility company that the service entrance equipment is acceptable prior to release the order to the supplier for fabrication. A copy

of the approval letter from the utility shall be transmitted to the Engineer along with the submittal.

3.02 INSTALLATION OF ELECTRICAL EQUIPMENT

- A. Coordinate the installation of electrical equipment with other trades.
 - 1. Arrange for the building in of equipment during structure construction.
 - 2. Where equipment cannot be built-in during construction, arrange for sleeves, box-outs, and other openings, as required to allow installation of equipment after structure construction is complete.
- B. Verify that equipment will fit support layouts indicated.
- C. Equipment Dimensions and Clearances:
 - 1. Do not use equipment that exceeds the indicated dimensions.
 - a. Except as approved in writing by the Engineer.
 - 2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.
- D. Install equipment in accordance with the manufacturer's instructions.
- E. Equipment Access:
 - 1. Install equipment so it is readily accessible for operation and maintenance.
 - 2. Equipment shall not be blocked or concealed.
 - 3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.
- F. Equipment shall be installed plumb, square and true with the building construction, and shall be securely fastened.
- G. Outdoor wall-mounted equipment, and indoor equipment mounted on earth, or water bearing walls, shall be provided with corrosion-resistant spacers to maintain ¼-inch separation between the equipment and the wall.
- H. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.
- I. Equipment fabricated from aluminum shall not be imbedded in earth or concrete.
- J. Provide all necessary anchoring devices and supports.
 - 1. Use supports as detailed on the Plans and as specified.
 - 2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.
 - 3. Hardware shall be stainless steel.
 - 4. Do not cut, or weld to, building structural members.

5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

K. Contractor shall verify exact rough-in location and dimensions for connection to electrical items furnished by others.

1. Shop drawings shall be obtained from those furnishing the equipment.
2. Proceeding without proper information may require the Contractor to remove and replace work that does not meet the conditions imposed by the equipment supplied.
3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the Engineer.
4. Should any cutting and patching be required on account of failure of the Contractor to coordinate penetrations, such cutting and patching shall be done at the expense of the Contractor.
 - a. The Contractor shall not endanger the stability of any structural member by cutting, digging, chasing, or drilling and shall not, at any time, cut or alter the work without the Engineer's written consent.
 - 1) Provide additional reinforcing if required.
 - 2) Cutting shall be done neatly using proper tools and methods.
 - b. Subsequent patching to restore walls, ceilings, or floors to their original condition shall be done by the Contractor.

L. Provide concrete foundations or pads required for electrical equipment as indicated or specified.

1. Floor-mounted equipment shall be mounted on a 3-inch concrete housekeeping pad unless otherwise noted on the drawings. Pad shall be poured on top of the finished floor or slab. Contractor shall verify the distance to all equipment from the finished floor meets the current NEC requirements. All modifications shall be made to the electrical equipment as required.
2. All conduits penetrating concrete floors shall have a 3-inch concrete housekeeping pad unless otherwise noted on the drawings. Conduits should be grouped as allowed to limit the number of housekeeping pads required.

3.03 TEMPORARY POWER

- A. The Contractor shall furnish, install, and maintain, temporary power and lighting systems needed for construction. This temporary system shall include weatherproof panel(s) for the Contractor's main breakers and distribution system. Ground fault interrupting equipment shall be installed. Connections shall be watertight, with wiring done with Type SO portable cable. After construction is completed, the Contractor shall remove temporary power equipment and devices.

3.04 CUTTING AND REPAIRING

- A. Where it becomes necessary to cut into existing work for the purpose of making electrical installations, core drills shall be used for making circular holes. Other demolition methods for cutting or removing shall be reviewed by the Engineer prior to starting the work.
- B. The Contractor shall repair damage caused by construction, or demolition work, and restore damaged areas to original condition.

3.05 CORROSION PROTECTION

- A. Wherever dissimilar metals, except conduit and conduit fittings, come in contact, the Contractor shall isolate these metals, as required, with neoprene washers, 9 mil polyethylene tape, or gaskets. Where fastening conduit, electro plated, or equivalent fasteners and stainless steel bolts shall be used.
- B. Factory finishes damaged during shipping, or construction, shall be restored to original new condition. Rust shall be removed, and bare metal surfaces shall be primed and painted to match the original surrounding finish.
- C. Electrical panels, switchgear, motor control centers, and other electrical equipment, shall be shipped in sealed dust and moisture proof plastic sheet enclosures, and the seal maintained until units are installed. Said units shall be new and free of any dirt, dust, water, grease, rust, damaged parts or components. Relays, starters, circuit breakers, switches, contacts, insulators, mechanisms, and buses shall be free of dust, dirt, oil, moisture, metal shavings, and other debris before testing and energizing.
- D. Equipment shall be protected at all times with plastic sheet covers until the area is free of dirt, dust, paint spray, water, heat, and other trades. Heat shall be provided to eliminate condensation. All repairs due to storage will be the responsibility of the contractor.

3.06 COORDINATION OF THE ELECTRICAL SYSTEM

- A. The Contractor shall verify actual equipment, and motor full load, and locked rotor current ratings. The necessary minimum equipment, wire, and conduit sizes are indicated on the Plans. If the Contractor furnishes equipment of different ratings, the Contractor shall coordinate the actual current rating of equipment furnished with the branch circuit conductor size, the overcurrent protection, the controller size, the motor starter, and the branch circuit overcurrent protection. The branch circuit conductors shall have a current carrying capacity of not less than 125 percent of the actual full load current rating. The size of the branch circuit conductors shall be such that the voltage drop from the overcurrent protection devices, up to the equipment, shall not exceed 2 percent, when the equipment is running at full load and rated voltage.

3.07 TESTING

- A. The electrical work shall be free from improper grounds, and from short circuits. The correctness of the wiring shall be verified first by visual comparison of the conductor connections with connection diagrams. Next, individual circuit continuity checks shall be made by using electrical circuit testers. Last, the correctness of the wiring shall be verified by the actual electrical operation of the electrical and mechanical devices. Any deviation from the wiring indicated on the Plans, or accepted Drawings, shall be corrected and indicated on the record drawings.

- B. Each conductor shall be identified as required by the Contract Documents. This identification shall be indicated on the record drawings to enable rapid and accurate circuit tracing by maintenance personnel.

3.08 ONE-LINE DIAGRAMS

- A. One-line diagrams, as indicated on the Drawings, show circuit voltages, circuit protection rating, and other pertinent data. Where conflicts exist on the Drawings, the one-line diagrams shall take precedence. Grounding conductors are not necessarily indicated. See grounding requirements specified elsewhere herein.

MAG SECTION 26 05 05 – CONDUITS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish and install conduits as required, and as shown on the Plans. Materials employed shall be as shown on the Plans.

1.02 SUBMITTALS

- A. Submit product literature including manufacturer part number, model number, material, size, and specifications. Material shall not be installed until the Engineer has reviewed the submittal data.
- B. Shop Drawings shall be submitted for review and acceptance showing routing, conduit size, and number and size of wires in each conduit before installation of conduit and any related work.
- C. Proposed routing of conduits buried under floor slabs-on-grade.
- D. Identify conduit by tag number of equipment served or by circuit schedule number.
- E. Proposed routing and details of construction including conduit and rebar embedded in floor slabs, columns, etc. Identify conduit by tag number of equipment served or by circuit schedule number.
- F. Proposed location and details of construction for openings in slabs and walls for raceway runs.
- G. Refer to Section 26 00 00 for further submittal requirements.

1.03 REFERENCES

- A. American National Standards Institute (ANSI): C80.1, Rigid Steel Conduit - Zinc-Coated.
- B. National Electric Manufacturers Association (NEMA): RN-1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit.
- C. Underwriters Laboratories Inc. (UL):
 - 1. 1, Flexible Metal Conduit.
 - 2. 6, Rigid Metal Conduit.
 - 3. 360, Liquid-Tight Flexible Steel Conduit.

4. 467, Grounding and Bonding Equipment.
5. 514, Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers.
6. 651, Schedule 40 and 80 Rigid PVC Conduit.
7. 870, Wireways, Auxiliary Gutters, and Associated Fittings.
8. 884, Underfloor Raceways and Fittings.
9. 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

PART 2 - PRODUCTS

2.01 RACEWAYS

- A. Exposed conduit in an unclassified or hazardous area shall be galvanized rigid steel (GRS) unless specifically indicated otherwise on the Plans. Conduits in the corrosive areas shall be PVC coated GRS unless otherwise indicated. Underground and/or concrete encased conduits shall be PVC, unless otherwise indicated. All wiring, except as otherwise noted, shall be in conduit. Conduit size shall not be less than the National Electrical Code (NEC) size required for the conductors therein and shall not be smaller than 3/4 inch. No underground conduit shall be less than one inch.
- B. Condulet type fittings shall be Crouse Hinds, Appleton, or equal with wedge nut covers. All condulets located outdoors or in wet locations shall be weathertight.
- C. In unclassified areas, flexible conduit shall be grounding type, weatherproof, corrosion resistant, and watertight.
- D. Couplings, connectors, and fittings shall be standard types specifically designed and manufactured for the purpose. They shall be installed to provide a firm mechanical assembly and electrical conductivity throughout.
- E. Expansion fittings shall be OZ type AX with jumper for exposed locations and type DX at structural expansion joints, Spring City, or equal. Conduits shall have expansion fittings in accordance with NEC.
- F. The conduits and fittings shall be supported per NEC requirements as a minimum.

2.02 GALVANIZED RIGID STEEL (GRS)

- A. Conduit and couplings shall be hot dipped galvanized with zinc coated threads and outer coating of zinc bichromate, in accordance with ANSI C80.1 standards, as manufactured by Jones & Laughlin Steel Corporation, Allied Tube & Conduit Corporation, Triangle PWC, or equal.
- B. Steel conduit shall not be buried in earth without concrete encasement and additional corrosion protection. A half lapped rapping of 20 mil PVC based corrosion protection tape shall be used.

2.03 PVC COATED GALVANIZED RIGID STEEL (PVC-GRS)

- A. PVC coated GRS conduit shall be installed where shown on the Plans or elsewhere specified and shall conform to NEMA RN-1 and ANSI C80.1 standards.
- B. The zinc surface of the conduit shall remain intact and undisturbed on both the inside and the outside of the conduit throughout the preparation and application processing. A Polyvinyl

Chloride (PVC) coating shall be bonded to the galvanized outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 0.040 inch (40 mil).

- C. A loose coupling shall be furnished with each length of conduit. A PVC coating shall be bonded to the outer surface of the coupling and a PVC sleeve equal to the outside diameter of the uncoated conduit shall extend beyond both ends of the coupling approximately one pipe diameter or 1 1/2 inches, whichever is smaller. The wall thickness of the coating on the coupling and the sleeve shall be a minimum of 0.055 inch (55 mil).
- D. A PVC coating shall be bonded to the inner and outer surface of all conduit bodies and fittings and a PVC sleeve shall extend from all hubs. The wall thickness of the coating on conduit bodies and fittings and the sleeve walls shall be identical to those on couplings in length and thickness. The covers on all conduit bodies shall be coated on both sides and shall be designed to be completely interchangeable. The inside of conduit bodies shall remain undisturbed in the processing.
- E. Type 304 stainless steel screws shall be furnished and used to attach the cover to the conduit body. All coated material shall be installed and patched according to the manufacturer's recommended installation and patching instructions.
- F. Conduit straps shall be PVC coated or stainless steel.
- G. PVC coated conduit and fittings shall be as manufactured by Kor Kap Corporation, Occidental Coating Company, Rob-Roy, or equal.
- H. PVC coated flexible conduits shall be liquid and vaportight and manufactured in accordance with UL 360 standards.

2.04 RIGID NONMETALLIC - PVC

- A. Where specifically indicated on the Plans, or elsewhere specified, conduit may be high density Schedule 40, 90 degrees C, heavy-duty PVC. The conduit shall be manufactured from virgin polyvinyl chloride compound which meets ASTM D1784, NEMA TC-2, ANSI C33.91, and UL 651 standards. Smoke emissions shall be limited to less than 6 grams per 100 grams of material tested.
- B. Where conduit concrete encasement is indicated on the Plans, conduit supports shall be installed at five-foot intervals. PVC conduit shall be manufactured by Carlon, Triangle Conduit & Cable, or equal.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Liquidtight flexible metal conduit shall be liquid and vaportight, oil and ultraviolet ray resistant and manufactured in accordance with UL 360 standards. Liquidtight flexible metal conduit shall be formed of a continuous, spiral wound, galvanized steel core with an extruded PVC jacket. The PVC jacket shall be rated for high ambient heat applications, 90 degrees Celsius.
- B. For corrosive locations, liquidtight flexible metal conduit shall be formed of a continuous, spiral wound, aluminum core with an extruded PVC jacket. The PVC jacket shall be impervious to corrosive liquids and vapors.

- C. An external bonding conductor shall be required for flexible conduit connections containing circuits rated at 60 amps or greater and for sizes 1 1/2 " or larger. Flexible conduit and connectors for 1 1/4 " and smaller shall be listed for grounding.
- D. Connectors for liquidtight flexible conduit shall be galvanized, furnished with a sealing ring and locknut, and suitable for wet locations.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Conduit runs are schematic only, and shall be modified as required to suit field conditions, subject to review and acceptance by the Engineer.
- B. Conduit shall run continuously between outlets and shall be provided with junction boxes where connections are made. Couplings, connectors, and fittings shall be acceptable types designed and manufactured for the purpose, and shall provide a firm mechanical assembly, and electrical conductivity throughout.
- C. Conduit runs shall be straight and true. Elbows, offsets, and bends shall be uniform and symmetrical. Changes in direction shall be made with long radius bends, or with fittings of the conduit type.
- D. Conduit runs in buildings and structures shall be exposed except as specifically noted or accepted by the Engineer.
- E. Conduit runs shall not interfere with the proper and safe operation of equipment and shall not block or interfere with ingress or egress, including equipment removal hatches.
- F. Exposed conduits shall be securely fastened with clamps, or straps, intended for conduit use. All exposed conduit shall be run on the walls and ceiling only and shall be parallel to the planes of the walls or ceiling. No diagonal runs will be permitted. Flexible conduit shall be used only for short lengths required to facilitate connections between rigid conduit to motors from junction boxes, or control equipment. The maximum length of flexible conduit shall be 3 feet.
- G. Conduit runs on water bearing walls shall be supported one inch away from the wall on an accepted channel. When channel galvanizing, or other coating, is cut or otherwise damaged, it shall be field coated to original condition. No conduit shall be run in water bearing walls, unless specifically designated otherwise.
- H. Conduit shall be thoroughly reamed to remove burrs. IMC or GRS shall be reamed during the treading process, and Rigid Nonmetallic PVC shall be reamed before applying fittings. A zinc rich cold galvanizing shall be used to restore corrosion protection on field cut threads. Bushings and lock nuts or hubs shall be used at conduit terminations. The total number of bends in any run between pull points shall not exceed 360 degrees. Junction boxes and pull boxes shall be installed at points acceptable to the Engineer. Conduit ends shall be plugged to prevent the entrance of moisture or debris during construction. All spare conduits shall be adequately capped and shall contain a suitable pull string.
- I. Joints shall be set up tight. Hangers and fastenings shall be secure, and of a type appropriate in design, and dimensions, for the particular application.
- J. Conduit runs shall be cleaned and internally sized (obstruction tested) so that no foreign objects, or obstructions remain in the conduit prior to pulling in conductors.

- K. After installation of complete conduit runs 2 inches and larger, conduits shall be snaked with a conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit. Conduits through which the mandrel will not pass shall not be used.
- L. Expansion fittings shall be installed across all expansion joints and at other locations where necessary to compensate for thermal expansion and contraction.
- M. Provide trenching, backfill, and compaction for conduits installed underground.

MAG SECTION 26 05 17 – LOW-VOLTAGE CABLES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section covers the furnishing and installation of 600 Volt Class cables and conductors, terminations and splicing, and pulling lubricants.

1.02 SUBMITTALS

- A. Products shall be submitted in accordance with Section 26 00 00, and elsewhere in the Contract Documents, prior to installation.

1.03 REFERENCES

- A. Insulated Cable Engineers Association/National Electrical Manufacturers Association (ICEA/NEMA):
 - 1. S-68-516/WC 8, ethylene-propylene rubber-insulated wire and cable for the transmission and distribution of electrical energy.
 - 2. S-61-402/WC 5, thermoplastic-insulated wire and cable for the transmission and distribution of electrical energy.
 - 3. S-66-524/WC 7, cross-linked thermosetting-polyethylene-insulated wire and cable for transmission and distribution of electrical energy.
- B. Underwriters Laboratory, Inc.
 - 1. 44, rubber insulated wires and cables.
 - 2. 83, thermoplastic-insulated wires and cables.
 - 3. 486A, wire connectors and soldering lugs for use with copper conductors.
 - 4. 486B, wire connectors for use with aluminum conductors.
 - 5. 510, insulating tape.
- C. National Electric Code
- D. Insulated Cable Engineers Association

PART 2 - PRODUCTS

2.01 ACCEPTED MANUFACTURERS

- A. Conductors and Multi Conductor Cables (MCC), subject to compliance with Contract Documents, the following manufacturers are acceptable: American Insulated Wire Corporation, Cablec Corporation, Okonite Company, Southwire Company, or equal.

2.02 CONDUCTORS

- A. Wire sizes shall be American Wire Gauge (AWG) sizes with Class B stranded construction. Number 2 AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored tape. Conductors sized No. 1 and larger shall be Type 2, rated for 90 degrees C. All circuit conductors, #6 or smaller shall be "THWN" stranded copper. All other conductors shall be "XHHW" stranded copper.
- B. Individual or multiple conductor cables for power, control, and alarm circuits of 480 volts or less shall be insulated for not less than 600 volts and shall have insulation type as indicated on the Plans. "THHW" shall conform to ICEA S-61-402/NEMA WC 5 and UL 83 and "XHHW" shall conform to ICEA S-66-524/NEMA WC 7 and UL 44. Where wire size is not indicated, they shall be of the size required by the NEC, except that no wire external to panels and motor control centers shall be less than No. 12 AWG, unless specifically noted on the Plans. Panel control wiring shall not be less than No. 14 AWG.
- C. All wiring shall be as indicated on the Plans. Wires shall be new and shall be soft drawn copper with not less than 97 percent conductivity. The wire and cable shall have size, grade of insulation, voltage, and manufacturer's name permanently marked on the outer covering at not more than 2-foot intervals. All wires shall conform to the latest Standards of the ASTM, and ICEA, and shall be tested for their full length by these Standards. Insulation thickness shall be not less than that specified by the National Electrical Code.

2.03 TERMINATIONS AND SPLICES

- A. Cable shall be rated 600 volts. Other parts of cable systems such as splices and terminations shall be rated at not less than 600 volts. Splicing shall join conductors mechanically and electrically to provide a complete circuit prior to installation of insulation.
- B. Splices in wires No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, Type I, Class 1, Grade B, Style G, or Type II, Class 1 of FS W-S-610 and conforming to the applicable requirements of UL 486A.
- C. Splices in wires No. 8 AWG and larger shall be made with non-insulated, solderless, pressure type connector, Type II, Class 2 of FS W-S-610, conforming to the applicable requirements of UL 486A and UL 486B. They shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket.
- D. Insulated conductor splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.
- E. Bare conductor splices in wet locations or below grade shall be of the exothermic type.

2.04 PULLING LUBRICANT

- A. All cables shall be properly coated with pulling compound (Aqua Gel, Polywater, or equal) before being pulled into conduits so as to prevent mechanical damage to the cables during installation. "Yellow 77" is not acceptable.
- B. Other lubricants to be substituted must be accompanied by a statement from the cable manufacturer as to its acceptable use with the cable being installed.

2.05 IDENTIFICATION

- A. All conductors shall be numbered with "tube sleeve" type tags with heat impressed letters and numbers.
- B. Color code all wiring as follows:

- 1. Lighting and power wiring:

	<u>120/208 VAC</u>	<u>480VAC</u>	<u>24V DC</u>	<u>120 VAC</u> <u>Control/Power</u>
a. Phase 1	Black	Brown	Blue	Red
b. Phase 2	Red	Orange		
c. Phase 3	Blue	Yellow		
d. Neutrals	White	White		White

- 2. Color code ends of feeder phase conductors only.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The pulling tension and side wall pressures, as recommended by the cable manufacturer, shall not be exceeded.
- B. As far as practical, all circuits shall be continuous from origin to termination without splices in intermediate pull boxes. Sufficient slack shall be left at the termination to make proper connections. In no case shall a splice be pulled into the conduit. Conductor splicing shall not be permitted without the Engineer's approval.
- C. Install all cables in conduit.
- D. Each feeder and branch circuit shall be installed in its own individual conduit unless combining feeder and branch circuits is permitted as defined in the following:
 - 1. As specifically indicated on the Plans.
 - 2. For lighting, multiple branch circuits may be installed in a conduit as allowed by the NEC and with the wire ampacity de-rated in accordance with the requirements of the NEC. Conduit fill shall not exceed the limits established by the NEC.
 - 3. When field conditions dictate and written permission is obtained from the Engineer.
- E. Feeder and branch circuits shall be isolated from each other and from all instrumentation and control circuits.
- F. Control circuits shall be isolated from all other feeder, branch and instrumentation circuits, except as noted above.
 - 1. 12 V DC, 24 V DC and 48 V DC control circuits may be combined in common conduit.

2. 125 V DC control circuits shall be isolated from all other DC and AC control circuits.

3. 120 V AC control circuits shall be isolated from all DC control circuits.

G. Make splices only at pull or junction boxes.

1. Crimp or indented-type connectors are not allowed, except for control circuits landed on terminal strips.

MAG SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Electrical identification work specified in this section covers the following:

1. Buried cable warnings
2. Electrical power, control and communication conductors
3. Operational instructions and warnings
4. Danger signs
5. Equipment/system identification signs

1.02 SUBMITTALS

A. Submittals to the engineer shall include the following:

1. Manufacturers data on electrical identification materials and products.
2. Samples of each color, lettering style and other graphic representation required for each identification material or system.

1.03 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering electrical identification products maybe incorporated in the work include, but not limited to, the following:

1. Brady, W.H. Co.
2. Ideal Industries, Inc.
3. Panduit Corp.
4. Or equal

1.04 QUALITY COMPLIANCE

- A. Comply with applicable requirements of UL Std. 969, "Marking and Labeling Systems", pertaining to electrical identification systems.
- B. Comply with applicable requirements of NEMA Std. No's WC-1 and WC-2 pertaining to identification of power and control conductors.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

2.02 COLOR-CODED CONDUIT MARKERS

- A. Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits; designed for attachment to conduit by adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pretensioned snap-on. Except as otherwise indicated, provide lettering that indicates voltage of conductor(s) in conduit. Provide 8" minimum length for 2" and smaller conduit, 12" length for larger conduit.
- B. Unless otherwise indicated or required by governing regulations, provide white markers with black letters.

2.03 CABLE AND CONDUCTOR WIRE MARKERS

- A. Cable and conductor wire markers shall be self laminating vinyl on white background, printed using a Brady TLS2200 printer, Seton printer, or equal. Handwritten wire markers are not acceptable.

2.04 SELF-ADHESIVE PLASTIC SIGNS

- A. Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., 208V, EXHAUST FAN, RECTIFIER.
- B. Unless otherwise indicated or required by governing regulations, provide white signs with black lettering.

2.05 LETTERING AND GRAPHICS

- A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.
- B. Where identification is to be applied to surfaces that require finish, install identification after completion of painting.
- C. Comply with governing regulations and requests of governing authorities for identification of electrical work.

3.02 CONDUIT IDENTIFICATION

- A. Where electrical conduit is exposed in spaces with exposed mechanical piping that is identified by a color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated, use white as coded color for conduit.

3.03 CABLE/CONDUCTOR IDENTIFICATION

- A. Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

3.04 EQUIPMENT/SYSTEM IDENTIFICATION

- A. Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication-control-signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
 - 1. Panelboards, electrical cabinets and enclosures.
 - 2. Access panel/doors to electrical facilities.
 - 3. Major electrical switchgear.
- B. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with brass or stainless steel screws, except use adhesive where screws should not or cannot penetrate the substrate.

3.05 CIRCUIT IDENTIFICATION

- A. The 3 phase wires shall be identified at the switchgear, panelboards and motor control centers as Phases A, B, and C. At 277/480V, Phase A shall be brown, Phase B shall be orange, and Phase C shall be yellow. The neutral shall be gray.
- B. In addition to color coding all conductors, each conductor shall be identified in each pull box, manhole, panelboard, cable tray, or termination with circuit identification markers. This identification is applicable to all power, control, alarm, and instrumentation conductors and these markings shall be recorded on the Record Documents. Markers shall be slip on PVC sleeve type as manufactured by Brady, Seton, or equal.
- C. Markers for other cabling shall be B 292 vinyl as manufactured by Brady, Seton, or equal.
- D. Exposed medium voltage conduits shall be labeled at 50-foot intervals with 1-inch letters stating the voltage - example - "12,470 volts". Labels shall be vinyl plastic as manufactured by Brady, Seton, or equal.

3.06 AUTOMATIC EQUIPMENT WARNING SIGNS

- A. Permanent warning signs shall be mounted at all mechanical equipment that may be started automatically or from remote locations. Signs shall be in accordance with OSHA regulations and shall be suitable for exterior use. The warning signs shall be fastened with round head brass screws or bolts, located and mounted in a manner acceptable to the Engineer.
- B. Warning signs shall be 7 inches high by 10 inches wide, colored yellow and black, on not less than 18 gauge vitreous enameling stock. Sign shall read:

CAUTION
THIS EQUIPMENT STARTS
AUTOMATICALLY
BY REMOTE CONTROL

3.07 HIGH VOLTAGE WARNING SIGNS

- A. Permanent and conspicuous warning signs shall be mounted on all equipment, doorways to equipment rooms, pull boxes, manholes, where the voltage exceeds 600 volts.
- B. Signs shall be in accordance with OSHA regulation and shall be suitable for exterior use. The warning signs shall be fastened with round head brass screws or bolts, located and mounted in a manner acceptable to the Engineer.
- C. Signs shall be 7 inches high by 10 inches wide, colored red and white, on not less than 18 gauge vitreous enameling stock. Sign shall read:

WARNING
HIGH VOLTAGE
KEEP OUT

3.08 CONDUCTOR FASTENERS

- A. Glue-on type conductor fasteners shall not be used in any panels, panelboards, switchboards, switchgear, motor control centers, or other enclosures containing electrical devices and/or conductors.

MAG SECTION 26 27 16 – ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This specification includes enclosures to house electrical controls, instruments, terminal blocks, and serve a junction boxes where shown on the Plans.

1.02 SUBMITTALS

- A. Products shall be submitted in accordance with Section 26 00 00, and elsewhere in the Contract Documents, prior to installation.

1.03 MANUFACTURERS

- A. Enclosures shall be manufactured by Hoffman, Rittal, or equal.

PART 2 - PRODUCTS

2.01 STEEL

- A. Enclosures shall be fabricated from 14 gauge steel with seams that are continuously welded. Doors shall have full length piano hinges with the door removable by pulling the hinge pin.
- B. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. The gasket shall be attached with oil resistant adhesive and held in place with steel retaining strips. Exterior hardware, such as clamps, screws, and hinge pins, shall be of stainless steel for outdoor installations. A hasp and staple shall be provided for padlocking. Each enclosure shall have a print pocket. All wires entering or leaving the enclosure shall terminate on terminal strips. All wires and terminals shall be clearly identified as specified elsewhere in these specifications.
- C. Finish shall be white enamel interior, light gray enamel, ANSI 61 exterior, over phosphatized surfaces. Special finishes and colors shall be furnished for wet locations. Plans should be checked for special conditions.

2.02 NEMA RATING

- A. Unless otherwise indicated on the Plans, enclosures shall be NEMA 12 for indoors, NEMA 4X for corrosive areas, and NEMA 4 for outdoor installations. NEMA 4X enclosures shall be fiberglass or polycarbonate unless noted otherwise. NEMA 4 enclosures shall also be used in wet or wash down areas.

2.03 FIBERGLASS

- A. Enclosures shall be heavy-duty, compression molded, fiberglass reinforced polyester, high impact, heat resistant, NEMA 4X.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Enclosures shall be installed as indicated on the Plans, and according to manufacturer's instructions.
- B. Enclosures shall be properly grounded and shall include ground straps connected to hinged doors and accessories.

MAG SECTION 26 29 23 VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Variable Frequency Drive (VFD) systems rated 480 VAC or lower.

1.02 VFD FEATURES

- A. The VFDs shall be provided with the following features:
 - 1. Fused control circuit transformer.

2. Provision for 4 to 20 mA input speed reference signal.
3. Electrically isolated auxiliary contacts for ready, running, and trouble status.
4. Adjustable minimum/maximum frequency limits.
5. Independent timed linear acceleration and deceleration.
6. Adjustable motor slip compensation based on motor current.
7. Terminal blocks for control and signal wires entering and leaving the controller.
8. Output transistors shall be insulated gate bipolar transistors (IGBT) type, or Darlington pair.
9. Current limit.
10. Programmable automatic restart.
11. 4 to 20 mA output signal proportional to VFD output frequency.
12. Digital keypad for configuration, programming, local control, and monitoring.
13. Microprocessor-based control for system logic sequencing functions.
14. VFD shall be 18-pulse or 6-pulse equipped with a harmonic filter so as to satisfy harmonic mitigation requirements defined elsewhere in this specification.

1.03 FUNCTIONAL REQUIREMENTS

- A. **SUPPLY POWER:** The VFD shall operate continuously with supply power of 460 volts plus or minus 10 percent, 60 hertz plus or minus 3 percent. The VFD shall remain online and operate without damage to either the VFD or its connected load during a supply power variation of plus 50 percent lasting for a period of up to 0.01 seconds and minus 100 percent lasting for a period of up to 0.5 seconds.
- B. **AMBIENT CONDITIONS:** The VFDs shall be rated to operate continuously as specified in an ambient temperature of 0 to +45 degrees C and an ambient humidity of 0 to 90 percent, non-condensing. VFD's are to be upsized as necessary so as to meet operating temperature requirements without the use of A/C units.
- C. **LOAD:** The VFD system shall be capable of 110% continuous current overload. Variable torque inverters shall be capable of delivering 120 percent of the specified load for up to 60 seconds, and constant torque inverters shall deliver 150 percent overload current for 120 seconds.
- D. **POWER FACTOR:** Displacement power factor shall be not less than 0.95 at rated full speed and load. Overall power factor, including harmonic distortion, shall be 0.85, or greater. Contractor shall provide power factor correction components as necessary to meet this requirement.
- E. **EFFICIENCY:** Efficiency of VFD systems shall be at least 96 percent at 60 hertz output driving the specified maximum load.
- F. **FREQUENCY AND VOLTAGE REGULATION:** VFD output frequency shall be regulated to within 0.6 hertz of the frequency set point. VFD output voltage shall be regulated to within ± 1.0 percent of that value which will produce minimum motor heating at any operating frequency within the specified range.

- G. FREQUENCY RANGE: VFD shall be capable of continuous operation with the specified load at any frequency between 0.1 hertz and 60 hertz.
- H. SPACE: VFD system size shall not exceed the size allotments specified on the Drawings, nor shall any portion of the VFD system exceed a height of 90 inches. VFD system shall be front accessible and shall not require rear access. The VFD equipment shall be suitable for mounting directly against the wall without any clearance for ventilation or other purposes. VFD units shall be arranged as required for entry of incoming line cables and as required for entry of load cables.
- I. AMBIENT NOISE: Free field noise generated by the VFD shall not exceed 85 dBA at 3 feet out from any point on the VFD cabinet under any normal operating condition.

1.04 PROTECTION AND ANNUNCIATION

- A. OVERCURRENT PROTECTION: The VFD system shall provide electronic current limit at 150 percent of motor nameplate current. Current limit shall be accurate to within 1.0 percent and shall smoothly limit motor speed at whatever value is necessary to limit motor current to that value.
- B. The VFD shall also provide motor running overcurrent protection in compliance with NFPA 70.
- C. SHORT CIRCUIT PROTECTION: The VFD shall be fully protected against load faults. Bolted faults, phase to phase, or phase to ground shall not damage the unit. Any impedance or other current limiting necessary to meet this requirement shall be provided as part of the VFD system, and any losses caused by current limiting devices shall be included in efficiency calculation for the VFD system.
- D. LINE VOLTAGE: The VFD shall be protected against high and low line voltage on one or more phases.
- E. INTERNAL FAULTS: The VFD shall incorporate an internal fault monitoring system to detect malfunctions. This system shall be designed to protect the VFD from transient and sustained faults, and to limit damage that may be caused by these faults.
- F. OVERTEMPERATURE: Overtemperature circuitry shall shut down the VFD upon overheating, and display an overtemperature alarm, or message.
- G. DIAGNOSTICS: The VFD shall be provided with a fault diagnostics system that indicates the cause of any shutdown. The system shall store faults in memory and discard the oldest faults as new ones fill the memory. Faults shall be accessible via a digital keypad, also used for local control and programming.

1.05 EXTERNAL CONTROL AND MONITORING

- A. SPEED REFERENCE: The VFD shall accept a 4 to 20 milliampere direct current speed reference signal. Speed reference input shall be galvanically isolated and input resistance shall not exceed 250 ohms.
- B. READY SIGNAL: The VFD shall provide a contact closure that indicates that the controller line power supply is within acceptable tolerances, the control circuits are normal, and there are no internal or external fault conditions that have not been reset. Presence of this signal indicates that the controller should start normally.

- C. RUNNING SIGNAL: The VFD shall provide a contact closure which indicates that the controller is running.
- D. SYSTEM TROUBLE: Isolated normally open contacts for remote fault annunciation shall be provided and wired to terminal blocks, which shall be labeled and identified. Contact shall close under fault conditions. Fault conditions that drive the outputs shall be selectable from the digital keypad.
- E. The VFD control circuitry shall shutdown the VFD if the motor overheats. Motor winding temperature switches, or RTDs, shall be connected if provided by the motor manufacturer.

1.06 QUALITY ASSURANCE

- A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
IEEE 519-1992	Guide for Harmonic Control in Electric Power Systems
NEMA 250-85	Enclosures for Industrial Control and Systems
NEMA ICS 2-83	Industrial Control Devices, Controllers and Assemblies
NEMA ICS 3-83	Industrial Systems
NFPA 70-87	National Electrical Code (NEC)

Underwriters Laboratories UL 508

- B. The VFD shall comply with the applicable requirements of NEMA ICS 3 and additional standards referenced by ICS 3.
- C. The VFDs specified in this section shall be the product of a single vendor. The Contractor shall assign unit responsibility for the adjustable frequency drives in this section. The Contractor shall submit letters of certification with the shop Drawings from the VFD manufacturer, the motor manufacturer, and the driven equipment manufacturer stating that they have reviewed each application and that the combination will satisfy the application duties required, for the actual motor sizes required, regardless of deviations from the scheduled “nominal horsepower”.
- D. VFD manufacturing facility shall be ISO 9001 certified.

1.07 SUBMITTALS

- A. The following information shall be provided in accordance with the Contract Documents:
 1. Catalog and technical data.
 2. Outline dimensions, shipping section dimensions, weight, and foundation requirements for all assemblies.
 3. External connection wiring diagram showing function and identification of all terminals requiring field connections.
 4. Line harmonic distortion calculations and filter design if applicable.

5. Component fabrication Drawings consisting of detailed circuit schematics, printed circuit board Drawings, and chassis layouts for all electrical and electronic components.
6. Manufacturer's certification that VFD can withstand fault conditions specified in paragraph 16904-1.04.
7. Manufacturer's certification that VFD can withstand environmental conditions specified in paragraph 16904-1.04.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The VFDs shall be manufactured by Durapulse, or equal.

2.02 ENCLOSURES

- A. Enclosures shall be as shown on the Drawings. Cabinets shall be fabricated from 14 gauge minimum thickness sheet steel. Cabinet shall be provided with an interior frame or otherwise formed so as to provide a rigid structure. Doors shall be hung on removable-pin hinges and equipped with vault-type latch capable of accepting a 3/8-inch-shackle padlock. Three-point latch hardware shall be provided.

2.03 INVERTER

- A. A door interlocked power disconnecting means shall be provided to protect the inverter against internal faults and as a backup for external load faults. Load faults shall normally be cleared by the inverter assembly.

2.04 CONTROL DEVICES

- A. The following control devices shall be front mounted on the VFD:
 1. Digital keypad.
 2. Manual/remote speed control selector switch.
 3. VFD run light.
 4. Inverter ready light.
 5. Inverter fault light
- B. Control devices shall be as specified herein. Indicating lamps shall be high intensity colored LED type with clear lenses.

PART 3 - EXECUTION

3.01 FIELD INSTALLATION

- A. Each VFD shall be installed and tested by the Contractor with the assistance of factory-trained engineers in accordance with the manufacturer's specifications and the Contract Documents. The installation shall be certified on forms provided in the Contract Documents.

3.02 TESTING

- A. Test in accordance with Specification 26 01 27 – ELECTRICAL ACCEPTANCE TESTING.

3.03 TRAINING

- A. Provide four (4) hours of VFD training for the Owner's Operations and Maintenance Staff. Training shall be certified on forms provided in the Contract Documents. Training shall cover VFD theory of operation, features and functions available, normal operation, troubleshooting, and routine maintenance. The Contractor shall submit a syllabus for the training session for approval, within 3 weeks of conducting the class. Provide each attendee with a class syllabus detailing each topic to be discussed.

3.04 SPARE PARTS

- A. The following spare parts shall be supplied with each type, or frame size, of VFD:
 - 1. Three sets of all replaceable fuses
 - 2. One of each type of replaceable printed circuit board
 - 3. Two of each type of output power transistor

MAG SECTION 28 30 00 – ELECTRICAL CONTROLS, RELAYS, AND ALARMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section includes the following:
 - 1. Pushbutton and Selector Switches
 - 2. Relays
 - 3. Wireways

1.02 RELATED SECTIONS

- A. Section 26 00 00 - General Electrical Requirements
- B. Section 26 27 16 - Electrical Cabinets and Enclosures

1.03 REFERENCES

- A. NEMA ICS 1 - General Standards for Industrial Control Systems.
- B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
- C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- D. NEMA ST 1 - Standard for Specialty Transformers (Except General Purpose Type).

1.04 SUBMITTALS

- A. Data - a complete list of equipment and material including manufacturer's descriptive data and technical literature, performance charts, catalog cuts and installation instructions, spare parts data for each different item of equipment specified. The data shall include a complete Bill of Materials.
- B. Drawings - containing complete wiring and schematic diagrams, control diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout, anchorage, support and

appurtenances of equipment and equipment relationship to other parts of the work including clearances for maintenance and operations.

- C. Submit shop drawings in accordance with the Contract Documents, and NEMA ICS 1 specifications indicating control panel layouts, wiring connections and diagrams, dimensions, support points.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit record documents in accordance with the Contract Documents.
- B. Accurately record actual locations of control equipment. Revise diagrams included in Drawings to reflect actual control device connections.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation data in accordance with the Contract Documents.
- B. Include instructions for adjusting and resetting time delay relays, timers, and counters.
- C. Submit maintenance data in accordance with the Contract Documents.
- D. Include recommended preventative maintenance procedures and materials.

PART 2 - PRODUCTS

2.01 PUSHBUTTONS AND SELECTOR SWITCHES

- A. Pushbuttons, pilot lights and selector switches shall be of the full size, heavy-duty industrial, oil tight, 120-volt, with interchangeable pilot lights, plug-in construction, double break silver contacts, chrome plated lock rings, with modular contacts, and NEMA rating equal to that of the enclosure on which devices are installed. All components shall be flush mounted on front of panel, unless otherwise noted.
- B. Provide individual legend plates for indication of switch, pushbutton, and light function (e.g., Open, Closed, Hand-Off-Auto). A list shall be submitted for review and approval.
- C. Pilot lights shall be high intensity LED type. Pilot lights shall have clear lenses and LED lamps colored as shown on the Plans. Common, remote push-to-test circuitry shall be provided for each control panel to simultaneously test all indicating lights on the panel using a single pushbutton when there are 10 or more lights on the panel. Control panels with less than 10 lights shall utilize individual push-to-test lights and control circuitry.
- D. Pushbuttons shall be maintained or momentary as required and as shown on the Drawings. Provide extended head pushbutton for all stop functions, mushroom head for emergency stop functions, and flush head pushbuttons for all other functions. Where indicated on the Drawings pushbuttons shall be illuminated type. Provide locking mechanism for all lock out functions. Selector switches shall have black knob operator, be maintained contact type unless noted otherwise, number and arrangement as required to perform intended functions specified but not less than one double pole, double throw, double break contact per switch. Contact rating shall be compatible with AC or DC throughput current of devices simultaneously operated by the switch contact but not less than 10 amperes resistive at 120 volts AC or DC continuous.
- E. The above devices shall be manufactured by Schneider Square D, Allen Bradley, General Electric, or equal.

2.02 RELAYS

- A. Timing Relays shall be heavy duty, 300V A.C., 10 amps, solid state design, poles as required per application, -10°C to +60°C, have timing repeatability of ±2.0% of setting, and be UL listed. The range shall be determined from the control descriptions and or schematic drawings. Provide mounting accessories, as required. The timing relays shall be manufactured by Allen Bradley, Square D, Cutler Hammer, or equal.
- B. Control Relays shall be of the plug-in socket base type with dust-proof plastic enclosures, with silver-cadmium oxide contacts rated 300-volt, 10 amperes, with contact arrangement and operating coils of the proper voltage as required by the control circuit sequence. Each relay shall have a minimum of two double pole, double throw contacts, or as required. Control relays shall be IDEC, Allen Bradley, Schneider Square D, Cutler Hammer, or equal.

2.03 WIREWAYS

- A. Wireways shall be PVC, snap-in slot design, with non-slipcover. Safe area wireways shall be light gray and marked "Safe Area Wiring." Hazardous area wireways shall be intrinsic blue and marked "Hazardous Area Wiring." The wireways shall be manufactured by Panduit Corporation, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fasteners shall be type 304 stainless steel.
- B. Install devices in strict accordance with NEC requirements and per manufacturers recommendation.
- C. Coordinate with other trades as necessary during installation of these devices.

3.02 ACCEPTANCE

- A. All installations are subject to evaluation in accordance with NEC requirements and manufacturers recommendations. Contractor shall remove the unacceptable work and correct work at no charge to Owner.

MAG SECTION 26 62 10 – ELECTRICAL TESTING

PART 1 - GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American National Standards Institute (ANSI):
 - a. 450, Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generator Stations and Substations.
 - b. C2, National Electric Safety Code.
 - c. C37.20.1, Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.
 - d. C37.20.2, Metal-Clad and Station-Type Cubicle Switchgear.

- e. C37.20.3, Metal-Enclosed Interrupter Switchgear.
 - f. C62.33, Standard Test Specifications for Varistor Surge Protective Devices.
2. American Society for Testing and Materials (ASTM):
- a. D665, Standard Test Method for Rust Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water.
 - b. D877, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
 - c. D923, Standard Test Method for Sampling Electrical Insulating Liquids.
 - d. D924, Standard Test Methods for A-Class Characteristics and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.
 - e. D971, Standard Test Method for Interfacial Tension of 0.1 Against Water by the Ring Method.
 - f. D974, Standard Test Method for Acid and Base Number by Color-Indicator Titration.
 - g. D1298, Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
 - h. D1500, Standard Test Method for ASTM Color of Petroleum Products.
 - i. D1524, Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field.
 - j. D1533, Standard Test Methods for Water in Insulating Liquids.
 - k. D1816, Standard Test Method for Dielectric Breakdown Voltage on Insulating Oils of Petroleum Origin Using VDE Electrodes.
 - l. D2285, Standard Test Method for Interfacial Tension of Electrical Insulating Oils of Petroleum Origin Against Water by the Drop-Weight Method.
3. Institute of Electrical and Electronics Engineers (IEEE):
- a. 43, Recommended Practice for Testing Insulating Resistance of Rotating Machinery.
 - b. 48, Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminators.
 - c. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
 - d. 95, Recommended Practice for Insulation Testing of Large AC Rotating Machinery with High Direct Voltage.
 - e. 118, Standard Test Code for Resistance Measurement.
 - f. 400, Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field.
4. National Electrical Manufacturers Association (NEMA):

- a. AB 4, Guideline for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
 - b. PB 2, Deadfront Distribution Switchboards.
 - c. WC 7, Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 - d. WC 8, Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- 5. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
 - 6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

1.02 SUBMITTALS

- A. Administrative Submittals: Submit 30 days prior to performing inspections or tests:
 - 1. Schedule for performing inspection and tests.
 - 2. List of references to be used for each test.
 - 3. Sample copy of equipment and materials inspection form(s).
 - 4. Sample copy of individual device test form.
 - 5. Sample copy of individual system test form.
- B. Quality Control Submittals: Submit within 14 days after completion of test:
 - 1. Test or inspection reports and certificates for each electrical item tested.
- C. Contract Closeout Submittals:
 - 1. Operation and Maintenance Data:
 - a. In accordance with Section 01 78 23 Operation and Maintenance Data.

1.03 QUALITY ASSURANCE

- A. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.
- B. Test instrument calibration shall be in accordance with NETA ATS.

1.04 SEQUENCING AND SCHEDULING

- A. Perform inspection and electrical tests after equipment has been installed.
- B. Perform tests with apparatus de-energized whenever feasible.
- C. Inspection and electrical tests on energized equipment are to be:
 - 1. Scheduled with OWNER prior to de-energization.

2. Minimized to avoid extended period of interruption to the operating plant equipment.

D. Notify OWNER at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Tests specified in this section are to be performed in accordance with the requirements of Section 01 73 60 Equipment Testing and Plant Startup.

B. Tests and inspection shall establish that:

1. Electrical equipment is operational within industry and manufacturer's tolerances.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and NFPA 70, NFPA 70E, and ANSI C2.

C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.

D. Adjust mechanisms and moving parts for free mechanical movement.

E. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

F. Verify nameplate data for conformance to Contract Documents.

G. Realign equipment not properly aligned and correct unlevelness.

H. Properly anchor electrical equipment found to be inadequately anchored.

I. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations, or as otherwise specified.

J. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

K. Provide proper lubrication of applicable moving parts.

L. Inform OWNER of working clearances not in accordance with NFPA 70.

M. Investigate and repair or replace:

1. Electrical items that fail tests.
2. Active components not operating in accordance with manufacturer's instructions.
3. Damaged electrical equipment.

N. Electrical Enclosures:

1. Remove foreign material and moisture from enclosure interior.
2. Vacuum and wipe clean enclosure interior.

3. Remove corrosion found on metal surfaces.
 4. Repair or replace, as determined by OWNER, door and panel sections having dented surfaces.
 5. Repair or replace, as determined by OWNER, poor fitting doors and panel sections.
 6. Repair or replace improperly operating latching, locking, or interlocking devices.
 7. Replace missing or damaged hardware.
 8. Finish:
 - a. Provide matching paint and touch up scratches and mars.
 - b. If required due to extensive damage, as determined by OWNER, refinish the entire assembly.
- O. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents.

3.02 LOW VOLTAGE CABLES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Inspect Each Individual Exposed Power Cable No. 4 and Larger for:
 - a. Physical damage.
 - b. Proper connections in accordance with single-line diagram.
 - c. Cable bends not in conformance with manufacturer's minimum allowable bending radius where applicable.
 - d. Color coding conformance with specifications.
 - e. Proper circuit identification.
2. Mechanical Connections for:
 - a. Proper lug type for conductor material.
 - b. Proper lug installation.
 - c. Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by manufacturer.
3. Shielded Instrumentation Cables for:
 - a. Proper Shield grounding.
 - b. Proper terminations.
 - c. Proper circuit identification.
4. Control Cables for:
 - a. Proper termination.
 - b. Proper circuit identification.

3.03 MOLDED CASE CIRCUIT BREAKERS

- A. General: Inspection and testing limited to circuit breakers rated 400 amperes and larger.
- B. Visual and Mechanical Inspection:
 - 1. Proper mounting.
 - 2. Proper conductor size.
 - 3. Feeder designation according to nameplate and one-line diagram.
 - 4. Cracked casings.
 - 5. Connection bolt torque level in accordance with NETA ATS, Table 10.1.
 - 6. Operate frame size and trip setting with circuit breaker schedules or one-line diagram.
 - 7. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.
 - 8. Verify that terminals are suitable for 75 degrees C rated insulated conductors.

3.04 INSTRUMENT TRANSFORMERS

- A. Visual and Mechanical Inspection:
 - 1. Visually Check Current, Potential, and Control Transformers for:
 - a. Cracked insulation.
 - b. Broken leads or defective wiring.
 - c. Proper connections
 - d. Adequate clearances between primary and secondary circuit wiring.
 - 2. Verify Mechanically That:
 - a. Grounding and shorting connections have good contact.
 - b. Withdrawal mechanism and grounding operation, when applicable, operate properly.

3.05 AC INDUCTION MOTORS

- A. General: Inspection and testing limited to motors rated 10 hp and larger.
- B. Visual and Mechanical Inspection:
 - 1. Proper electrical and grounding connections.
 - 2. Shaft alignment.
 - 3. Blockage of ventilating air passageways.
 - 4. Operate Motor and Check for:
 - a. Excessive mechanical and electrical noise.
 - b. Overheating.
 - c. Correct rotation.

- d. Check vibration detectors, resistance temperature detectors, or motor inherent protectors for function ability and proper operation.
- e. Excessive vibration.
- 5. Check operation of space heaters.
- C. Electrical Tests:
 - 1. Insulation Resistance Tests:
 - a. In accordance with IEEE 43 at test voltages established by NETA ATS, Table 10.2 for:
 - 1) Motors 200 hp and less for 1-minute duration with resistances tabulated at 30 and 60 seconds.
 - b. Insulation resistance values equal to, or greater than, ohmic values established by manufacturers.
 - 2. Insulation resistance test on insulated bearings in accordance with manufacturer's instructions.
 - 3. Measure running current and voltage and evaluate relative to load conditions and nameplate full-load amperes.

3.06 LOW VOLTAGE MOTOR CONTROL

A. Visual and Mechanical Inspection:

- 1. Proper operation of indicating and monitoring devices.
- 2. Proper overload protection for each motor.
- 3. Check Nameplates for Proper Identification of:
 - a. Equipment title and tag number with latest one-line diagram.
 - b. Pushbuttons.
 - c. Control switches.
 - d. Pilot lights.
 - e. Control relays.
 - f. Circuit breakers.
- 4. Verify that fuse and circuit breaker sizes and types conform to Contract Documents.
- 5. Verify that current and potential transformer ratios conform to Contract Documents.
- 6. Control Wiring:
 - a. Compare wiring to local and remote control, and protective devices with elementary diagrams.
 - b. Check for proper conductor lacing and bundling.
 - c. Check for proper conductor identification.

- d. Check for proper conductor lugs and connections.
 - 7. Exercise active components.
 - 8. Compare fuse, motor protector, and circuit breaker with motor characteristics for proper size.
- B. Electrical Tests:
- 1. Control Wiring Tests:
 - a. Apply secondary voltage to control power and potential circuits.
 - b. Check voltage levels at each point on terminal boards and each device terminal.
 - c. Insulation resistance test at 1,000 volts dc on control wiring except that connected to solid state components.
 - 1) Insulation resistance to be 1 megohm minimum.
 - 2. Operational test by initiating control devices to affect proper operation.

MAG SECTION 40 05 13.13 – STEEL PROCESS PIPING (BLACK AND GALVANIZED)

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section covers furnishing and installing all steel piping, fittings, accessories, and supports, etc., with the exception of any piping which is an integral part of any equipment assembly and which would be furnished by the manufacturer.
- B. Where piping connects to equipment, particular care shall be taken to see that pipe fittings are suitable for connection to the equipment fittings.

1.02 RELATED SECTIONS – NONE

1.03 CITED STANDARDS

- A. All steel piping and fittings shall conform to the following standard specifications, of the latest revisions, as applicable:
 - 1. ASME/ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
 - 2. ASME/ANSI B16.3 - Malleable Iron Threaded Fittings
 - 3. ASME/ANSI B16.4 - Cast Iron Threaded Fittings
 - 4. ASME/ANSI B16.5 - Pipe Flanges and Flanged Fittings
 - 5. ASTM A53 / A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 6. ANSI B36.10 Welded and Seamless Wrought Steel Pipe

1.04 NOTED RESTRICTIONS – NONE

1.05 QUALITY CONTROL

- A. The CONTRACTOR shall furnish and install steel pipe and all appurtenances, complete in place, all in accordance with the standard DRAWINGS and as described in these specifications.
- B. All pipes shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.
- C. During the manufacture of the pipe, the OWNER or ENGINEER shall be given access to all areas where manufacturing and testing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.
- D. Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with requirements as applicable.

PART 2 - PRODUCTS

2.01 STEEL PROCESS PIPING

- A. The steel pipe shall consist of welded or seamless carbon steel type in accordance with ANSI B36.10. The steel pipe shall be black unless otherwise indicated or specified on the DRAWINGS. All pipe 12" and larger shall be standard weight. All steel pipe 10" diameter and smaller shall be Schedule 20, unless otherwise specified.
- B. Where flanged pipe is required, the flanges shall be ANSI 150 lb. Flanges may be screwed on using tapered pipe threading, weld neck, or slip-on welded.
- C. All flange gaskets on the piping at the treatment system shall be constructed of Kel-F or Teflon. Products containing neoprene and silicone are not recommended for TCE & PCE use.
- D. Where threaded pipe is required, screwed fittings shall be Grinnell, Providence, RI, or equal. Where welded pipe is required, fittings shall be long radius type, Tube Turns Technologies, Louisville, KY, or equal.
- E. Pipe sizes, joints, wall thicknesses, (or thickness schedule), shall be as indicated in the Pipe Schedule included with these specifications.
- F. Steel pipe shown on the Plans shall be shop lined hot dipped galvanized.
- G. Joints
 - 1. Threaded Joints
 - a. Pipe screw threads to conform to ANSI B2.1. Ream pipe ends and remove all burrs and chips after cutting and threading. Protect pipe thread during assembly. Apply thread lubricant to male threads as follows: John Crane Co., Morton Grove, IL, "Anti-Seize"; red lead graphite for vent lines and roof conductors and Teflon tape for all other services.
 - 2. Flanged Joints
 - a. Steel pipe flanges shall conform to ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings." Cast iron pipe flanges shall conform to ANSI B16.1 "Cast Iron Flanges and Flanged Fittings." Steel flanges shall be raised face except when bolted to flat face cast iron flange.

- b. Flanged joints shall be made with bolts, bolt studs with nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges.
- c. SAE Grade 5 zinc coated bolts shall be used for above-ground joints. Threads shall be coated with an anti-seizing compound before nut installation.
- d. 316 Stainless Steel per ASTM F593-95 with an 85,000 psi average tensile strength shall be used for buried joints. Threads shall be coated with an anti-seizing compound before nut installation.
- e. Bolting for services up to 500 degrees F shall be ANSI/ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts." Bolt studs and studs shall be of the same quality as machine bolts.
- f. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.
- g. Gaskets for flat face flanges shall be full face type. Gaskets for raised face flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Gaskets shall be 1/8 in. thick minimum and of following types: Kel-F or Teflon.
- h. All welded joints shall be electric welded. Welding shall be in accord with AWWA C 206. Qualification of welders shall be as covered in AWWA C 206. All testing of welders shall be at the Contractor's expense, including cost of test nipples, welding rod, and equipment.

PART 3 - EXECUTION

3.01 PREPARATION – NONE

3.02 INSTALLATION

- A. The maximum spacing between pipe supports shall be in accordance with the following table.

Steel (Std. Weight or heavier) Cast Iron, Ductile Iron	Max. Spacing	
	Steam & Liquids	Air & Gases
1-1/2" and smaller	7'-0"	7'-0"
2" - 3"	10'-0"	14'-0"
4" - 6"	14'-0"	20'-0"
8" and above	20'-0"	20'-0"

- B. Additional supports shall be provided where the following occurs:
 1. where the pipe changes direction
 2. adjacent to flanged valves and strainers
 3. at equipment connections and heavy fittings
 4. Where indicated on the drawings

- C. The CONTRACTOR shall provide at least one hanger adjacent to each joint in cast-iron soil pipe and grooved-end steel pipe with mechanical couplings.
- D. Vertical pipe runs shall be supported and laterally braced at every floor level in multistory structures and at intervals not exceeding 15 ft. in other structures.

3.03 FLUSHING AND TESTING

- A. Installed piping shall be flushed and tested as per the manufacturer’s specifications.

MAG SECTION 40 05 13.33 – BRASS, BRONZE, AND COPPER PROCESS PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section covers furnishing, and installing, all copper piping, fittings, accessories, and supports, etc., with the exception of any piping which is an integral part of any equipment assembly which would be furnished by the manufacturer.

1.02 REFERENCED SECTIONS – NONE

1.03 CITED STANDARDS

- A. All copper piping and fittings shall conform to the following standard specifications, of the latest revisions, as applicable:

1. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings
2. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
3. ASTM B32 – Standard Specification for Solder Metal
4. ASTM B88 – Standard Specification for Seamless Copper Water Tube
5. ASTM B 828 – Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

1.04 NOTED RESTRICTIONS

- A. Solder filler metal shall be in accordance with ASTM B32 but shall not be Alloy Sn50.
- B. Approved Manufacturers
 1. All materials shall be the appropriate model number of specified on the construction plans as manufactured by the companies listed herein.
 - a. Copper Tubing:
 - 1) Anaconda
 - 2) Phelps Dodge
 - b. Service Saddle:
 - 1) James Jones - J-979 or equal
 - c. Corporation Stop:

- 1) Mueller – 110 H-15013 or equal
- d. Angle Meter Stop:
 - 1) Mueller – 110 H-142258 or equal
- e. Ninety Bend Coupling:
 - 1) Mueller – 110 H-15526 or equal
- f. Insulating Pipe Bushings, Unions, or Couplings:
 - 1) Pipeline Coating and Engineering Co.
 - 2) Smith Blair
 - 3) Pipe Seal and Insulator Company

1.05 QUALITY ASSURANCE

- A. The CONTRACTOR shall furnish and install copper pipe and all associated appurtenances, complete in place, in accordance with the standard DRAWINGS and as described in these specifications.
- B. All piping shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.
- C. During the manufacture of the pipe, the OWNER or ENGINEER shall be given access to all areas where manufacturing and testing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.
- D. All soldering processes, procedures, and solderers for copper and copper alloy pipe and tube shall be in accordance with ASTM B 828.
- E. Double strap bronze service saddles shall be installed on asbestos cement or ductile iron pipe.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Pipe and tube required by the applicable standard to be cleaned and capped shall be delivered to the job site with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipe and tube from moisture and dirt. Elevate above grade. When stored inside, do not exceed the structural capacity of the floor.
- C. Protect fittings, flanges, and piping specialties from moisture and dirt.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Copper
 - 1. Copper tubing shall conform to the requirements of ASTM B 88 for seamless copper water tube. Copper tubing shall be true, smooth, and clean on both inside and outside and free from any cracks, seams or other defects. It shall be truly cylindrical, of the full specified outside and inside diameters, and of uniform thickness of metal. Piping located aboveground or suspended within vaults shall be Type L. Buried piping shall be Type K.

2. Fittings shall be copper conforming to ASTM B 75 and ANSI B16.22, with solder end joints. Fittings 3/8 inch and smaller may have flared end connections only.
3. Solder shall be silver solder conforming to ASTM B32, Grade 95TA. Do not use cored solder.

B. Brass Pipe, Nipples, and Fittings

1. Short threaded nipples, brass pipe and fittings shall conform to ASTM B 43, Schedule 40. Threads shall conform to ANSI B2.1.

C. Bronze Appurtenances

1. All items specified herein shall be manufactured of bronze conforming to ASTM B 62, "Composition Brass or Ounce Metal Castings."
2. All service saddle bodies shall be manufactured of bronze and shall be tapped for an iron pipe thread. The seal with the pipe shall be affected with either a rubber gasket or an O ring.
 - a. Service saddles shall be the double strap type for all sizes of asbestos cement or ductile iron pipe. The straps (or bails) shall be flat and shall be manufactured of Everdur or Silnic bronze.
3. Corporation stops shall be manufactured of bronze. The inlet fitting shall be a male iron pipe thread when used with saddle and the outlet connection shall be a compression type.
4. Angle meter stops shall be manufactured of bronze. The inlet connection shall be a compression type and the outlet fitting shall be a meter flange or meter coupling. The inlet and outlet shall form an angle of 90 degrees on a vertical plane through the centerline of the meter stop. A rectangular lug and lock wing shall be provided on the top of the fitting to operate the shutoff mechanism. Two-inch angle meter stops shall be with "slotted" holes for 1 1/2 inch or 2 inch meters.

D. Flanges, Gaskets, Bolts, and Nuts

1. Connect to flanged valves and fittings with bronze flanges conforming to ANSI B16.24, Class 125 or Class 150, to match the connecting flange. Use solder end companion flanges.
2. Gaskets shall be full face, 1/8-inch thick, and shall be one of the following non-asbestos materials:
 - a. Cloth-inserted rubber. Products: John Crane Co. Style 777 or equal. Gaskets shall be suitable for a pressure of 200 psi at a temperature of 180°F.
 - b. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal. Gaskets shall be suitable for a water pressure of 500 psi at a temperature of 400°F.
3. When both aboveground adjoining flanges are bronze, use bronze bolts and nuts. Bolts shall conform to ASTM F 468, Grade C65100 or C63000. Nuts shall conform to ASTM F 467, Grade C65100 or C63000.

4. When only one of the aboveground adjoining flanges is bronze, use Type 316 stainless steel bolts and nuts conforming to ASTM A 193, Grade B8M for bolts, and ASTM A 194, Grade 8M for nuts.
5. Connect to buried ferrous flanges with flange insulation kits. Bolts used in flange insulation kits shall conform to ASTM B 193, Grade B7. Nuts shall comply with ASTM A 194, Grade 2H. If the adjoining buried flange is bronze, use bronze bolts and nuts as described above, without a flange insulation kit.
6. Provide one (1) washer for each nut. Each washer shall be of the same material as the nut.

2.02 JOINING MATERIALS

- A. Solder filler metal shall be in accordance with ASTM B32 and shall be Alloy Sn95 or Alloy Sn94; where Tin (Sn) is approximately 95%, and Silver (Ag) is approximately 5%, having 0.10% maximum Lead (Pb) content.

PART 3 - EXECUTION

3.01 PREPARATION – NONE

3.02 INSTALLATION

A. Copper Tubing and Fittings

1. Cut tubing square and remove burrs. Clean both the inside and outside of fitting and pipe ends with steel wool and muriatic acid before soldering. Prevent annealing of fittings and tubing when making connections. Do not miter joints for elbows or notch straight runs of pipe for tees.
2. Bends in soft copper tubing shall be long sweep. Shape bends with shaping tools. Form bends without flattening, buckling, or thinning the tubing wall at any point.
3. Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of the ASME Boiler and Pressure Vessel Code. Silver solder shall be used. Solder shall penetrate to the full depth of the cup in joints and fittings. Solderers shall comply with ANSI B31.3, paragraph 328.
4. Buried piping shall be installed with some slack to provide flexibility in the event of a load due to settlement, expansion or contraction. A MINIMUM COVER OF 36 INCHES BELOW THE FINISHED STREET GRADE SHALL BE ADHERED TO. The tubing is to be bedded and covered with sand or select material as determined by the ENGINEER.
5. All 2 inch size services shall be installed with straight lengths of soft copper water tube Type K. Solder or compression fittings are acceptable on only the corporation stop and angle meter stop. All couplings and adapters shall be silver soldered.

B. Service Saddle

1. The service saddle shall be no closer than 18 inches to a valve, coupling, joint, or fitting unless it is at the end of the main. The installation of a service saddle on any machined section of ACP will NOT be permitted.
2. The surface of the pipe shall be filed to remove all loose material and to provide a hard, clean surface before placing the service saddle.

3. The service saddle shall be tightened firmly to ensure a tight seal; however, care shall be used to prevent damage or distortion of either the corporation stop or service saddle by overtightening.
4. The tap into the pipe shall be made in accordance with the pipe manufacturer's recommendation.

C. Installing Flange Bolts and Nuts

1. Lubricate bolt threads with graphite and oil prior to installation.
2. Set flange pipe with the flange bolt holes straddling the pipe horizontal and vertical centerlines.

D. Insulating Bushings and Unions

1. Pipe or fittings made of nonferrous metals shall be isolated from ferrous metal by nylon insulating pipe bushings, union, or couplings.

3.03 TESTING – NONE

MAG SECTION 40 05 13.73 – PLASTIC PIPE

PART 1 - GENERAL

1.01 REQUIREMENT

- A. The Contractor shall furnish and install all PVC and polyethylene plastic pipe, fittings, transitions, connections and appurtenant work, complete and in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

- A. Section 31 00 00 - Earthwork
- B. Section 41 36 10.16 - Pipeline Testing

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards:

ASTM D 1784 and ASTM D 1785 Specifications for Polyvinyl Chloride (PVC) Plastic Pressure Pipe

STM D 3034 Specifications for Polyvinyl Chloride (PVC) Plastic Gravity Sewer Pipe

ASTM D 2321 Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

1.04 SUBMITTALS

- A. Contractor shall submit copies of the manufacturer's product specifications according to the requirements of Section 01 33 00 Submittal Procedures.

PART 2 - PRODUCTS

2.01 PVC (POLYVINYL CHLORIDE) PRESSURE PIPE, 6-INCHES AND SMALLER, SOLVENT-WELDED

- A. All PVC pressure pipe 6-inches and smaller shall be made from all new rigid unplasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 40, to conform to ASTM D 1785, unless otherwise shown. Elbows and tees shall be of the same material and schedule as the pipe. Unless otherwise shown, joint design shall be for solvent-welded construction.

2.02 CPVC (CHLORINATED POLYVINYL CHLORIDE) PRESSURE PIPE, 4-INCHES AND SMALLER, SOLVENT-WELDED

- A. All CPVC pressure pipe 4-inches and smaller shall be made from all new rigid unplasticized polyvinyl chloride and shall be Schedule 80, to conform to ASTM D 2846, unless otherwise shown. Elbows and tees shall be of the same material and schedule as the pipe. Unless otherwise shown, joint design shall be for solvent-welded construction.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPE

- A. All pipe, fittings, etc. shall be carefully handled and protected against damage, impact shocks and free fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe shall not be placed directly on rough ground but shall be supported in a manner which will protect the pipe against injury whenever stored at the work site. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.
- B. The Contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Damaged pipe shall be replaced with new undamaged sections of pipe.
- C. Before placement of the pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work. As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, rocks and any other debris following completion of pipe laying prior to testing, disinfecting and placing the completed pipeline in service.
- D. Pipe shall be laid directly on the imported bedding material. No blocking will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Bell holes shall be formed at the ends of the pipe to prevent joint loading at the bells or couplings.
- E. Where necessary to raise or lower the pipe grade due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer.
- F. No pipe shall be installed upon a foundation into which frost has penetrated or any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be laid unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.
- G. Immediately before jointing bell and spigot pipe, both the bell and spigot end of the pipe shall be thoroughly cleaned and lubricated with an approved vegetable-based lubricant. The spigot

end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper alignment. Tilting of the pipe to insert the spigot into the bell will not be permitted.

- H. Solvent-welded and heat-fused joints shall be carefully and thoroughly cleaned immediately before jointing the pipe. Particular care shall be taken in making solvent-welded joints to ensure a uniform, homogeneous and complete bond.

MAG SECTION 40 05 23 – COMMON WORK RESULTS FOR PROCESS VALVES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Furnish and install all valves complete and in accordance to the requirements of the Contract Documents.

1.02 REFERENCED SECTIONS – NONE

1.03 CITED STANDARDS – NONE

1.04 NOTED RESTRICTIONS – NONE

1.05 QUALITY CONTROL

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service.
- B. Valve Types: Provide valves of same type by same manufacturer.
- C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- D. Codes and Standards:
 - 1. MSS Compliance: Mark valves in accordance with MSS 25 "Standard Marking System for Valves, Fittings, Flanges and Unions."
 - 2. ANSI Compliance: For face to face and end to end dimensions of flanged or welded end valve bodies, comply with ANSI B16.10 "Face to Face and End to End Dimensions of Ferrous Valves."

1.06 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve.
- B. Shop DRAWINGS: Submit manufacturer's assembly type (exploded view) shop DRAWINGS for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data and spare parts list for each type of valve. Include this data, product data, and shop DRAWINGS in maintenance manual, in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.01 BALL VALVES (2-INCHES AND SMALLER)

1. The valve is to meet ASTM standards for PVC and CPVC materials. PVC versions of the Type 546 shall be NSF-61 approved for drinking water applications. Unless specifically indicated on the plans, all ball valves 2-inches in diameter and smaller shall have stainless steel bodies with PTFE seats and seals with stainless steel ball. Valves shall have a minimum working pressure rating of 1500 psi at 150°F. All valves shall have integral lock-out devices incorporated in the design.
2. Approved Manufacturers
 - a. George Fischer Type 546.
 - b. ENGINEER approved equal.

B. Bronze Ball Valves

1. Where specifically called for on the plans, provide bronze ball valves. Bronze ball valves, 2-inches and smaller shall be brass bodied with PTFE seats and seals with stainless steel ball. Valves shall be rated for 150 psi WWP minimum. All valves shall have integral lock-out devices incorporated into the design.
2. Approved Manufacturers
 - a. Parker Model XVP500P
 - b. ENGINEER approved equal.

2.02 KNIFE GATE VALVES (6-INCHES AND SMALLER)

1. The valve shall be PVC with white color, the handle shall be metal with a stainless steel paddle for valves 4" and larger and plastic for valve under 4" in size
2. Approved Manufacturers
 - a. Valterra
 - b. ENGINEER approved equal.

PART 3 - EXECUTION

3.01 PREPARATION – NONE

3.02 INSTALLATION

A. General

1. Except as otherwise indicated, comply with the following requirements:

- a. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
 - b. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane.
- 2. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.
- 3. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections.
 - a. Pipe Size 2" and Smaller: One of the following, at Installer's option:
 - 1) Threaded valves.
 - 2) True Union.
 - b. Pipe Size 2 1/2" and Larger:
 - 1) True Union.
 - 2) Socket Weld.
- 4. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non rising stem valves where headroom prevents full opening of OS&Y valves.
- 5. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.
- B. Adjusting and Cleaning:
 - 1. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.
 - 2. Valve Identification: Tag each valve.
- C. Valve Installation:
 - 1. Locate all valves in locations which will allow easy operation and facilitates maintenance.
 - 2. Provide chain operators for any valves located more than 8 feet above finished floor. This means double acting lever handles for quarter turn valves, or chain wheels for multi-turn valves. Arrange valves and set up chain length for proper operation.

3.03 TESTING – NONE

MAG SECTION 41 36 10.16 – PIPELINE TESTING

PART 1 - GENERAL

1.01 REQUIREMENT

- A. The Contractor shall perform flushing and testing of all pipelines and appurtenant piping complete, including conveyance of test water from Owner-designated source to point of use and all disposal thereof, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

- A. Section 41 36 10.17 - Hydraulic Structures Testing

PART 2 - PRODUCTS

2.01 MATERIALS REQUIREMENTS

- A. All test equipment, temporary valves, bulkheads or other water control equipment and materials shall be determined and furnished by the Contractor subject to the Engineer's review.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall notify the Engineer at least 48-hours in advance of any planned testing and shall review the testing procedures with the Engineer.
- B. Unless otherwise provided herein, water for testing pipelines shall be furnished by the Owner; however, the Contractor shall make all necessary provisions for conveying the water from the Owner-designated source to the points of use.
- C. All pipelines shall be tested. All testing operations shall be performed in the presence of the Engineer.
- D. Disposal or release of test water from pipelines, after testing shall be acceptable to the Engineer.

3.02 HYDROSTATIC TESTING OF PIPELINES

- A. Prior to hydrostatic testing, all pipelines shall be flushed or blown out as appropriate. The Contractor shall test all pipelines either in sections or as a unit. The Contractor shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Care shall be taken to see that all air vents are open during filling.
- B. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled it shall be allowed to stand under a slight pressure for at least 24-hours to allow the concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the Engineer shall be taken.
- C. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 4 hours. The test pressure for distribution and transmission pipelines shall be 133% of the pipe pressure class shown or specified measured at the lowest point of the pipeline being tested. The test pressure for yard piping shall be as shown or specified on the Piping Schedule

measured at the lowest point of the pipeline section being tested. All leaks shall be repaired in a manner acceptable to the Engineer.

- D. All piping shall have no leakage. In the case of pipelines that fail to pass the leakage test, the Contractor shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks and shall again test the pipelines.

MAG SECTION 41 36 10.17 – HYDRAULIC STRUCTURES TESTING

PART 1 - GENERAL

1.01 REQUIREMENT

- A. The Contractor shall perform all cleaning, flushing, testing and appurtenant work, including conveyance of test water from Owner-designated source to point of use, and including all disposal thereof, complete and acceptable, for hydraulic structures and appurtenant piping all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

- A. Section 41 36 10.16 - Pipeline Testing
- B. Section 03 30 00 - Cast-in-Place Concrete

PART 2 - PRODUCTS

2.01 MATERIALS REQUIREMENTS

- A. Temporary valves, bulkheads or other water control equipment and materials shall be as determined by the Contractor subject to the Engineer's review.

PART 3 - EXECUTION

3.01 GENERAL

- A. Prior to testing, all hydraulic structures shall be thoroughly cleaned, and all surfaces hosed down with a high pressure hose and nozzle. All water, dirt and foreign material accumulated in this cleaning operation shall be removed from the structure.
- B. All hydraulic structures and appurtenant piping shall be tested for leaks. All testing operations shall be done in the presence of the Engineer.
- C. The Contractor shall notify the Engineer at least 48-hours in advance of any planned testing and shall review with the Engineer the testing procedures.
- D. Water for testing will be furnished by the Owner; however, the Contractor shall make all necessary provisions for conveying the water from the Owner-designated source to the points of use.
- E. If industrial paint finishes or other protective coatings are to be applied to the interior surfaces of the hydraulic structure, such coatings shall be applied after all testing operations have been completed.
- F. Disposal of test water from structures, after testing has been completed, shall be acceptable to the Engineer.

3.02 TESTING OF HYDRAULIC STRUCTURES

- A. General: Testing shall be performed prior to backfilling, except where otherwise acceptable to the Engineer. Testing shall not be performed sooner than 14-days after all portions of structure walls and associated roof systems have been completed. The test shall consist of filling the structure with water to the maximum operating water surface. The rate of filling shall not exceed 48-inches of depth per day.
- B. Leakage Test and Repairs: After the structure has been filled, the leakage test shall be performed as follows: An initial water level reading shall be made. Seven days following the initial reading, a second reading shall be made. The structure shall be considered to have passed the test if water loss during the 7-day period, as computed from the two water level readings, does not exceed 0.2 percent of the total volume of water in the structure, after allowance is made for evaporation loss. If intermediate readings or observed leakage indicate that the allowable leakage will be exceeded, the test may be terminated before the end of the 7-day period and appropriate action taken to correct the problem before commencing a new 7-day test period. If the structure continues to fail the leakage test, the Contractor shall empty the structure and shall examine the interior for evidence of any cracking or other conditions that might be responsible for the leakage. Any cracks shall be "vee'd" and sealed with polyurethane sealant in accordance with Section 03 30 00 Cast-in-Place Concrete. Any evidence of leakage shall be repaired. Following these operations, the Contractor shall again test the hydraulic structure. The structure will not be accepted as completed until it has passed the leakage test.

3.03 TESTING OF APPURTENANT PIPING

- A. Piping appurtenant to hydraulic structures shall be tested as specified in Section 41 36 10.16 Pipeline Testing.

MAG SECTION 44 42 23 – CLARIFIER (OWNER FURNISHED)

PART 1 - GENERAL

1.01 GENERAL

- A. Scope: The VENDOR will furnish equipment per attached Specifications for one (1) fiberglass reinforced plastic (FRP) clarifier in accordance with the Drawings. The equipment includes flow direction baffles, air lifts for sludge removal, surface skimmers, an effluent collection weir and all other appurtenances required or shown on the Drawings.

1.02 DESIGN CRITERIA

1. Influent flow rate per clarifier (45,000 GPD – w/o recycle)
2. Design (avg. flow): 90,000 GPD
3. Maximum (max. daily flow): 125,000 GPD
4. Design recycle rate: 50 % 100%
5. MLSS (mg/l): 2000 % 40006.

6. Tank Details: diameter (ft.): 12'-6"; Length 28'-1" and Capacity; 12,869 Gallons Min.
7. Influent feed pipe diameter (in.): 6"

PART 2 - PRODUCTS

2.01 GENERAL DESIGN

A. Description:

1. The clarifier performs the following integrated functions:
2. Dissipate energy and control localized currents.
3. Separate solids from the clear liquid.
4. Evenly withdraw the clear liquid.
5. Transport and thicken settled sludge.
6. Prevent sludge dilution at withdrawal point.
7. Remove scum from the clarifier surface.

B. Materials and Loading Criteria

Clarifier tank is pre-fabricated and made of fiberglass reinforced plastic (FRP). Tank material shall conform to the requirements of ANSI/AWWA D120-02 Thermosetting Fiberglass-Reinforced Plastic Tanks. Also, tank manufacturer shall be in business of manufacturing tanks to UL 1316 Standards and ASTM D883 Standards. The tank shall be single wall type. The FRP Clarifier shall be supplied per Drawing C-2 and P-6.

1. The tank meets following design criteria:

Internal Load – The tank will be designed to withstand a 5-psig air-pressure test with 5:1 safety factor. Maximum test pressure is 5 psig.

Surface Loads – Water tank shall withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current installation manuals and operating guidelines.

Exterior Hydrostatic Pressure and Burial Depth – Tank is capable of being buried in the ground with 7' overburden over the top of the tank, the hole fully flooded, and maintain a safety factor of 5:1 against general buckling.

Tank will support accessory equipment – such as access openings, risers, internal pump platform, drop/fill tubes, submersible pumps, manways, manway extensions, collars, risers, FRP or PVC inlet/outlet piping, and ladders.

Buried tanks shall be manufactured with integral trapezoidal ribs for structural integrity.

Product Storage – Tank shall be capable of handling liquids with specific gravity up to 1.1.

Tank shall be vented to atmospheric pressure.

2. Accessories:

The manways are provided per drawings.

All the manway openings are FRP and Flanged.

All internal piping will be supplied by the tank manufacturer and assembled in the field by the Contractor

The tank will have lifting lugs that are capable of withstanding weight of tank with safety factor of 2:1.

Suction/Fill tubes will be Schedule 40 PVC or FRP.

Number and location of straps will be shown on submittal drawing provided by the Vendor.

Deadmen will be pre-manufactured and supplied by the tank manufacturer.

PART 3 - EXECUTION

3.01 PAINTING AND COATING

- A. Painting of FRP tank shall be done per manufacturer's standards. Painting and coating shall include all materials, labor tools, equipment and services required for the furnishing and application of all painting and coatings as specified herein or as indicated on the drawings. Work shall include, but not be limited to, cleaning and preparation of surfaces, paint materials, and the application of all paint and other materials.

3.02 QUALITY ASSURANCE

- B. Codes and Standards. In addition to the requirements of these specifications, the work to be performed under this section shall comply with the following codes and regulations:
1. National Association of Corrosion Engineers Standards (NACE).
 2. Applicable Standards of American National Standards Institute, Inc. (ANSI).
 3. Occupational Safety and Health Act regulations (OS HA).
- C. Painter's Qualifications. The Contractor shall cause the work specified under this section to be performed by or under the supervision of a qualified painter. The Contractor shall be prepared to document the painter's experience, competence and ability to comply with the requirements of these specifications and to complete the work in a timely manner. The painting and coating subcontractor shall provide three references which show successful experience with the specified coating systems.
- D. Standard Products. All materials, supplies and articles provided shall be the standards products of recognized, reputable manufacturers. All paints in a particular paint system shall be the products of a single manufacturer. The Contractor shall also minimize the number of paint suppliers. Do not use lead-base primers or final coats on any surface or metals.

1. The standard products of manufacturers other than those specified will be accepted when it is demonstrated to the satisfaction of the Engineer they are equal in composition, durability, usefulness and convenience for the purpose intended.

3.03 DELIVERY AND STORAGE

- A. All materials will be delivered to the application site by the Vendor in their original, unopened containers bearing the manufacturer's name, brand, batch number, date of manufacture, and any special directions. Only the approved material will be stored at the job site and stored only in designated areas. The Contractor is responsible for offloading and installing the tank in accordance with the Vendors printed instructions.

3.04 INSTALLATION

- A. General: The equipment shall be installed properly to provide a complete working system. Installation shall follow the supplier's recommendations.
- B. Manuals: The Vendor will furnish four (4) copies of operation and maintenance manuals which will be retained at the installation site to assist plant operators. The manual shall include the supplier's erection and assembly recommendations and a complete list of recommended spare parts.
- C. Shop Assembly and Inspection: The equipment specified herein will be completely factory assembled as one unit as far as practical to ensure that all mating parts can be field assembled. All mating parts shall be trial fit and match marked. The customer and installing contractor shall be given the opportunity to witness the shop assembly.
- D. Field Service: The equipment supplier will provide the service of a qualified representative for a minimum two (2) trips and two (2) days to inspect the mechanism installation, lubrication, torque test, assist in startup, and instruct plant personnel in the proper operation and maintenance of the mechanism.
- E. Field Testing:
 1. Operation Tests: The mechanism shall be operated in a dry tank for a minimum of 4 continuous hours before flow is allowed to enter the system. After the unit has successfully passed this initial test, flow shall be introduced into the tank and the same 4-hour observation test run. If the unit should fail under any of these conditions, the test shall be halted and the problem corrected. If, after several attempts, the unit does not successfully pass the field test, the faulty portion of the equipment shall be repaired or replaced and the test re run.